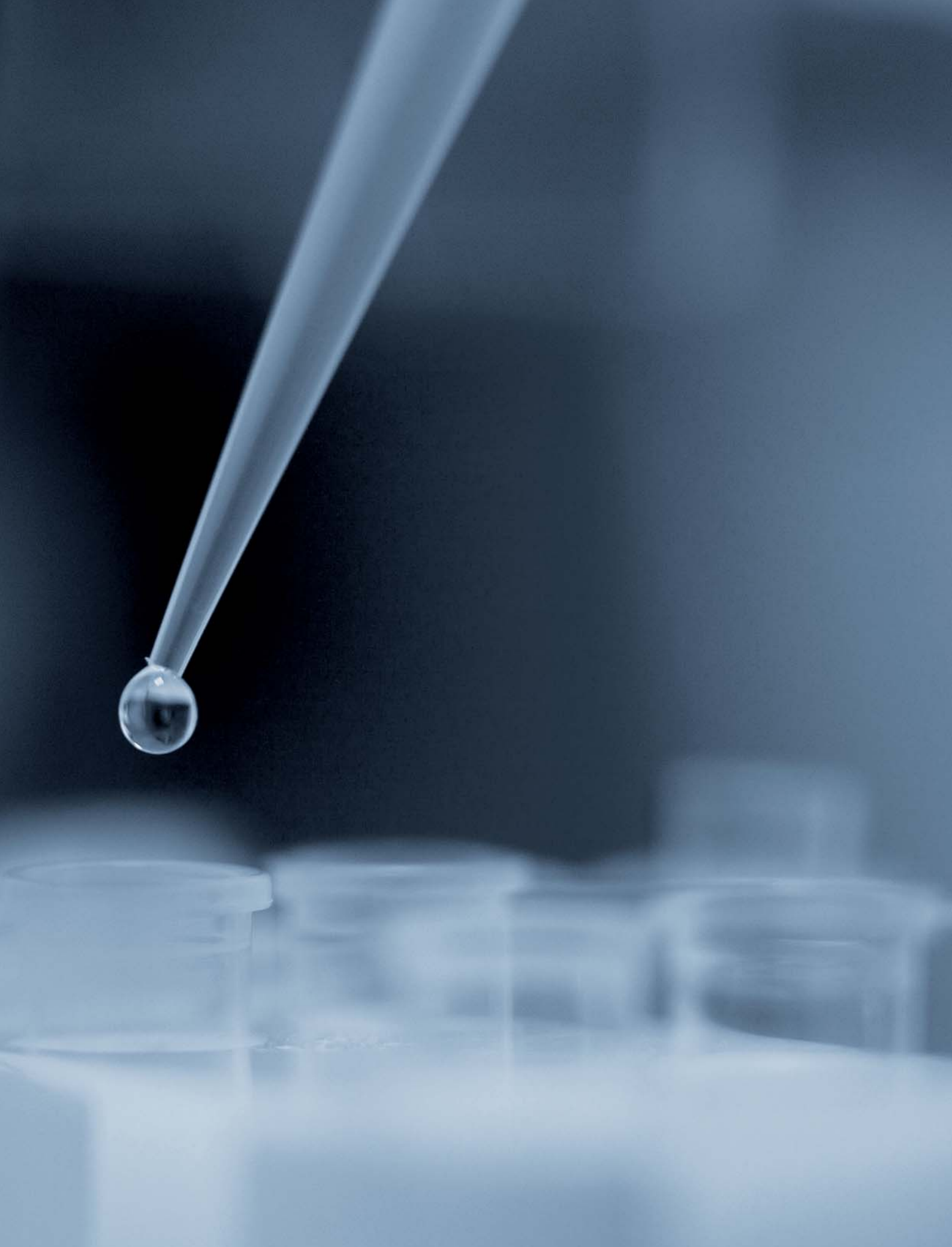


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# Biomedicine

*Interdisciplinary  
doctoral  
programme*



# Biomedicine

## *Interdisciplinary doctoral programme*

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# Introduction

The field of biomedicine encompasses knowledge from the areas of basic medicine, biochemistry and molecular biology, clinical biochemistry and laboratory biomedicine, clinical medicine, genetics, microbiology, neuroscience, pharmacy, public health, toxicology and veterinary medicine. The need for a high-quality and up-to-date doctoral programme to acquire suitable knowledge in these areas is dictated by rapid and extensive development in these various scientific fields, as well as their impact on the quality of life. Due to previous good experiences and the advantages of an interdisciplinary approach to existing postgraduate studies, the doctoral study of biomedicine is organised at university level. The field of biomedicine is very broad and is being developed at the first two educational levels by various faculty members at the University of Ljubljana. It seems reasonable to link the third educational level (doctoral studies) in terms of organisation and content. This approach also enables the collaboration of teachers and researchers from separate scientific fields, thus forming a broader interdisciplinary field. The connections of university research with research institutes are also achieved. • The primary emphasis of doctoral study is on research, interdisciplinarity and collaboration between internationally renowned local and foreign experts. Based on recommendations of the European University Association (EUA), international student exchange is also encouraged. As the end result of the research work, the publishing of at least one scientific article is expected. Special emphasis is placed on a productive relation between the doctoral candidates and their mentors. Students can choose mentors from amongst internationally recognised and established experts in compliance with the rules of the University of Ljubljana and collaborating faculties.



# 1 The programme

## 2 Basic programme goal and general competence

**T**he duration of the Interdisciplinary Doctoral Programme in Biomedicine is three years (180 ECTS credits), and according to the Bologna guidelines this represents the third cycle of the educational scheme. The programme has been conceived in agreement with all the requirements and legislation of the Republic of Slovenia and meets all criteria for doctoral study established by the EUA. In this way, the direct inclusion of programme components in an international exchange with universities from other countries using the ECTS system is rendered possible.

The programme consists of organised classes (60 credits) and individual research work for the doctoral thesis (120 credits).

The programme leads to the degree of Doctor of Science in the following fields:

- **Basic Medicine**
- **Biochemistry and Molecular Biology**
- **Clinical Biochemistry and Laboratory Biomedicine**
- **Clinical Medicine**
- **Genetics**
- **Microbiology**
- **Neuroscience**
- **Pharmacy**
