



UNIVERZA V LJUBLJANI
University of Ljubljana

Interdisciplinary
Doctoral Programme in

BIOSCIENCES

Science of Life – Science for Life



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Science of Life – Science for Life

Ljubljana, 2026

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The interdisciplinary doctoral study programme in Biosciences is a joint project encompassing five Faculties of the University of Ljubljana. The Biotechnical Faculty (BF) coordinates the programme, and the Faculty of Electrical Engineering (FE), the Faculty of Computer and Information Science (FRI), the Faculty of Mechanical Engineering (FS) and the Faculty of Health Sciences (ZF) also participate in its implementation. Research in the field of basic and applied biotechnical sciences in the last two decades has set new theoretical paradigms and elucidated the functioning of diverse biological systems. Development of modern solutions in biosciences, which were beyond imagination a decade ago, is based on the integration of specific knowledge of many disciplines. The main concept of interdisciplinary doctoral programme in Biosciences is, therefore, cooperation. We combine the knowledge and experience of Agronomy, Animal Science, Bioinformatics, Bioengineering in Health Sciences, Biology, Biotechnology, Cell Sciences, Economics of Natural Resources, Food Sciences, Horticulture, Landscape Architecture, Managing Forest Ecosystems, Microbiology, Nanosciences, Nutrition, Protection of the Natural Heritage, Technical Systems in Biotechniques and Wood and Biocomposites, and the key is the interplay of all scientific fields. Developing high-quality and modern doctoral study programme for the acquisition and upgrade of knowledge in biotechnical sciences is also dictated by the rapid development of the scientific fields and their impact on important aspects of our lives, such as food and nutrition, health, environment and landscape, and renewable energy sources.

An essential element of the doctoral programme is the fusion of different scientific fields with the aim to identify and interpret research areas, which are not addressed at the bachelor and master study programmes. This is only possible with attentive investigation of the international scientific community, publications, and innovations as well as involvement of domestic and foreign experts in the study process and mentoring. In addition to the lecturers from five Faculties consistently implementing the programme, other members of the University of Ljubljana and researchers from leading Slovenian institutes are actively participating

in the programme. The research-oriented, individually designed and analytically modern training of doctoral candidates thus takes place in a technologically advanced research environment, in which doctoral students develop specific skills and are closely integrated into scientific and academic groups. The doctoral programme enables active international exchange of students, training in laboratories worldwide and participation in wider research community. We are committed to the European University Association (EUA) and, as a condition for ensuring the internationally comparable quality of doctoral programme, doctoral students must publish at least one scientific article in an international scientific journal before completing their doctoral studies. Lastly, we must emphasize the importance of close cooperation between the doctoral student and the mentor. In unison, they design a personal training programme that meets the candidate's ambitions and curiosity and leads to deepening of knowledge in a specific scientific field.

Prof. Dr. Valentina Schmitzer

President of the Programme Council for Biosciences

The Interdisciplinary Doctoral Study Programme in Biosciences is a third cycle study programme of the Bologna Process. It lasts for four years and grants 240 credit points. The study programme consists of an organised educational part amounting to 60 credit points and individual research work for the doctoral thesis awarding the remaining 180 credit points.

The study requirements of the programme are in accordance with the Higher Education Act and Criteria for Accreditation of Higher Education Institutions and Study Programmes adopted by the Council of RS for Higher Education and assessed according to the European Credit Transfer System (ECTS). This enables a direct inclusion of parts of the programme in the international exchange between universities in the countries that use the ECTS system as well.

The programme awards the academic title **DOCTOR OF PHILOSOPHY** in the following scientific fields:

- Agronomy
- Animal Science
- Bioinformatics
- Bioengineering in Health Sciences
- Biology
- Biotechnology
- Cell Sciences
- Economics of Natural Resources
- Food Science
- Horticulture
- Landscape Architecture
- Managing Forest Ecosystems
- Microbiology
- Nanosciences
- Nutrition
- Protection of the Natural Heritage
- Technical Systems in Biotechniques
- Wood and Biocomposites

The Interdisciplinary Doctoral Study Programme in Biosciences is provided by the following members of the University of Ljubljana:

- Biotechnical Faculty, Jamnikarjeva 101, Ljubljana
- Faculty of Electrical Engineering, Tržaška cesta 25, Ljubljana
- Faculty of Computer and Information Science, Večna pot 113, Ljubljana
- Faculty of Mechanical Engineering, Aškerčeva 6, Ljubljana
- Faculty of Health Sciences, Zdravstvena pot 5, Ljubljana.

The Biotechnical Faculty coordinates the following scientific fields (15): Agronomy, Animal Science, Bioengineering in Health Sciences, Biology, Biotechnology, Cell Sciences, Economics of Natural Resources, Food Science, Horticulture, Landscape Architecture, Microbiology, Nutrition, Managing Forest Ecosystems, Protection of the Natural Heritage and Wood and Biocomposites. The Faculty of Electrical Engineering coordinates the scientific field of Nanosciences. The Faculty of Computer and Information Science coordinates the scientific field of Bioinformatics and the Faculty of Mechanical Engineering coordinates the scientific field of Technical Systems in Biotechniques.

The doctoral student submits the application for the approval of the theme and title of their doctoral thesis to the faculty which coordinates the scientific field the doctoral student is enrolled in.

The fundamental goal of the Doctoral Study Programme in Biosciences is educating highly-qualified specialists for each of the included scientific fields of study.

The programme aims at qualifying the doctoral students for creative and independent scientific research and solving challenging scientific problems. The students will broaden their basic knowledge of the selected fields of study and acquire problem-solving tools; they will be qualified for a critical approach to answering complex scientific research questions, for the development of new research methods and utilisation of new technologies and discoveries. The students will learn to use scientific literature and follow new discoveries in their scientific field. They will be qualified for obtaining and leading or coordinating scientific research projects and will be able to present their results to the general public. The candidates will be capable of communicating with experts from other academic fields.

The study programme encompasses traditional scientific fields in life sciences supplemented with new ones resulting from the development of new technologies and social changes.

2 FUNDAMENTAL GOALS AND COMPETENCES OVERVIEW

Agronomy

Modern agronomy focuses not only on plant cultivation, but also on a wider understanding of the environment in which the cultivation takes place. The scientific field of agronomy introduces the postgraduate students to the research of interactions between agricultural production and other environmental human activities. The main focus of agronomy is studying the laws of structure and functioning of agricultural and other ecosystems, the reaction of plants and other cohabiting organisms to abiotic and biotic environmental factors and agricultural technology. The programme includes studying and analysing the effects of global environmental changes and pollution on plants, soil and climate and researching new technologies enabling sustainable development of agriculture and related activities as well as preserving biodiversity and environment.

All the mentioned contents are covered by 16 courses. The interdisciplinary oriented study plan enables the students to gain a comprehensive understanding of the field of study, which is important given the complexity of (agro)ecosystems. On the other hand, the elective courses enable the students to focus on a specific area of interest. The competences gained from methodological subjects prepare the doctorate students for independent research of agroecosystems.

Prof. Dr. Dominik Vodnik
Coordinator for Agronomy

Animal Science

The doctoral study programme in the field of Animal Science is intended to qualify a wide circle of experts for research, development, and pedagogic work in the fields of quantitative genetics, selection, ethology, and technology of breeding animals. Knowledge of the impact of breeding animals on the environment and quality of animal products is also included.

The field of selection deals with questions of obtaining information for the genetic assessment of animals in increase, experiments or laboratories. It includes knowledge from the field of information technology, which we use in obtaining, communicating, storing and processing data in data collections. Contents for forecasting genetic values, both from phenotypic

and genetic information, determining bio-economic theses, procedures of selection and monitoring the effects of individual measures on a population, are emphasized. The field also covers knowledge of monitoring and directing small populations, which are met both with local populations as well as in specialised nuclei.

The field of ethology is based on familiarity with the body language of animals, since these signs enable us to recognise how the animals feel and interpret changes in the state of health of individual animals or groups. Physiological research is also often connected with observation in order better to understand the responses of animals and to make use of them in overcoming deficiencies in various environments and systems of breeding. The aim of such research is increasingly connected with monitoring the effects of elements of well-being on the increase of animals.

The technology of breeding animals has greatly changed recently because of changes to the environment, awareness of the negative influences of breeding animals in the environment, stricter ethological standards, and greater market and economic pressures. With the increased use of domestic sources in animal care, we reduce the negative impact on the environment. On the other hand, this demands deviation from general recipes in breeding animals and the development of friendly technologies adapted to the environment. It is necessary to adapt to natural, social and market conditions, and solutions must guarantee sustainable development. The research in this field is therefore often interdisciplinary.

In all fields, the development of basic knowledge and its transfer into practice are emphasized. Both in studies and in individual research work, we strive for international cooperation and cooperation with users. There are possibilities of employment of graduates in educational institutions, public services, animal breeding research, development, and professional institutes, specialised advisory services and development departments of agricultural, food, and pharmaceutical companies.

Asst. Prof. Dr. Dušana Jordan
Coordinator of Animal Science

Bioengineering in Health Sciences

The study programme of Bioengineering in Health Sciences is intended for graduates from different faculties who wish to devote themselves to research and/or engineering in the field of health sciences. The contents include the study of mechanisms of health maintenance in relation to environmental impacts, new materials, and new procedures. Environmental impacts include ecological engineering, the design of ecosystem services, cleaning of polluted water, the use of ecotechnologies, the assessment of the quality of water, soil and air, biocompatibility of materials for prostheses and orthoses, and the effects of photocatalytic materials and materials used for laboratory equipment in research- and clinical medicine. The interactions of nanostructured surfaces, which play an important role, are also considered. Another subject of this field of study is the design and production of microfluidic devices and lab-on-chip systems, and their use in bioanalytics of bioprocesses, in the development and in production of pharmaceuticals, and in diagnostics. Furthermore, the field of study focuses on the construction of biomechanical models of the locomotor system, and the related planning of operations based on the prediction of biomechanical parameters in addition to optimization of shape and implementation of prostheses and orthoses. In short, the subject of Bioengineering in Health Sciences is any impact on health which can be studied using scientific methods. The field is therefore suitable for all who wish to contribute to health maintenance, treatment of diseases, and preventive measures with the use of scientific methods. Bioengineering in Health Sciences promotes life- and environment-friendly methods and high ethical standards.

Prof. Dr. Veronika Kralj Iglič

Coordinator for Bioengineering in Health Sciences

Bioinformatics

How similar are living beings? What are the genetic differences between people? Are people really the descendants of the Neanderthals? How can animal species adapt to the living environment? Damage to what genes is responsible for the appearance of different illnesses? Can the side effects of medicines be predicted from their structural properties?

All these questions can today be answered by bioinformatics. In recent decades, with the development of genomics and other molecular experimental techniques, researchers have obtained a large amount of data from the field of molecular biology. Techniques used in bioinformatics enable us to suitably process these data, to search them for informative patterns and to analyse them in order to improve understanding of biological processes. Typically, bioinformatics is used in the following areas: the arrangement of sequences of proteins and nucleic acids, the search for genes, the composition of genomes from short sequences, the phylogenetic analysis, the forecasting of protein structures and active parts of proteins, the analysis of gene expression, the process of genetic networks, the analysis of data on polymorphisms and protein interactions, and in the modelling of biological processes and evolution.

The scientific field of bioinformatics is intended for students of two different profiles: the students with prior knowledge of biomedicine will be instructed in the use of modern computer applications for solving problems in these areas. The programme will similarly be of interest to students from technical faculties, especially for the students of computer science, who will learn to apply their computer knowledge to the increasingly attractive field of bioinformatics.

Assoc. Prof Dr. Tomáš Curk

Coordinator for Bioinformatics

Biology is one of the central scientific fields in natural sciences. It offers knowledge about animals, plants, microorganisms, and fungi and their mutual interactions in relation to the environment. Biology deals with all levels of biological organisation, from molecules to ecosystems. The phenomenon of new scientific fields emerging does not reduce the role of biology, but quite the opposite. The need for an all-encompassing view of life, in which molecules and ecosystems intertwine to form a dynamic and rounded-up whole, gives biology ever greater importance. The scientific field of Biology in study programme in Biosciences is planned in such a way that it covers the broadest view of life and

Biology

offers an understanding of the dynamic, changeable and transitory nature of living beings. This knowledge is of vital importance for many human activities, including interventions in the environment, interventions in the genome, production of chemicals and materials organisms have never come in contact with before, and interventions in ecosystems, which have inconceivable consequences. We know that survival on this planet will depend on our responsible behaviour. A precondition for this is familiarity and understanding of biological systems and their interconnection and interdependence.

Assoc. Prof. Dr. Anita Jemec Kokalj

Coordinator for Biology

Biotechnology

The scientific field of biotechnology offers students a deepening of knowledge about those physiological processes in microbes, plants, animals, and humans that can be modified using biotechnological methods with the aim to improve the quality of organisms or for the purpose of producing certain substances. Microbial Biotechnology, Plant Biotechnology, and Animal Biotechnology are more comprehensive subjects that define the three main areas of biotechnology. Microbial biotechnology addresses industrially relevant approaches to metabolic, biosynthetic, and protein engineering using recombinant DNA and the development of new and improved bioprocesses for the production of generic products. It provides a comparative overview of the most important industrial microorganisms, newer host strains, and a comparative overview of the latest methods and approaches that are still in development but are already entering the industrial environment.

Prof. Dr. Jernej Jakše

Coordinator for Biotechnology

Cell Sciences

Cell Sciences are based on cell biology, which is an explicitly dynamic, integrative field of science the aim of which is to recognise the structure and functions of eukaryotic cells in normal and diseased states. The subject of research is

individual cells in cell culture and cells as part of tissue and organs. The scientific field of Cell Sciences is planned so that it communicates knowledge of the dynamic nature of cell structures in connection with secretion, division, differentiation and cell death, mainly concerning the distribution of the endomembrane system, organisation of the cytoskeleton of intercellular communication and physiological renewal of tissue. Sections from the fields of molecular cell and systemic physiology enable understanding of strategies for transforming the functioning of cells with engineering approaches and biotechnical methods. The programme includes sections on the functioning of selected toxins and the dynamics of metals in regulatory cell processes and the functioning of affected cells.

The interdisciplinary scientific field of Cell Sciences has been planned by higher education teachers in cooperation with chairs and laboratories of the Biology Department UL, the Biotechnical Faculty, Institute of Pathophysiology of the Medical Faculty UL, Institute of Cell Biology of the Medical Faculty UL, National Institute of Biology, Biomedical Scientific Centre of Cells and the Jožef Stefan Institute.

The programme provides excellent research opportunities and an interdisciplinary approach to the field of Cell Sciences. It is intended for students who wish to obtain theoretical and methodological knowledge in the field of cell biology, molecular physiology and the biology of membranes and toxins.

Asst. Prof. Dr. Nada Žnidaršič

Coordinator of Cell Sciences

The aim of the doctoral education in the scientific field of Economics of Natural Resources is to provide doctoral candidates for state-of-the art research work that connects ecological, social, and economic aspects of the bioeconomy at both micro and macro levels. It develops an interdisciplinary researcher profile capable of integrating and enhancing knowledge from applied life sciences (basic natural science knowledge, biological sciences, ecology, engineering skills

**Economics
of Natural
Resources**

in production and processing of biological resources) with expertise in economics, business studies, and public policies. The study programme addresses research and development challenges related to organizing business processes in conventional (agri-food, forestry-wood) and extended value chains of the bioeconomy in ways that contribute to achieving sustainable development goals. Special emphasis is placed on examining the social dimensions of natural resource management and the role of the state.

The content and methodological approaches of the study programme are designed to enable participants to actively engage in international research in relevant scientific or methodological areas. Within the comprehensive methodological course titled Methodology of Economic and Social Sciences in Bioscience, participants become familiar with research planning, data acquisition and processing methods, and the use of fundamental quantitative and qualitative methodological approaches specific to the scientific field of Economics of Natural Resources. Methodological knowledge can be further deepened through three additional methodological courses. In addition to Mathematical Models and Operations Research in Biosciences and Multivariate Statistical Methods, we have added the course Behavioral Research in Economics and Environmental Social Sciences, which trains participants to address research challenges using experimental economics approaches.

In terms of content, the study programme aims to unveil both, the complexity and the particularities of current research topics within the Economics of Natural Resources. The foundational course titled Bioeconomy, Innovations, and Systems Management in Biotechnology fosters an understanding of the complexity and interconnectedness of the economic system, society, and natural resources in bioeconomy-related industries. The course Economic and Sociological Aspects of Rural Development provides additional insights into theoretical foundations and models necessary for in-depth research on interactions within socio-ecological systems. Course Digitalization in Business Process Management in Bioeconomy bridges competencies related to managing business processes with the increasing need for effective

integration of modern information technologies. Lastly, Consumer Behavior and Marketing Strategies in Bioeconomy equips participants with an understanding of specific consumer behaviors related to products and services in the dynamic business environment of the bioeconomy.

If students reach beyond the curriculum of the scientific field of natural resource economics in order to achieve the set goals of doctoral education, we guide and encourage them to enhance their knowledge and skills by selecting modules from comparable doctoral programmes both domestically and internationally.

Prof. Dr. Luka Juvančič

Coordinator for Economics of Natural Resources

The doctoral study programme in the field of Food Science enables acquisition of new knowledge in the interdisciplinary field of food science. The interdisciplinary approach is intended to motivate the inclusion of graduates of Food Science, Nutrition, and many other complementary fields and encourage innovativeness of research for the transfer of knowledge and the development of contemporary trends in the production and supply chain of foods. Study is oriented to foods, technologies and processes that enable sustainable development, rational energy use, water, raw materials and thus preserving the environment and, at the same time, satisfy modern human food requirements. The consumer, who is aware of the importance of food for their health and quality of life, demands the development of safe, nutritious, tasty and in all aspects attractive and also the most long-lasting foods. These can derive from tradition (e.g., regional foods) or modern (bio)technologies (e.g., GMOs). Development challenges already commence at the beginning of the chain – e.g. in the cultivation of agricultural raw materials or breeding livestock, with the development and control of production- processing processes, with the introduction of new methods of checking quality and traceability in the agro-food chain, with better understanding of the causes and consequences of pathogens and toxic factors as a result of man's interventions or natural processes (e.g., the presence

Food Science

of chemical contaminants, increased allergenic properties of food components or the resistance and virulence of pathogenic organisms). Development, and thus also study, includes models for ensuring greater quality and safety in the cultivation, processing and distribution of foods, with the involvement of all links, including the consumer. This remains the critical point of the whole chain, since s/he must be educated, and innovative food products must be offered so that s/he recognises and buys them. All the mentioned fields will be a challenge for the doctoral students of food science in their studies and scientific research work.

Prof. Dr. Sonja Smole-Možina

Coordinator for Food Sciences

Horticulture

The scientific field of Horticulture covers fruit growing, viticulture, horticulture, ornamental plants, and medicinal plants. It is the fastest growing agronomic branch in- and outside of Europe regarding quality of the existing and new horticultural products and contribution to more pleasant living conditions. The students will be acquainted with various aspects of horticulture, especially its role in Slovenia and worldwide, the contemporary results in the field of plant propagation and development, cultivation of functional and safe food, and modern biotechnological methods of plant breeding. The importance of various groups of primary and secondary metabolites in horticultural plants as well as synthetic paths with key regulations and groups of substances and their importance within stress, disease, and pest resistance mechanisms will be presented. Additionally, biotic and abiotic factors and technologies of production that influence the content of biologically active substances as well as the growing importance of secondary metabolites within fruit for human health will be discussed.

Students who have not yet attended horticultural courses are available for elective contents from the field of fruit growing, viticulture, and horticulture, and ornamental plants.