- **Public health**
- **Toxicology**
- **Veterinary Medicine**

The programme is organised by the University of Ljubljana through its faculties and three Slovene research institutes, all in Ljubljana.

- **Biotechnical Faculty**, Jamnikarjeva ulica 101
- **Faculty of Pharmacy**, Aškerčeva cesta 7, Ljubljana
- **Faculty of Chemistry and Chemical Technology**, Aškerčeva cesta 5
- **Faculty of Medicine**, Vrazov trg 2
- **Veterinary Faculty**, Gerbičeva ulica 60
- **The Jožef Stefan Institute**, Jamova cesta 39
- **The National Institute of Chemistry**, Hajdrihova ulica 19
- **The National Institute of Biology**, Večna pot 111

The research institutes contribute teachers who take part in organised courses, mentors and the research infrastructure for executing the experimental part of doctoral work.

## 2 Basic programme goal and general competence

**T**he basic goal of the Interdisciplinary Doctoral Programme in Biomedicine is to further educate highly qualified experts in the scientific fields that constitute the area of biomedicine. The programme is interdisciplinary and encompasses biochemistry and molecular biology, pharmacy, genetics, clinical biochemistry and laboratory biomedicine, clinical and basic medicine, microbiology, neuroscience, public health, toxicology and veterinary medicine.

The graduates of doctoral programme in Biomedicine will acquire the ability of understanding, critically judging and solving complex scientific-research issues. They will be qualified for creative and independent research, for the critical assessment of research results, the development of new research methods and the transfer of new research methods and knowledge into practice.



# 3 Application and enrolment

## 4 Tuition Fee

## 5 Mentoring

### 3 Application and enrolment in the Doctoral Programme in Biomedicine

Call for enrolment is published on the UL web page ([www.uni-lj.si](http://www.uni-lj.si)) no later than 4 months prior to the start of the academic year. Applicants for admission to the programme can apply according to the instructions in call for enrolment.

Candidates will receive information regarding the success of their application in September. Enrolment in Year 1 of the Biomedicine doctoral study programme takes place at the providing faculties. Enrolment dates will be published at the webpage [http://www.uni-lj.si/studij/studijski\\_programi/podiplomski\\_studij\\_3\\_stopnja/biomedicina/](http://www.uni-lj.si/studij/studijski_programi/podiplomski_studij_3_stopnja/biomedicina/).

Enrolment and all other procedures required to obtain the scientific title are carried out by providing faculties coordinating the relevant scientific field. Enrolment in the scientific fields of biochemistry and molecular biology, clinical medicine, basic medicine, neuroscience, public health and microbiology is held at the Faculty of Medicine, enrolment in the scientific fields of pharmacy, clinical biochemistry and laboratory biomedicine and toxicology is held at the Faculty of Pharmacy, enrolment in the scientific field of genetics is held at the Biotechnical Faculty and enrolment in the scientific field of veterinary medicine is held at the Veterinary Faculty.