Prof. Dr. Robert Veberič

Coordinator for Horticulture

Landscape Architecture

The doctoral study programme in the scientific field of Landscape Architecture is intended to qualify students for the research work in this field. The two fundamental areas of research are the theory of the profession, for instance the theory of design, form, structure, landscape samples, etc. and the methodology of the profession focusing on research and development of new planning procedures/methods. Even though landscape planning is technically not considered a research activity, the responsibility towards public and the complexity of problems require substantiated and credible decisions based on the results of research activity. As one of the planning activities, landscape architecture connects knowledge of various natural science and social science disciplines, such as geomorphology, ecology, hydrology, spatial sociology, ecological psychology, etc. When solving landscape planning problems, specific needs for new discoveries often arise, which are addressed by individual research fields using their own research methods. The doctoral study programme in the field of Landscape Architecture is directed to recognising these needs and developing a capacity to use the scientific instruments of various scientific disciplines for the needs of landscape planning.

Prof. Dr. Valentina Schmitzer

Coordinator for Landscape Architecture

Managing Forest Ecosystems

The doctoral study programme of Managing Forest Ecosystems enables the expansion of knowledge of the nature of forest ecosystems, their administration and management in line with the three principles of modern forestry – sustainability, close-to-nature structure and multi-functionality.

The courses provide a wide range of knowledge of the ecology of forest ecosystems and their management, which includes technical as well as social aspects.

Forests cover 60% of the entire territory of Slovenia and the importance of forests for their environmental, production, and social effects is on the increase. Consequently, studying the Managing Forest Ecosystems offers a unique challenge; successful management requires overall familiarity with

forest ecosystems and their components on various spatial levels – composition, landscape, and regional level – as well as knowledge of adapted management and technological procedures.

The doctoral study programme qualifies the candidates to solve development problems and to carry out independent scientific, development, pedagogic, and highly professional tasks in the field of forestry and renewable forest resources. Upon the completion of the programme, they are granted the title of Doctor of Philosophy in the field of Managing Forest Ecosystems.

Assoc. Prof. Dr. Thomas Andrew Nagel
Coordinator for Managing Forest Ecosystems

Microbiology

The scientific field of Microbiology enables PhD students to acquire knowledge about function of microorganisms in natural and industrial systems as well as in environmental technologies where microorganisms are used as working organisms. The study programme offers the latest findings in the fields from molecular microbiology to environmental microbiology and microbial biotechnology. The study programme offers insight into modern microbiological methods and techniques, structure and dynamics of microbial genomes, sociomicrobiology of microbial interactions in model and complex systems such as soil, water, plants, gastrointestinal tract of animals, or food. You will learn about the role of microbial interactions in the management of harmful microorganisms, ways and means to produce new biologically active molecules, biopesticides and probiotics, molecular characteristics and useful properties of microbial polymers, you will study the structure and role of microbial biofilms, and understand new solutions in the management of harmful biofilms. The study programme offers in-depth knowledge of the procedures for ensuring microbiologically safe food. An important focus is given to the role of microorganisms in sustainable agriculture, and the use of the latest technologies for the generation of renewable energy from organic waste (methane, hydrogen) and waste recycling in a circular economy. Modern biotechnological solutions for

the production of bioethanol, biobutanol, mineral fertilizers, the use of bioremediation technologies and recent trends in the production of drug precursors by microbial metabolism will be discussed. The study programme offers a comprehensive view of the role, function, and various possibilities to exploit and modify microorganisms in natural and anthropogenic systems.

Prof. Dr. David Stopar

Coordinator for Microbiology

New technologies, which include nanotechnology, will undoubtedly shape our future. Many believe that we have already entered the nano-era, since products of nanotechnology can be found in many products intended for everyday use. Nanotechnologies are established in the pharmaceutical, cosmetic, electro-technical, textile and food industries. Nanoproducts have long had indispensable importance in computer science, informatics, space technology, etc. Nanotechnological products have in common that, because of their small size, they have numerous special properties that are different from the properties of macroscopic bodies, and these properties can be used for practical purposes. The question is continuously raised, of course, of their safety for humans and the environment. The field of Nanosciences within the study programme in Biosciences combines familiarisation with the properties and production of nanoparticles and nanomaterials and understanding of the interactions between biological systems and products of nanotechnology as well as aspects of their safe use. The field of nanosciences is explicitly interdisciplinary. Each candidate will expand their knowledge of their own basic field of study (physics, biology, pharmacy, medicine, electrotechnology, nutrition, etc.) while getting acquainted with other aspects common to all fields of nanosciences. By the end of their studies, candidates enrolled in the programme will gain a better understanding of physical, chemical, technological, and biological properties and possibilities of the use of nanoparticles and nanomaterials. Numerous scientists will be actively included as lecturers or co-mentors in the implementation of studies in the field of Nanosciences. The

Nanosciences

aim of the new scientific field at the University of Ljubljana is to enable its candidates contact with world's leading experts in the field of nanosciences and the possibility of cooperation with foreign universities and institutions. Upon the completion of studies, candidates will be universally educated professionals capable of cooperating in top projects in the field of nanosciences at home and abroad.

Prof. Ddr. Aleš Iglič

Coordinator for Nanosciences

Nutrition

Nutrition research is of great importance as it provides the basis for setting the reference values for nutrient intakes and forms the basis for designing a sustainable food system and developing new food products. It also enables the planning of policies in the field of nutrition, public health, agriculture and food technology.

Nutrition is an interdisciplinary science, which is also reflected in the design of the doctoral study programme in Nutrition. Within two main subjects, students deepen their knowledge of the fundamentals of nutrition and nutritional biochemistry. Lecturers from various fields provide a comprehensive overview of the mechanisms of nutrition's influence on health, including a basic understanding of metabolism, physiology, biochemistry, nutrigenetics and nutrigenomics, as well as various nutritional research and other current topics in the field of nutritional science. In other subjects, doctoral students acquire in-depth knowledge of clinical nutrition and molecular biological methods that are directly related to their doctoral thesis. Through lectures, seminars, laboratory research work and consultations, students deepen their understanding of current research problems in human and animal nutrition. The main aim of the doctoral work is to acquire modern research methods in the field of nutrition, to develop a critical approach and to understand the processes in the development of the nutritional science. Upon completion of their doctoral studies, candidates will play an important role in academia, the food industry, the private sector and government, not only as researchers, but also as experts who disseminate scientific

discoveries and knowledge to the general and target populations in order to maintain and improve health and reduce the risk of chronic non-communicable diseases.

Assoc. Prof. Dr. Jasna Bertonec

Coordinator for Nutrition

The framework of the Protection of the Natural Heritage is quite broad, ranging from geomorphology and biology to social sciences applied to nature conservation. The focus is on rapid assessment and monitoring methods for estimating the conservation status of plant and animal species, ecosystems, as well as natural features, and the application of legal and management measures in and outside protected areas. Special emphasis is in communication skills and in management of the participation process with various stakeholders as a key issue for successfully achieving nature conservation goals.

The broader concept sets the scene for many possibilities for specialisation in a particular applicative work, which is organised on an individual level.

There are active connections with other similar study programmes in Europe.

Asst. Prof. Dr. Mojca Nastran

Coordinator for Protection of the Natural Heritage

The programme is interdisciplinary and provides a direct link with the fundamental research work in biotechniques, the definition of processes, and the development of all types of technical systems that enable substitutes in nature. It is compatible both with biotechnical and with natural science technical profile. An individual professional commission adapts the programme to each student that has completed the second cycle, which enables supplementing knowledge from the other field. Due to suitably qualified research personnel, we enable studies in the fields of agricultural, forestry, wood science and food processing professions.

**Protection of the
Natural Heritage**

**Technical
Systems in
Biotechniques**

A student from the field of biotechnology first obtains basic knowledge regarding the problems of machines and equipment. They are then introduced to the basic research and development characteristics shared by biotechnology and techniques.

A student from the field of techniques first obtains knowledge of the basic biotechnical contents. They are then introduced to the basic research and development characteristics shared by techniques and biotechnology.

We must particularly emphasize contents that refer directly to the overall development of innovative technical systems, based on an iterative process of construction with the use of the golden loop.

In the second year, a student chooses, together with the mentor, specific contents that enable a quality insight into the specific knowledge required for research into technical systems for satisfying functions of natural processes.

Prof. Dr. Iztok Golobič

Coordinator for Technical Systems in Biotechniques

**Wood and
Biocomposites**

Wood is certainly the oldest high-tech natural and renewable polymer composite, which contains exceptional properties and enables virtually unlimited methods of use.

The scientific field of Wood and Biocomposites is defined by elective theoretical and individual research courses, which enable the acquisition of in-depth knowledge of properties and technologies of the production, processing and use of wood, wood composites and similar ligno-cellulose materials. The individual research courses provide further insight into the contents of the selected fields of research with the support of high-quality research equipment.

The programme focuses on contemporary research studies of wood formation supported by dendrochronological and climate-related contents further developed by studies related

to the quality changes of wood, structure and properties of wood composites, durability and resistance of material, and mechanical properties of wood and wood-based material with emphasis on their use in civil engineering. Doctoral students will have the opportunity to expand their knowledge of formulation and development of wood composites, modern processes of biotechnological and chemical processing of wood, synthesis and use of compounds with high added value such as nanocellulose, modern biocidal and non-biocidal wood protection, use of nanomaterials in wood processing, and evaluation of the life cycle of biocomposites and wood products.

Upon the completion of the study programme, candidates will be capable of creative independent research work in the wide interdisciplinary field of wood processing. They will be qualified to recognise and solve fundamental scientific problems, to cooperate in the elite international research projects, and to contribute to the added value of the economy.

Prof. Dr. Marko Petrič

Coordinator for Wood and Biocomposites

STUDY CONDITIONS

Conditions for Enrolment

Enrolment in the interdisciplinary doctoral study programme Biosciences is open to candidates who have completed:

- A second-cycle study programme;
- A study programme leading to professions regulated by EU directives, or another integrated master's degree programme evaluated at 300 ECTS credits;
- A study programme leading to an academic higher education qualification, adopted before 11 June 2004;
- A master of science degree or a study programme leading to specialisation, if the candidate has previously completed a programme leading to an academic higher education qualification. Course units totalling 60 ECTS credits are recognised for these candidates based on their application, as provided by law;
- A study programme leading to a specialisation following a completed professional higher education programme. Additional study requirements for individual fields totalling 30 to 60 ECTS credits are determined for these candidates by the Biosciences Programme Council.

Enrolment in the doctoral programme is also open to graduates of foreign universities. The equivalence of previously acquired education in a foreign country will be established by means of the procedure for the recognition of foreign qualifications for the purposes of further education in accordance with the Statutes of the University of Ljubljana.

Criteria for Selection for Limited Enrolment

1. Success in higher education studies to date

The average grade of studies (without the diploma grade) is scored:

Average success is scored linearly, by the formula:

$$4 \times \text{grade} - 20.$$

The average grade of previous higher education studies of students who have completed university education, in which they enrolled before 11 June 2004, or 1st and 2nd cycles of study or a single study programme or specialization after completion of higher professional studies, is calculated by weighting, namely such that the average grade of each cycle

of study is weighted by the number of years of study in a particular cycle, summed for all completed cycles together and divided by the total number of years of study.

2. Research or professional work, awards

- a) A scientific article, monograph or patent accepted into procedure in RS (Cobiss type 1.01 –, 1.02, 1.03, 1.16, 2.01, 2.18) – **up to 5 points** (first authorship 5 points, co-authorship 2 points)
- b) Active participation at a scientific conference (Cobiss type 1.06, 1.08, 1.10, 1.12) – **2 points**
- c) Professional article in the field of study (Cobiss type 1.04) – **2 points**
- d) Awards connected with study; on the university level (**5 points**); on the level of a member, or other award (**2 points**)

The maximum number of points that a student can obtain is 40. If the composite score according to the above criteria exceeds 40 points, the student shall receive a maximum of 40 points. In the event of restricted enrolment, candidates with a higher total number of points will be selected.

If there are a number of students at the lower boundary with the same number of points, they will be invited for an interview and candidates will be selected from among them.

The decision on the acceptance of candidates shall be made by the Programme Council of Bio-science.

Knowledge and skills obtained through formal, informal and experience learning prior to admission to the programme will be recognised during selection with limited admission in accordance with the Criteria for Accreditation of Study Programmes. The programme council will decide on recognition of knowledge and skills obtained by a candidate prior to admission to the programme on the basis of a written request from the candidate and submitted evidence (certificates and other documents) which show successfully obtained knowledge and the content of such knowledge. If there is no limited admission in an individual study year, the extent and content of such knowledge

**Recognising
Knowledge
and Skills
Obtained Prior to
Admission to the
Programme**

and skills will be evaluated by the ECTS and may, on the basis of the judgement of the programme council, replace one or a part of a subject selected in doctoral studies in Biosciences amounting to 5 credit points.

In recognising such knowledge and skills, the following will be taken into account:

- Professional specialisation;
 - Other diploma from a higher education institution which is thematically linked to the field of doctoral study;
 - Published scientific work, patents, etc.;
 - Professional further training which is possible to evaluate in terms of credits.
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Conditions for Advancement Through the Programme

The condition for advancement from the 1st to the 2nd year of doctoral studies in Biosciences is the completion of requirements to the extent of at least 45 credit points.

The condition for advancement from the 2nd to the 3rd year is completion of all obligations from the 1st and 2nd years of study, in which are included:

- All exams passed from the 1st and 2nd years of doctoral studies;
- Individual research work completed to a total extent of 70 ECTS;
- The confirmation of the positive assessment of the proposed doctoral dissertation theme and topic by their Committee for the follow-up of a doctoral student from the senate of the Faculty which coordinates the scientific field the doctoral student is enrolled in.

The condition for advancement from the 3rd to the 4th year is completion of all obligations from the first three years of study and obtained the approval of the proposed doctoral dissertation topic by the University Senate.

The final, 4th year, is devoted to individual research work and the preparation and defence of a doctoral dissertation.

In the event of a student, for justifiable reasons, not completing the study requirements, s/he must present a request to the programme council for the extension of his/her

status. The request must be accompanied by documentary evidence of the reasons for the extension of status.

The student can repeat a year once in the course of the programme.

A student must gain at least 10 credits points to be able to repeat the first year of the doctoral study programme in Biosciences. This amount does not include the points gained for individual research work and/or a presentation of the doctoral thesis topic.

To qualify for the repetition of the second year, a student must gather at least 25 credit points. This amount does not include the points gained for individual research work and/or a presentation of the doctoral thesis topic.

The requirement for repeating the third year is completion of all study obligations of the first and second year of study.

If a student wishes to change his/her field of study, he/she must re-apply to the call for applications for the doctoral programme in Biosciences during the open application period and, if accepted, continue his/her studies in the new field of study in the following academic year.

The condition for completion and obtaining the scientific title of doctor of philosophy is that the candidate successfully completes all study requirements specified in the programme, is enrolled in all four years of doctoral study, and successfully defends a doctoral dissertation. According to the Statute of the University of Ljubljana, a student also has the right to a faster advancement or preliminary completion of study.

A doctoral student is required to publish at least one scientific article from the field of the doctorate in an internationally recognised journal on the SCI index, or exceptionally SSCI index or AHCI and has an impact factor. A doctoral student

The Conditions of Year Repetition

Changing Scientific Field of Study

Conditions for Completion of Study

must be the first author of the article. The scientific article must be published or accepted for publication when the doctoral dissertation is submitted for assessment.

Obtaining the Scientific Title

The interdisciplinary doctoral study programme in Biosciences enables a student to obtain the scientific title of Doctor of philosophy, with the scientific field cited on the doctoral diploma.

Transfer Between Study Programmes

Transfer between study programmes shall be considered to be cessation of student education in the study programme in which the student was enrolled and continuation of education in the interdisciplinary doctoral programme in Biosciences. Requests from candidates for transfer to the doctoral studies in Biosciences will be dealt with individually by the programme council in compliance with the Statute UL.

Transfer between various study programmes for obtaining the same level of education is possible if at least half of the requirements for enrolment in the new study programme, which the candidate performed in the first study programme, can be recognised.

The interdisciplinary doctoral study programme in Biosciences is planned in such a way that it enables domestic and international exchange on all levels of implementation of the programme, from research and experimental work to the exchange of subjects with comparable programmes of other universities on the basis of international contracts and bilateral agreements. International exchange is also possible through the cooperation of visiting professors to member providers of studies and cooperation in programmes of mobility for students. The programme is also open to foreign students. Cooperation with other higher education and research institutions abroad takes place within the framework of scientific research projects, through the cooperation of foreign professors in individual subject (co)mentorship and cooperation in assessment and defences of doctoral dissertations.

Providers of the programme cooperate with numerous foreign universities with which they have concluded agreements on cooperation. The programme council decides on the comparability of the quality of programme subjects of other universities. International exchange takes place on the basis of international projects and agreements signed by the University of Ljubljana and its members.

The interdisciplinary doctoral study programme in Biosciences is implemented as a part-time study.

The tuition fee is paid for each year separately, i.e. for each year a student enters for the first time. The cost of the fee is determined by the price list of the University of Ljubljana for each year separately. The price list can be found on the official page of the University of Ljubljana.

Candidates must choose a mentor before enrolling in the first year of the PhD programme. At the latest at the time of enrolment, the candidate must submit a written agreement from the mentor to accept the mentoring.

The doctoral candidate has one mentor or, in the context of a doctoral dissertation contract with a foreign university or institution, several mentors. A doctoral candidate may have a co-mentor, or exceptionally several co-mentors if this is necessary for his/her doctoral thesis. The doctoral candidate may also have an external adviser who contributes his/her specific knowledge to the doctoral thesis. An external advisor is an external expert from practice who contributes to the doctoral thesis (e.g. from business, public administration, cultural and artistic organisations, etc.).

Mentors and co-mentors in doctoral studies shall be university teachers with the title of assistant professor, associate professor or full professor, or academic worker with the title of scientific associate, senior scientific associate or academic counsellor, and shall demonstrate their research work, with the requisite bibliography, from

Implementation of the Study Programme

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TUITION FEE

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MENTORING

the broader field covered by the doctoral dissertation. The minimum condition for proven research activity of a (co) mentor, is a bibliography of the last five years that achieves 150 points according to SICRIS and has an index of important achievements A1/2 higher than 0 points or to have published at least two significant works in the last five years, as defined in the UL Habilitation Criteria and the faculties' Annexes to these Criteria. For the purposes of determining eligibility as a mentor and a co-mentor, significant scientific works for which the mentor or co-mentor is the first or lead author shall be taken into account. In scientific fields where first or lead authorship does not exist or is not routinely demonstrated, the candidate's relevant contribution to these works must be clearly evident.

Mentors and co-mentors may also be persons with the appropriate habilitation of another institute (domestic or foreign) and who have references from the broader field covered by the topic of a doctoral dissertation, and who work in a study programme or are employed by an institute with whom the University of Ljubljana (UL) or a member faculty of the UL has concluded an agreement or entered into a cooperation agreement.

The mentor, the co-mentor and the external advisor shall be appointed by the Senate of the faculty which is conducting the procedure for the award of the degree of Doctor of Science or Doctor of Arts. The Senate of the faculty shall also decide on any change of the mentor, co-mentor or external advisor.

The conditions for the mentor, the co-mentor and the external advisor shall be verified by the competent authority of the faculty within three months of the doctoral candidate's enrolment in the doctoral programme. The mentor and/or external advisor may also be appointed by the Senate of the faculty at a later stage during the doctoral studies, on the proposal of the mentor and the doctoral candidate.

One person may supervise or co-supervise a maximum of six doctoral candidates enrolled in any doctoral programme at the University of Ljubljana, and no more than two

years have elapsed since their last enrolment in a year or additional year. That number shall not include doctoral candidates who have already submitted their dissertation for assessment.

Doctoral candidates may have several mentors or co-mentors. The list of potential mentors is published on the Biosciences PhD website: www.bioznanosti.si.

The study programme consists of organised learning (lectures, practicals, presentations of themes of doctoral dissertations etc.) amounting to 60 credit points (ECTS), while the remaining 180 points are devoted to individual research work for the doctoral dissertation.