The procedure for registering a doctoral dissertation topic is in the domain of the coordinating faculty senate. The doctoral dissertation topic is approved by the University of Ljubljana Senate. Following a nomination by the member where the candidate has successfully defended doctoral dissertation, the Rector performs the promotion for the doctor of science.

Upon enrolment in each individual year of the doctoral study programme, the candidate and the University of Ljubljana sign an education agreement.

### 4 Tuition Fee

The tuition fee is paid individually for each study year or for each year that the student enrolls in.

The tuition fees are published in the price list adopted by the UL Board: [http://www.uni-lj.si/studij/cenik\\_storitev\\_za\\_studente/](http://www.uni-lj.si/studij/cenik_storitev_za_studente/).

#### 4.1 Scholarship Opportunities

For information about scholarship opportunities, please visit [http://www.uni-lj.si/studij/moznosti\\_stipendiranja/](http://www.uni-lj.si/studij/moznosti_stipendiranja/) and <http://www.sklad-kadri.si/>.

### 5 Mentoring

Prior to enrolment, candidates are required to choose a mentor and submit upon enrolment at the latest the mentor's written acceptance of mentorship. The doctoral dissertation mentor or co-mentor is a university teacher (assistant professor, associate professor, full professor) or researcher (research associate, senior researcher or higher research associate) with a relevant scientific bibliography in the field of the doctoral dissertation topic.

The mentor is appointed officially in the process of registration and approval of the doctoral dissertation topic.

The mentor's role is to guide the student and to provide conditions for work. The mentor must ensure that appropriate research capacities and research infrastructure are available. A foreign expert with a title comparable to a Slovenian title can be a mentor, but in this event the University of Ljubljana will also appoint a co-mentor.

The list of potential mentors is available at [http://www.uni-lj.si/studij/studijski\\_programi/podiplomski\\_studij\\_3\\_stopnja/biomedicina/](http://www.uni-lj.si/studij/studijski_programi/podiplomski_studij_3_stopnja/biomedicina/).





# 6 Access requirements and criteria

## 7 Recognition of knowledge and skills

### 6 Access requirements and criteria for selection

#### 6.1 Access requirements

For admission to the Interdisciplinary Doctoral Programme in Biomedicine graduates of the following programmes can apply:

- Second cycle study programmes;
- Study programmes providing education for occupations regulated by Directives of the European Union (93/16/EEC for doctors, 78/1027/EEC for veterinarians, 78/687/EEC for dentists and 85/432/EEC for pharmacists) evaluated with at least 300 credits;
- Study programmes leading to specialisation, provided that candidates have previously completed a higher education professional study programme. The Biomedicine Programme Council will specify additional entry requirements for candidates in individual areas amounting from 30 to 60 credits;
- Study programmes leading to a master of science or to specialisation after completing an academic study programme. 60 credits of study obligations will be recognised to such candidates;
- Academic study programmes.

Candidates with foreign qualifications are required to apply for recognition of their entry qualifications. Applications should be separately submitted at the same time as applications to the programme to the University of Ljubljana, Kongresni trg 12, Ljubljana, Slovenija.

#### 6.2 Admission requirements

The selection of candidates is an issue when the number of candidates significantly exceeds the number of places offered. Selection will be primarily based on the candidate's level of achievement in previous studies.

The main criteria for selection are based upon: achievement in previous studies (achived grades and graduation work – diploma) – elective exam where the following is rated:

1. research article(s)
2. student scientific awards and awards at international competitions
3. professional specialisation or degrees from other high level programmes
4. others

Rating is determined by Programme Council.

### 7 Recognition of knowledge and skills acquired before admission to the programme

**K**nowledge and skills acquired through formal and informal learning, and experience before entry will be recognised and evaluated by the Programme Council in accordance with criteria for the accreditation of study programmes.

In recognising respective knowledge and skills, the following are considered:

- professional specialisation
- a second degree from an undergraduate programme
- previous scientific research work
- published scientific work
- previous professional experience



# 8 Requirements for progression 9 Conditions for completing

## 8 Requirements for progression through the programme

Successful completion of at least 45 credits, of which at least 20 credits must derive from core courses, is required. Candidates who have fulfilled all study obligations in the first and second year are permitted to enter the third year of doctoral study.