The programme consists of two types of elective subjects:

1. Theoretical subjects (5 or 10 ECTS)
2. Individual research subjects (5 or 10 ECTS)

A doctoral student, together with the mentor, chooses subjects from **the selection of all the subject included in the programme**. The study plan is approved by the coordinator of the scientific field of study the doctoral student is enrolled into. The choice of other subjects is possible from among all other elective subjects and from the syllabuses of other comparable programmes of domestic and foreign universities that have programmes evaluated by the ECTS or other systems that enable assessment of comparability. In the 1st and the 2nd year, the students can select courses from other programmes amounting to up to 15 ECTS. A doctoral student chooses subjects in relation to the research field of the doctoral dissertation.

First year:

- Elective subjects (choice possible among the chosen or another scientific field) – 30 ECTS
 - Individual research work (30 ECTS)
- Total 60 ECTS**

The doctoral student chooses 30 ECTS from subjects in the following manner: The subjects are chosen in accordance

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STRUCTURE OF THE STUDY PROGRAMME

Content Structure of the Programme

with the mentor based on the candidate's research area. The study plan is confirmed by the coordinator of the selected scientific field of study.

Doctoral students may already attend presentations of the themes of doctoral dissertations of other doctorands in their first year of study. Participation in at least three presentations is a prerequisite for applying for a doctoral dissertation theme in the second year of study.

Second year:

- Elective subjects (15 ECTS)
- Successful presentation of theme of doctoral dissertation (5 ECTS) and its approval by the Faculty Senate
- Individual research work (40 ECTS)

Total 60 ECTS

In the second year, a doctoral student chooses elective subjects to a total extent of 15 ECTS: subjects shall be chosen in agreement with the mentor and in relation to the field of the research work. The study plan is confirmed by the coordinator of the selected scientific field of study.

A doctoral student hands in an application for approval of the theme and title of a doctoral thesis by the start of the summer semester in the second year of study the member institution holding the programme and being responsible for the coordination of the scientific field of study the candidate is enrolled in (see chapter: General information on the programme).

By the time of submission of the application for approval of the theme and title of their doctoral dissertation, a doctoral student must have attended the presentation of at least three themes of doctoral dissertations of other doctorands. At the time of submission of his application, she or he shall attach evidence (form) by which she or he proves participation in the presentations of themes.

Third year:

- Individual research work (60 ECTS)

Total 60 ECTS

The content of the 3rd year shall relate to research work and preparation of scientific article.

Fourth year:

- Individual research work (50 ECTS)
 - Successful presentation of doctoral dissertation prior to defence (5 ECTS)
 - Preparation of a doctoral dissertation and public defence (5 ECTS)
- Total 60 ECTS

The content of the 4th year shall relate to research work and preparation and defence of the doctoral dissertation.

Ensuring Mobility

Doctoral students may, during the 1st and 2nd years, with the agreement of mentors and coordinators of the field, select a total of 15 ECTS elective content from other programmes of UL, comparable programmes of other Slovene or foreign universities and from subjects for which the University of Ljubljana will invite applications and which will enable the candidate to gain special knowledge and generic skills. Participation in international competitions and summer schools which have a programme of credit points and which conclude with a test of knowledge, is also encouraged. Exceptionally, a doctoral student may, with the agreement of the mentor and field coordinator, also choose more contents from other study programmes.

Students may ask for a recognition of an exam they intend to pass abroad or in the frame of international student exchange programmes in the following manner:

1. A doctoral student studying abroad in the frame of international student exchange programmes (Erasmus+, CEEPUS, NFM...) is required write a formal request in cooperation with their mentor **before they travel abroad**. In the request, the student explains which of the subjects offered abroad would they like to exchange for the subjects from the selection of "Interdisciplinary Doctoral Study Programme in Biosciences". The request contains an application for "Learning agreement for

studies” and must be co-signed by the student’s mentor. The request and the form must be sent to the Student Office for the 3rd Bologna Cycle of the Biotechnical Faculty, which confirms the reception and sends them to the coordinator of the field of study the student is enrolled in.

2. The coordinator of the scientific field reviews the request and the application form “Learning agreement for studies” and informs the Programme Council of their approval/denial of the request.
3. After the request has been positively reviewed by the Programme Council, the coordinator of the scientific field signs the student’s “Learning agreement for studies”. The student sends the copy of the signed and stamped application form to the Office of International Relations of the Biotechnical Faculty.
4. The signed form “Learning agreement for studies” ensures that the selected courses the student will successfully complete in the frame of international exchange programmes will also be recognized by the Biosciences study programme.
5. Upon the completion of the study obligations at a foreign university, the student must receive an official document confirming a successful conclusion of qualifications, i.e. Transcript of records (e.g. on a successfully passed exam), which should include a numbered grade (in %). The mentor suggests the numbered grade in accordance with the grading norms and the Statute of the University of Ljubljana, which is entered in the student’s index. The copy of Transcript of records, the copy of the recognition of successfully passed exams and the copy of the certificate on the successful exchange must be sent to the Office of International Relations of the Biotechnical Faculty.

If the student files the requests shortly after the last regular session of the Programme Council of Biosciences but needs confirmation before the next regular session, their request is discussed at a correspondence session of the Council (between two regular sessions).

The coordinators of the scientific fields covered by Biosciences are also the coordinators for the 3rd cycle exchange students who come to Slovenia and select subjects from the Interdisciplinary Study Programme in Biosciences.

Modes and Methods of Implementation of the Study Programme

The doctoral study programme is organized and implemented according to the credit system principle. The study comprises lectures, seminars, consultations, individual learning and active participation in research processes. If there are less than 5 students registered for a course, the course is carried out as consultations. A student discusses the arrangement of consultations with the professor responsible for the course. When 5 or more than 5 students are registered for the course, lectures are organized, the timetables of lectures are published on the Biosciences website: www.bioznanosti.si.

The List of Subjects

Scientific fields each contain a number of elective subjects. Doctoral students can choose from **among theoretical** and **individual research** subjects. Each scientific field contains a theoretical subject amounting to 10 ECTS. The contents of subjects are chosen on the basis of the research work of the persons responsible and providers of the subjects, who, for individual teaching plans, are represented by six scientific articles in the field covered by the subject.

Study plans of the subjects are published on the website: www.bioznanosti.si.

Individual research subjects are carried out in the laboratories of departments and institutes, clinics and other research units of course lecturers.

Subject Structure of the Programme

List of Theoretical Elective Subjects

Number	Course Title	Lecturers	ECTS
Agronomy			
01-1-01	Analysis of organic and inorganic polutants in ecosystems	<i>Prosen Helena</i>	5
01-1-02	Biometeorological modeling	<i>Pogačar Tjaša Črepinšek Zalika</i>	5
01-1-03	Biotic interactions in agroecosystems and plant protection	<i>Trdan Stanislav Celar Aco Franci Dermastia Marina</i>	10
01-1-04	Determination of plant pests and diseases	<i>Trdan Stanislav Kutnjak Denis</i>	5
01-1-05	Functional plant ecology in tracking the effects of environmental changes	<i>Eler Klemen Batič Franc</i>	5
01-1-06	Soil health and functioning	<i>Leštan Domen</i>	10
01-1-07	Interactions between genotypes and environment inthe agricultural plants	<i>Luthar Zlata</i>	5
01-1-08	Information searching and paper writing	<i>Bartol Tomaž</i>	5
01-1-09	Measurement of physical, chemical and biological properies of soil	<i>Zupanc Vesna Grčman Helena</i>	10
01-1-10	Methods in plant ecophysiology and ecology of terrestrial ecosystems	<i>Vodnik Dominik Eler Klemen Šircelj Helena</i>	10
01-1-11	Microbial ecology of agroecosystems	<i>Stopar David Maček Irena</i>	5
01-1-12	Pesticide risk assessment and management	<i>Suhadolc Marjetka</i>	5

01-1-13	Climate change	<i>Pogačar Tjaša</i>	5
01-1-14	Statistical methods for data analysis	<i>Kastelec Damijana</i>	5
01-1-15	Water as a natural resource for agriculture	<i>Pintar Marina</i>	5

Bioinformatics

02-1-01	Bioinformatics Tools and Databases	<i>Jakše Jernej Jerala Roman Kunej Tanja Petrovič Uroš Gostinčar Cene Curk Tomaž Stres Blaž</i>	10
02-1-02	Introduction to data science	<i>Zupan Blaž Demšar Janez</i>	5
02-1-03	Image Acquisition and Computer-Assisted Analysis	<i>Pernuš Franjo Likar Boštjan Špiclin Žiga Vrtovec Tomaž</i>	5

Bioengineering in Health Sciences

03-1-01	Biocompatible materials	<i>Jenko Monika</i>	5
03-1-02	Biomechanics and biophysics in health sciences	<i>Kralj-Iglič Veronika Iglič Aleš Veranič Peter Bohinc Klemen</i>	10
03-1-03	Biosciences and surgery	<i>Battelino Saba Dolinar Drago</i>	10
03-1-04	Ecological engineering	<i>Griessler-Bulc Tjaša</i>	5

03-1-05	Public health aspects of surfaces hygiene	<i>Fink Rok Jevšnik Podlesnik Mojca Ovca Andrej Oder Martina</i>	5
03-1-06	Disinfection materials in health sciences	<i>Trebše Polonca</i>	5
03-1-07	Microfluidic devices in bioengineering	<i>Žnidaršič Plazl Polona</i>	5
03-1-08	Oxidative stress and methods for its detection	<i>Poljšak Borut Milisav Ribarič Irina</i>	5

Biology

04-1-01	Analysis of ancient and museum DNA	<i>Palandačič Anja</i>	5
04-1-02	Biological education	<i>Tomažič Iztok</i>	5
04-1-03	Ecology	<i>Germ Mateja Gaberšček Alenka Čarni Andraž Debeljak Marko Kos Ivan Likar Matevž Skrbinšek Tomaž Urbanič Gorazd Vrezec Al</i>	10
04-1-04	Physiology and Morphology of Plants – An Integrative Approach	<i>Regvar Marjana Gruden Kristina Vogel-Mikuš Katarina</i>	10
04-1-05	Physiology and Morphology of Animals – An Integrative Approach	<i>Kreft Marko Štrus Jasna Drobne Damjana Zidar Primož Virant-Doberlet Meta Glavan Gordana Golja Petra</i>	10

04-1-06	Geographic Information Systems as a Research Tool for Biology and Nature Conservation	Zagmajster Maja Skrbinšek Tomaž	5
04-1-07	Interactions in Plant Biology	Regvar Marjana Gruden Kristina Vogel-Mikuš Katarina Dolenc Koce Jasna Likar Matevž	5
04-1-08	Molecular and Systems Biology	Gunde-Cimerman Nina Sepčič Kristina Gruden Kristina Bavec Aljoša Rogelj Boris Gostinčar Cene Glavač Damjan Poklar-Ulrih Nataša Serša Gregor Čemažar Maja	10
04-1-09	Systematic and Evolutionary Biology	Trontelj Peter Fišer Cene Frajman Božo Gunde-Cimerman Nina Kuntner Matjaž	10
04-1-10	Statistical analysis of biological data	Kajin Maja	5

Biotechnology

05-1-01	Animal biotechnology	Dovč Peter Kunej Tanja Gorjanc Gregor Zorc Minja	10
05-1-02	Biodiagnostics and biosensors	Pišlar Anja	5

05-1-03	Bioprocess engineering of biologic macromolecules, viruses and cells	<i>Podgornik Aleš Žnidaršič Plazl Polona Plazl Igor</i>	5
05-1-04	Bioreaction Engineering	<i>Plazl Igor</i>	5
05-1-05	Host-pathogen interactions	<i>Dovč Peter Zorc Minja</i>	5
05-1-06	Microbial Biotechnology	<i>Petković Hrvoje Benčina Mojca</i>	10
05-1-07	Planning of research activities, reporting and project proposals	<i>Drobne Damjana</i>	5
05-1-08	Natural medicines from fungi, plants and animals	<i>Sepčič Kristina Gregori Andrej Kreft Samo</i>	5
05-1-09	Next generation of molecular markers	<i>Štajner Nataša Jakše Jernej</i>	5
05-1-10	Plant biotechnology	<i>Štajner Nataša Baebler Špela Dobnik David Murovec Jana</i>	10
05-1-11	Modern biological medicines	<i>Bratkovič Tomaž Lunder Mojca Berlec Aleš</i>	5
05-1-12	Modern biotechnological methods	<i>Križaj Igor Petan Toni</i>	5

Economics of Natural Resources

06-1-01	Bioeconomy, innovation and management of systems in life sciences	<i>Juvančič Luka</i>	5
06-1-02	Digitalization and Management of Business Processes in Biosciences	<i>Kropivšek Jože</i>	5

06-1-03	Economic and sociological aspects of rural development	<i>Udovč Andrej Černič Istenič Majda</i>	5
06-1-04	Mathematical models and operations research in biosciences	<i>Žgajnar Jaka Zadnik Stirn Lidija</i>	5
06-1-05	Methodology of economic and social sciences in biosciences	<i>Erjavec Emil</i>	10
06-1-06	Multivariate statistical methods	<i>Kastelec Damijana</i>	5
06-1-07	Consumer Behaviour and Marketing Strategies in Biosciences	<i>Oblak Leon</i>	5
06-1-08	Behavioural research in economics and environmental social sciences	<i>Šumrada Tanja</i>	5

Horticulture

07-1-01	Horticulture	<i>Štampar Franci Veberič Robert Slatnar Ana Hudina Metka</i>	10
07-1-02	Selected topics of vegetable production	<i>Kacjan Maršič Nina</i>	5
07-1-03	Selected topics in viticulture and nursery	<i>Rusjan Denis</i>	5
07-1-04	Extraction and analytical methods of plants secondary metabolites	<i>Veberič Robert Mikulič Petkovšek Maja</i>	5
07-1-05	Specific topics in ornamental plants	<i>Osterc Gregor</i>	5
07-1-06	Primary and secondary metabolism of horticultural plants	<i>Veberič Robert Mikulič Petkovšek Maja</i>	10

07-1-07	Sustainable technological measures in fruit production	<i>Štampar Franci Veberič Robert Jakopič Jerneja Hudina Metka</i>	5
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Landscape Architecture

08-1-01	Selected chapters from the theory of design	<i>Kučan Ana</i>	10
08-1-02	Strategic planning and policy analysis	<i>Golobič Mojca</i>	10

Wood and Biocomposites

09-1-01	Wood and lignocellulosic materials for building applications	<i>Humar Miha Petrič Marko Medved Sergej</i>	10
09-1-02	Wood, bark and environment	<i>Merela Maks Čufar Katarina Balzano Angela</i>	5
09-1-03	High value added compounds from woody biomass	<i>Oven Primož Poljanšek Ida Likožar Blaž Vek Vilijem</i>	5
09-1-04	The fracture mechanics of wood and wood composites	<i>Merhar Miran</i>	5
09-1-05	Mechanical systems in wood industry	<i>Fajdiga Gorazd</i>	5
09-1-06	Microremediation	<i>Kržišnik Davor</i>	5
09-1-07	Development and LCA analysis of new product in wood industry	<i>Oblak Leon Kitek Kuzman Manja</i>	5
09-1-08	Rheology and curing kinetics of wood adhesives	<i>Šernek Milan</i>	5

09-1-09	Structural analysis of wood in the field of cultural heritage	<i>Merela Maks Balzano Angela</i>	5
09-1-10	Acoustic measurement methods in the forestry, wood industry and in building with wood	<i>Straže Aleš Žigon Jure</i>	5
09-1-11	Key competences for researchers	<i>Kržišnik Davor</i>	5

Microbiology

10-1-01	Microbiology and Biotechnology of Yeasts	<i>Čadež Neža</i>	5
10-1-02	Dynamics of Microbial Genomes	<i>Starčič Erjavec Marjanca Žgur-Bertok Darja</i>	5
10-1-03	Microbiology of Food	<i>Smole Možina Sonja Rupnik Maja</i>	5
10-1-05	Fungal Ecology and Biodiversity	<i>Gunde Cimerman Nina Gostinčar Cene Zalar Polona</i>	5
10-1-06	Resistance to antimicrobial agents in the environment	<i>Godič Torkar Karmen Trebše Polonca Ambrožič Avguštin Jerneja Klančnik Anja</i>	5

Nanosciences

11-1-01	Biophysics of membranes and biological nanostructures	<i>Kralj-Iglič Veronika Iglič Aleš</i>	10
11-1-02	Electrostatics surfaces and nanostructures	<i>Iglič Aleš Kralj-Iglič Veronika</i>	5

11-1-03	Colloids	<i>Urbič Tomaž Kogej Ksenija</i>	5
11-1-04	Micro/nano technologies and structures	<i>Penič Samo</i>	5
11-1-05	Nanotechnology and bio-nano interactions	<i>Drobne Damjana</i>	10
11-1-06	Innovations in research	<i>Junkar Ita</i>	5

Nutrition

12-1-01	Clinical nutrition	<i>Benedik Evgen</i>	5
12-1-03	Nutrition	<i>Salobir Janez Pajk Žontar Tanja Horvat Simon</i>	10
12-1-04	Nutrition of ruminants and non-ruminants	<i>Lavrenčič Andrej Salobir Janez</i>	5
12-1-05	Nutritional biochemistry	<i>Poklar Ulrih Nataša Battelino Tadej</i>	10
12-1-06	Probiotics	<i>Treven Primož</i>	5

Technical Systems in Biotechniques

13-1-01	Bioprocess techniques	<i>Golobič Iztok</i>	5
13-1-02	Product innovation	<i>Vukašinović Nikola</i>	5
13-1-03	Safety criteria	<i>Jerman Boris</i>	5
13-1-04	Measurement in agriculture	<i>Kutin Jože</i>	5
13-1-05	Processes and mechanisation	<i>Kos Leon</i>	10
13-1-06	Technical information systems	<i>Kos Leon</i>	5

13-1-07	Technologies in meat production and processing	<i>Demšar Lea Polak Tomaž</i>	5
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Managing Forest Ecosystems

14-1-01	Dendroecology, growth and structure characteristics of forest stands	<i>Levanič Tomislav Klopčič Matija</i>	5
14-1-02	Dendrology and forest genetic resources	<i>Brus Robert</i>	5
14-1-03	Physiology of forest trees and conservation of forest genetic resources	<i>Kraigher Hojka</i>	5
14-1-04	Forest techniques and forest work	<i>Potočnik Igor Krč Janez</i>	5
14-1-05	Methods of ecological modelling	<i>Debeljak Marko</i>	5
14-1-06	Research in forest phytosociology and silviculture	<i>Diaci Jurij Rozman Andrej Roženberger Dušan</i>	10
14-1-08	Research methods used in wildlife ecology and management	<i>Jerina Klemen</i>	5
14-1-09	Forest ecosystem management	<i>Ficko Andrej Bončina Andrej Jerina Klemen Grošelj Petra</i>	10
14-1-10	Forest protection	<i>Jurc Maja</i>	5
14-1-11	International and EU forest policy	<i>Pezdevšek Malovrh Špela</i>	5

Protection of Natural Heritage

15-1-01	Applied methods in protection of natural heritage	<i>Nastran Mojca Nagel Andrew Thomas</i>	10
15-1-02	Conservation of local elements of natural heritage within wider European context	<i>Kos Ivan</i>	5

Animal Science

16-1-01	Anthrozoology	<i>Zupan Šemrov Manja</i>	5
16-1-02	Advanced animal husbandry	<i>Terčič Dušan</i>	5
16-1-03	Quantitative and statistical genetics	<i>Kovač Milena</i>	10
16-1-04	Assessment of animal welfare	<i>Jordan Dušanka</i>	5
16-1-05	Animal production systems	<i>Simčič Mojca</i>	10
16-1-06	Bioinformatics methods in population genomics	<i>Zorc Minja Dovč Peter</i>	5

Cell Sciences

17-1-01	Biological signal analysis	<i>Kreft Marko Belušič Gregor</i>	5
17-1-02	Dynamics of cell architecture	<i>Žnidaršič Nada Štrus Jasna Erdani Kreft Mateja Romih Rok Vittori Miloš Mrak Polona</i>	10
17-1-03	Correlative microscopy	<i>Erdani Kreft Mateja</i>	5