It is also possible to repeat the year. Requirements for repeating the first year is completion of at least 10 credits from core course and 20 from individual research work.

Requirement for repeating the second year is all study obligations in the first year fulfilled.

## 9 Conditions for completing the programme

### *9.1 Doctoral thesis*

The registration of topic, the nomination of an academic advisors – mentors, as well as the nomination of an expert committee for evaluation of a doctoral thesis and graduation committee, are in the domain of coordinating faculty senates. The Senate of the University of Ljubljana approves of the topic of the doctoral thesis and the proposed academic advisor(s).

### *9.2 Conditions for completing the programme*

The condition for completing the programme of study and acquiring a doctoral degree is the successful completion of all study obligations defined by the programme and the successful defence of the doctoral thesis. The doctoral candidate must publish at least one scientific article based on the research presented in the doctoral thesis in a scientific journal indexed by the SCI or SSCI. The article with the candidate's name listed as first author must be published or accepted for publication prior to the public defence of the doctoral thesis.

### *9.3 Doctoral diploma*

After completing the programme the doctoral diploma jointly signed by the Rector of the University of Ljubljana and the dean of the responsible faculty, is awarded to the candidates. Doctoral diploma is awarded by the Rector of the University of Ljubljana. Graduates of the Interdisciplinary Doctoral Programme in Biomedicine receive the title »Doctor of Sciences«.





# 10 International exchanges

## 11 Transfer between study programmes

## 12 Grading system

## 13 Career Prospects

### 10 International exchanges

**T**he Interdisciplinary Doctoral Programme in Biomedicine is both horizontally and vertically linked to other study programmes at the University of Ljubljana. Horizontal exchange enables students to fulfill their elective course requirements from other graduate study programmes at the University of Ljubljana in agreement with their mentors and course lecturers. The vertical link is inherent in the very design of the study programme through its syllabus and the possibilities of choosing different courses. Furthermore, it is possible to exchange study courses with other comparable programmes taught at other universities. The quality and comparability of courses must be evaluated by the Programme Council. International exchange takes place on the basis of international contracts and bilateral agreements.

International exchange is also possible through collaboration in mobility programmes for students and professors (ERASMUS, SOCRATES, CEEPUS and others). The programme is also open to foreign students.

### 11 Transfer between study programmes

**T**ransfer between programmes is possible if candidates fulfil the access requirements of the programme. Applications for transfer of such candidates to Interdisciplinary Doctoral Programme in Biomedicine will be treated individually by the Programme Council in accordance with the University Statute.

### 12 Grading system

**A**ccording to the programme, exams are written and oral. In accordance with the Statute of University of Ljubljana examination results are graded from 1 to 10, pass grades range from 6 to 10. Preparation and oral presentations of seminars are also graded. The examinations in doctoral programs may also be graded as not passed, passed and passed with honors.

### 13 Career Prospects

**T**he possibilities for employment of graduates from the Interdisciplinary Doctoral Programme in Biomedicine are diverse. They will present an important pool of experts at Slovene universities and other educational or research institutions. They can also work in health institutions as well as in other institutions that perform research. They will also be employable in the pharmaceutical industry and in government administration. The employment in other institutions that employ experts with the highest educational level is also possible.



# 14 Programme

## 14. Programme

The programme consists of organised forms of teaching and research. Organised teaching comprises of 60 credits; the remaining 120 credits are intended for individual research work (IRW) for the doctoral thesis.

The procedure for registering a doctoral dissertation topic is in the domain of the coordinating faculty senate. The doctoral dissertation topic is approved by the University of Ljubljana Senate. Following a nomination by the member where the candidate has successfully defended doctoral dissertation, the Rector performs the promotion for the doctor of science.



### *14.1 Content and structure of the programme by year*

The structure of the programme is designed to emphasise organised study in the first year and beginning of second year, while later the emphasis is on research and the preparation of the doctoral thesis.

Year 1	Credits
Core courses	30
IRW	30

Year 1	Credits
Elective courses	15
Presentation of the doctoral dissertation topic	5
IRW	40

Year 3	Credits
IRW	50
A presentation of the result of doctoral dissertation	5
Completed doctoral dissertation and public defence	5

The candidate's selection of courses must be approved by the mentor and the coordinator of the specific scientific field. Part of these credits may be earned at foreign universities. With the mentor's approval, 10 percent of the programme credits may be obtained in other doctoral programmes offered by the University of Ljubljana or other universities.