17-1-04	Methods in Live Cell Imaging	<i>Veranič Peter</i>	5
17-1-05	Microscopy and image analysis of biological samples* *Simultaneous inscription with the subject 17-2-02 is not possible	<i>Kostanjšek Rok Žnidaršič Nada Kreft Marko</i>	5
17-1-06	Molecular physiology	<i>Zorec Robert Kreft Marko</i>	10
17-1-07	Toxins and biomembranes	<i>Sepčič Kristina Križaj Igor Anderluh Gregor</i>	10

Food Science

18-1-01	Physical-biochemical methods	<i>Poklar Ulrih Nataša Anderluh Gregor Plavec Janez</i>	5
18-1-02	Food quality and safety	<i>Smole Možina Sonja Abramovič Helena Bertoncelj Jasna Jeršek Barbka</i>	10
18-1-03	Interaction of sensory and instrumental methods	<i>Korošec Mojca</i>	5
18-1-04	New technologies in food of animal origin	<i>Demšar Lea Polak Tomaž Čanžek Majhenič Andreja</i>	5
18-1-05	Contemporary technologies of plant food	<i>Vidrih Rajko Košmerl Tatjana Požrl Tomaž</i>	5

List of Individual Research Elective Subjects

Number	Course Title	Lecturers	ECTS
Agronomy			
01-2-01	Research work in the field of plant protection	<i>Trdan Stanislav</i>	10
Bioinformatics			
02-2-01	Bioinformatics Algorithms	<i>Curk Tomaž</i>	5
02-2-02	Topics in biology for non-biologists* *The subject will not be implemented in 2025/26 academic year		5
02-2-03	Computational Biology	<i>Mraz Miha Belič Aleš Moškon Miha</i>	5
Biology			
04-2-01	The analysis of interactions between molecules using surface plasmon resonance	<i>Butala Matej</i>	5
Biotechnology			
05-2-02	Global analysis of genome, transcriptome and proteome	<i>Jakše Jernej Štajner Nataša</i>	5
05-2-03	Research planning and elaboration of a project proposal - practical course* *A prerequisite for choosing this course is also choosing the theoretical course: "Research planning and elaboration of a project proposal"	<i>Drobne Damjana</i>	5

Wood and Composites

09-2-01	Selected methods for characterisation of wood and lignocellulosic composites	<i>Humar Miha</i>	5
09-2-02	Methods for the assessment of the condition of timber and lignocellulosic materials in historic and new buildings	<i>Lesar Boštjan</i>	5

Microbiology

10-2-01	Biofilms	<i>Stopar David Mandić Mulec Ines</i>	10
10-2-02	Experimental evolution of microorganisms	<i>Dragoš Anna</i>	5
10-2-03	Methods in microbiology	<i>Štefanič Polonca Zalar Polona Smole Možina Sonja Danevčič Tjaša Klančnik Anja</i>	5
10-2-04	Microbial Interactions	<i>Mandić Mulec Ines</i>	10
10-2-05	Practical Prokaryotic Genomics	<i>Accetto Tomaž</i>	5

Nutrition

12-2-01	Molecular biology methods in nutrition and food science	<i>Klančnik Anja Dobnik David Smole Možina Sonja</i>	5
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Managing Forest Ecosystems

14-2-01	Technologies and mechanization for harvesting of forest biomass	<i>Poje Anton</i>	5
14-2-02	Sustainable design of work processes	<i>Poje Anton</i>	5

Animal Science

16-2-01	Animal reproduction biotechnology	<i>Dovč Peter</i>	5
16-2-02	The quality of the products of animal origin	<i>Klopčič Marija</i>	5
16-2-03	Assessment methods of psychological profile in animals	<i>Zupan Šemrov Manja</i>	5

Cell Sciences

17-2-01	Electrophysiology in nanometer scale	<i>Zorec Robert Kreft Marko Chowdhury H. Helena</i>	5
17-2-02	Microscopy and image analysis of biological samples - project work* <small>*Simultaneous inscription with the subject 17-1-05 is not possible</small>	<i>Kostanjšek Rok Žnidaršič Nada Kreft Marko</i>	10
17-2-03	Special techniques of electron microscopy	<i>Romih Rok</i>	5
17-2-04	Live Cell Imaging – practical course	<i>Veranič Peter</i>	10

Food Science

18-2-01	Antioxidants	<i>Abramovič Helena</i>	5
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Methods of Assessment

In accordance with the Statute UL, success in exams will be evaluated by grades from 5-10 whereby grades from 6 to 10 will be considered pass grades. There are no partial examinations in subjects. The grades consist of one number. Examinations are either written or oral, and the full marks may also be obtained through seminar papers or projects. Study requirements may also be assessed by grades: pass with distinction, pass or fail.

A student of the doctoral study programme in Biosciences can apply for a change of the selected course only if they have not yet attended lectures or consultations. The request is confirmed or denied by the programme council of Biosciences and signed by the student, the mentor, the lecturer of the course the student wishes to abandon and the lecturer of the course they wish to enrol into.

Changing / Abandoning Selected Course

Doctoral studies in Biosciences are regulated by the Regulation on doctoral studies by which is specified the manner and organisation of the implementation of a doctoral study programme.

- The University publishes a call for applications for admission to the doctoral study programme in Biosciences. The call for applications must be in compliance with Statute of the University of Ljubljana.
- The Biotechnical Faculty collects applications from students for admission, and delivers them for review and confirmation by the Programme Council.
- Prior to admission, the student chooses a mentor from the range of higher education teachers or scientific workers working in a field which is connected to the student's selected scientific field. Together they choose subjects and specify the scientific orientation of studies.
- At the time of enrolment in the 1st year of doctoral study, the student signs a contract on carrying out studies.
- The Biotechnical Faculty enrolls all the accepted candidates. All the procedures tied to the acquisition of scientific titles are led by the coordinator of the scientific field.
- The Biotechnical Faculty organises and ensures the implementation of the doctoral programme in terms of keeping records in connection with studies and students, organising and ensuring the implementation of lectures and other study requirements for subjects (lecturers, premises, timetables, informing lecturers and students etc.).
- A written agreement is concluded for each student by which is determined which obligations (subjects) the student will undertake at another faculty, and when s/he will undertake them (coordination of obligations in terms of time is necessary). Evaluation of obligations (no. of credit points) and costs connected with the implementation of

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ORGANISATION AND IMPLEMENTATION OF INTERDISCIPLINARY DOCTORAL STUDIES IN BIOSCIENCES

Rules on the Organisation of Studies

- programmes at other faculties.
- Member lecturers, in cooperation with mentors, ensure the undisturbed research work of the student.
 - The procedure for registering themes for a doctoral dissertation is conducted by the Senate of the faculty that is coordinating the field in which the student is enrolled. The theme of the doctoral dissertation is confirmed by the Senate of the University of Ljubljana.
 - On the proposal of the member faculty in which the candidate has successfully defended the doctoral dissertation, the Rector promotes the candidate to Doctor of Philosophy.
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Authorities and Decision-making

Collegiums / Commissions for Doctoral Studies / Faculty Senates

All procedures for monitoring themes and titles of doctoral dissertations, appointing commissions in doctoral procedures, applications for resolving individual requests from candidates (e.g., change of subjects etc.) and conducting all other matters in connection with doctoral procedures shall be commenced by the responsible authorities commissioned by the faculties providing each of the fields of study. The coordinators of the scientific fields (see chapter 9) are members of these bodies (e.g. collegium of the field of study, commission for doctoral studies or faculty senate).

Programme Council

The Programme Council consists of the coordinators of the scientific fields, representatives of faculties and other institutions which have at least five lecturers in the programme and representative of doctoral students. The Programme Council is chaired by the President of the Programme Council, who has a deputy. The term of office of the president is four years and is renewable.

Competences of the Programme Council:

- It examines applications from candidates and decides which candidates will be admitted to the programme;
- It adopts supplementary programmes;
- It adopts the working plan of education in doctoral studies in Biosciences;

- It prepares self-evaluation reports;
 - It analyses the effectiveness of implementation and suggests measures for its improvement;
 - It adopts rules on the organisation and financial business of doctoral studies in Biosciences for each year separately;
 - It decides on individual student applications and requests (e.g. subject change, enrolment in another field of study);
 - It ensures the connection and cooperation of research groups.
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Competences and tasks of field coordinators:

- Ensures that prospective and current PhD students are adequately informed about the study process, advises on the selection of an appropriate mentor and assists candidates in establishing contacts with potential mentors,
- Takes care of coordination with lecturers and ensures appropriate cooperation between mentors and their doctoral students,
- Organizes annual meetings of regularly enrolled students of their field,
- Supervise the improvement and updating of the study programme, by making coordinated proposals to the Faculty Senate, which coordinates the field, and to the Programme Council,
- Participates in sessions where decisions are made about doctoral procedures,
- Collaborates in preparing individual course plan for candidates enrolled in the selected scientific field. Co-signs the course plans.
- Attends meetings of the Programme Council.

Coordinators of individual scientific fields in the doctoral study of Biosciences are also coordinators for exchange students at the 3rd level. The coordinator of the field, in which a Biosciences student is enrolled, when a student goes abroad as part of an international exchange, signs the "Learning agreement for studies". Coordinators are also responsible for foreign students who come to Slovenia on exchange and choose subjects from the Biosciences study programme.

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COORDINATORS OF SCIENTIFIC FIELDS

List of Coordinators and Deputy Coordinators

Coordinator

Deputy Coordinator

Agronomy

Prof. Dr. Dominik Vodnik
Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 32 91
E-mail: dominik.vodnik@bf.uni-lj.si

Prof. Dr. Marjetka Suhadolc
Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 32 04
E-mail: marjetka.suhadolc@bf.uni-lj.si

Bioinformatics

Assoc. Prof. Dr. Tomaž Curk
Faculty of Computer and Information
Science
Večna pot 113, 1000 Ljubljana
Phone: 00386 1 479 82 29
E-mail: tomaz.curk@fri.uni-lj.si

Prof. Dr. Tanja Kunej
Biotechnical Faculty
Department of Animal Science
Groblje 3, 1230 Domžale
Phone: 00386 1 320 38 90
E-mail: tanja.kunej@bf.uni-lj.si

Bioengineering in Health Sciences

Prof. Dr. Veronika Kralj Igljič
Faculty of Health Sciences
Zdravstvena pot 5, 1000 Ljubljana
Phone: 00386 1 300 11 94
E-mail: kraljiglic@gmail.com

Prof. Dr. Polonca Trebše
Faculty of Health Sciences
Zdravstvena pot 5, 1000 Ljubljana
Phone: 00386 1 300 11 15
E-mail: polonca.trebse@zf.uni-lj.si

Biology

Assoc. Dr. Anita Jemec Kokalj
Biotechnical Faculty
Department of Biology
Večna pot 111, 1000 Ljubljana
Phone: 00386 1 320 33 78
E-mail: anita.jemec@bf.uni-lj.si

Prof. Dr. Matej Butala
Biotechnical Faculty
Department of Biology
Večna pot 111, 1000 Ljubljana
Phone: 00386 1 320 33 97
E-mail: matej.butala@bf.uni-lj.si

Coordinator

Deputy Coordinator

Biotechnology

Prof. Dr. Jernej Jakše

Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 32 80
E-mail: jernej.jakse@bf.uni-lj.si

Assoc. Prof. Dr. Nataša Štajner

Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 32 55
E-mail: natasa.stajner@bf.uni-lj.si

Economics of Natural Resources

Prof. Dr. Luka Juvančič

Biotechnical Faculty
Department of Animal Science
Groblje 3, 1230 Domžale
Phone: 00386 1 320 39 25
E-mail: luka.juvancic@bf.uni-lj.si

Assoc. Prof. Dr. Damijana Kastelec

Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 32 45
E-mail: damijana.kastelec@bf.uni-lj.si

Horticulture

Prof. Dr. Robert Veberič

Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 31 41
E-mail: robert.veberic@bf.uni-lj.si

Prof. Dr. Nina Kacjan Maršič

Biotechnical Faculty
Department of Agronomy
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 31 13
E-mail: nina.kacjan.marsic@bf.uni-lj.si

Landscape Architecture

Prof. Dr. Valentina Schmitzer

Biotechnical Faculty
Department of Landscape Architecture
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 30 76
E-mail: valentina.schmitzer@bf.uni-lj.si

Asst. Dr. Nadja Penko Seidl

Biotechnical Faculty
Department of Landscape Architecture
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 30 62
E-mail: nadja.penko@bf.uni-lj.si

Coordinator

Deputy Coordinator

Wood and Biocomposites

Prof. Dr. Marko Petrič

Biotechnical Faculty
Department of Wood Sciences
Rožna dolina, C. VIII/34, 1000 Ljubljana
Phone: 00386 1 320 36 20
E-mail: marko.petric@bf.uni-lj.si

Prof. Dr. Primož Oven

Biotechnical Faculty
Department of Wood Sciences
Rožna dolina, C. VIII/34, 1000 Ljubljana
Phone: 00386 1 320 36 16
E-mail: primoz.oven@bf.uni-lj.si

Microbiology

Prof. Dr. David Stopar

Biotechnical Faculty
Department of Microbiology
Večna pot 111, 1000 Ljubljana
Phone: 00386 1 320 34 12
E-mail: david.stopar@bf.uni-lj.si

Prof. Dr. Gorazd Avguštin

Biotechnical Faculty
Department of Animal Science
Groblje 3, 1230 Domžale
Phone: 00386 1 320 38 27
E-mail: gorazd.avgustin@bf.uni-lj.si

Nanosciences

Prof. Ddr. Aleš Iglič

Faculty of Electrical Engineering
Tržaška 25, 1000 Ljubljana
Phone: 00386 1 476 82 35
E-mail: ales.iglic@fe.uni-lj.si

Asst. Prof. Dr. Sara Novak

Biotechnical Faculty
Department of Biology
Večna pot 111, 1000 Ljubljana
Phone: 00386 1 320 33 83
E-mail: sara.novak@bf.uni-lj.si

Nutrition

Assoc. Prof. Dr. Jasna Bertoneclj

Biotechnical Faculty
Department of Food Science and Technology
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 37 25
E-mail: jasna.bertoneclj@bf.uni-lj.si

Asst. Prof. Dr. Tanja Pajk Žontar

Biotechnical Faculty
Department of Food Science and Technology
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 37 13
E-mail: tanja.pajk@bf.uni-lj.si

Coordinator

Deputy Coordinator

Technical Systems in Biotechniques

Prof. Dr. Iztok Golobič

Faculty of Mechanical Engineering

Aškerčeva 6, 1000 Ljubljana

Phone: 00386 1 477 14 20

E-mail: iztok.golobic@fs.uni-lj.si

Managing Forest Ecosystems

Assoc. Prof. Dr. Thomas Andrew Nagel

Biotechnical Faculty

Department of Forestry

Večna pot 83, 1000 Ljubljana

Phone: 00386 1 320 35 35

E-mail: tom.nagel@bf.uni-lj.si

Assoc. Prof. Dr. Milan Kobal

Biotechnical Faculty

Department of Forestry

Večna pot 83, 1000 Ljubljana

Phone: 00386 1 320 35 29

E-mail: milan.kobal@bf.uni-lj.si

Protection of the Natural Heritage

Asst. Prof. Dr. Mojca Nastran

Biotechnical Faculty

Department of Forestry

Večna pot 83, 1000 Ljubljana

Phone: 00386 1 320 35 28

E-mail: mojca.nastran@bf.uni-lj.si

Prof. Dr. Uroš Stepišnik

Faculty of Arts

Aškerčeva 2, 1000 Ljubljana

Phone: 00386 1 241 12 38

E-mail: uros.stepisnik@ff.uni-lj.si

Animal Science

Asst. Prof. Dr. Dušanka Jordan

Biotechnical Faculty

Department of Animal Science

Groblje 3, 1230 Domžale

Phone: 00386 1 320 38 66

E-mail: dusanka.jordan@bf.uni-lj.si

Asst. Prof. Dr. Dušan Terčič

Biotechnical Faculty

Department of Animal Science

Groblje 3, 1230 Domžale

Phone: 00386 1 320 39 15

E-mail: dusan.tercic@bf.uni-lj.si

Coordinator

Deputy Coordinator

Cell Sciences

Asst. Dr. Nada Žnidaršič

Biotechnical Faculty
Department of Biology
Večna pot 111, 1000 Ljubljana
Phone: 00386 1 320 34 20
E-mail: nada.znidarsic@bf.uni-lj.si

Acad. Prof. Dr. Robert Zorec

Faculty of Medicine
Laboratory of Experimental
Neuroendocrinology – Centre of
Molecular Cell Physiology (Center
LN-MCP)
Zaloška 4, 1000 Ljubljana
Phone: 00386 1 543 70 20
E-mail: robert.zorec@mf.uni-lj.si

Food Science

Prof. Dr. Sonja Smole Možina

Biotechnical Faculty
Department of Food Science and Technology
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 37 51
E-mail: sonja.smole@bf.uni-lj.si

Prof. Dr. Lea Demšar

Biotechnical Faculty
Department of Food Science and Technology
Jamnikarjeva 101, 1000 Ljubljana
Phone: 00386 1 320 37 41
E-mail: lea.demsar@bf.uni-lj.si

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ACQUISITION OF THE ACADEMIC TITLE DOCTOR OF PHILOSOPHY

The procedure for the application of a doctoral dissertation topic shall be carried out by the faculty coordinating the field. The rules for obtaining the title of Doctor of Philosophy are published on the website of participating faculties:



www.bf.uni-lj.si



www.fe.uni-lj.si



www.fri.uni-lj.si



www.fs.uni-lj.si

The Coordinator

Biotechnical faculty

Student office of the third Bologna cycle
Jamnikarjeva 101
1000 Ljubljana

Contact person: Vesna Ješe Janežič, M. phil.

Phone: 00386 1 320 30 27

E-mail: vesna.jesejanezic@bf.uni-lj.si

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**ADDITIONAL
INFORMATION ON
THE STUDY
PROGRAMME**

Participating Faculties

Faculty of Electrical Engineering

Student office
Tržaška cesta 25
1000 Ljubljana

Contact person: Nina Gorenc Rebernik

Phone: 00386 1 476 83 38; E-mail: nina.gorenc-rebernik@fe.uni-lj.si

Faculty of Computer and Information Science

Student office
Večna pot 113
1000 Ljubljana

Contact person: Aleš Smonig Grnjak

Phone: 01 479 81 19; E-mail: ales.grnjak-smonig@fri.uni-lj.si

Faculty of Mechanical Engineering

Student office
Aškerčeva 6
1000 Ljubljana

Contact person: Tjaša Sterle Polak

Phone: 00386 1 477 11 69; E-mail: tjasa.sterlepolak@fs.uni-lj.si
or doktorski@fs.uni-lj.si

Faculty of Health Sciences

Student office
Zdravstvena pot 5
1000 Ljubljana

Contact person: Marjeta Rot

Phone: 00386 1 300 11 24; E-mail: marjeta.rot@zf.uni-lj.si

Annex A

Subjects are coded with three numbers, the first of which represents the scientific field, the second the type of subject and the third the successive number of the subject.

- 01 Agronomy
- 02 Bioinformatics
- 03 Bioengineering in Health Sciences
- 04 Biology
- 05 Biotechnology
- 06 Economics of Natural Resources
- 07 Horticulture
- 08 Landscape Architecture
- 09 Wood and Biocomposites
- 10 Microbiology
- 11 Nanosciences
- 12 Nutrition
- 13 Technical Systems in Biotechniques
- 14 Managing Forest Ecosystems
- 15 Protection of the Natural Heritage
- 16 Animal Science
- 17 Cell Sciences
- 18 Food Science

1–Theoretical subjects

2–Individual research subjects

For example, a subject with code 01-1-05 is in the field of Agronomy (01), is a theoretical subject (1), and its successive number within the field of Agronomy is 5.

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