### *14.2 Schedules*

The core course schedules are published at [http://www.uni-lj.si/studij/studijski\\_programi/podiplomski\\_studij\\_3\\_stopnja/biomedicina/](http://www.uni-lj.si/studij/studijski_programi/podiplomski_studij_3_stopnja/biomedicina/) in early September each year. Schedules for elective courses are designed individually.

# 15. Course presentation

## 15. Course presentation

The programme is composed of three types of courses:

- core courses
- elective theoretical courses
- elective individual research courses

The doctoral candidates, together with their mentors and the field coordinators, design individual study programmes by selecting courses from core and both types of elective course pools. The core courses are modular. For each scientific field a choice of at least 20 credits is needed from the core modules proposed by the respective scientific fields, while the remaining 10

credits can be chosen from modules of other core courses. Remaining credits can be obtained from the selection of various elective courses. Elective credits can also be selected from the university pool of generic skills courses, listed at the web page of the University of Ljubljana.

### 15. 1 Core courses

Core courses are designed for each specific scientific field. The content of courses is chosen on the basis of the research work of the professors.

Each scientific field proposed at least one core course, which is as a rule constructed from modules. The selection of modules is made in agreement with the mentor and the field coordinator.

Core courses

Code	Scientific field	Course title
J-1-400	Basic Medicine	Medical Cell Biology
B-1-100	Biochemistry and Molecular Biology	Selected advanced topics in Biochemistry and Molecular biology
L-1-300	Clinical Biochemistry and Laboratory Biomedicine	Algorithms of clinical biochemical diagnostics
K-1-500	Clinical Medicine	Research in clinical medicine
G-1-600	Genetics	Genetics
M-1-410	Microbiology	Selected Topics in Microbiology
N-1-540	Neuroscience	Neuroscience
F-1-200	Pharmacy	Pharmaceutical sciences
S-1-420	Public health	Research aspects of public health
T-1-340	Toxicology	Toxicology
V-1-700	Veterinary Medicine	Regulation processes in healthy and diseased animals





## 15. 2 Short presentation of core courses

**Code:** J-1-400

**Course title:** *Medical Cell Biology*

### **Contents:**

The course Medical Cell Biology enables in depth study of cell structures and functions, their alterations during pathological processes at molecular level, and upgrading of that knowledge in some important areas of medicine. The course consists of the obligatory module Fundamentals of medical cell biology and four elective modules: Cell biology in human reproduction, Biology of malignant cells and translational oncology, Cell biology in clinical genetics and System medicine of multifactorial disorders such as human reproductive biology, Oncology, genetics and multifactorial disorders. The course is composed of a core module (Module 1) and four elective modules.

#### **Module 1: Fundamentals of medical cell biology**

The basic module focuses on cell and molecular mechanisms of normal and abnormal cell cycle, cell death, the role of cell junctions in development, differentiation and diseases, the role of cell compartments of biosynthetic and endocytotic pathway in normal and transformed cells, the role of peroxisomes and mitochondria and on the structure and function of cytoskeleton during cell differentiation and their role in various diseases.

#### **Module 2: Cell biology in human reproduction**

The module deals with the development of gonads, oogenesis, folliculogenesis, spermatogenesis, fertilization, embryogenesis. Students get knowledge on assisted reproduction and stem cells.

#### **Module 3: Biology of malignant cells and translational oncology**

Students acquire knowledge on fundamentals of cancer biology, carcinogenesis, principles and targets for cancer treatment, new treatment approaches and advances in translational oncology.

#### **Module 4: Cell biology in clinical genetics**

The module covers genetic defects in different areas of the cell function and their impact on the disease development. Such knowledge is crucial for adequate treatment decisions, follow-up of the patients and prognosis, as well as for genetic counselling.

#### **Module 5: System medicine of multifactorial disorders**

The module 5 consists of work on the project, which is based on the most recent scientific discoveries and research interests of the study group. The study focuses on the systems approaches of the post-genome era, the computation with large datasets, statistics, data modelling and on the role of global genome studies for the predictive personalized medicine.

**Code:** B-1-100

**Course title:** *Selected advanced topics in Biochemistry and Molecular biology*

**Contents:**

Core course entitled »Selected advanced topics in Biochemistry and Molecular biology« is divided into three independent modules, each equivalent to 10 ECTS:

**Module 1: Selected metabolic processes with regulatory mechanisms**

Included are topics on metabolism of xenobiotics and ROS, mitochondrial biogenesis, growth, ontogenetic development in mammals, structure and functional asymmetry of biological membranes, membrane microdomains, protein interaction with lipid membranes, and mechanisms of signal transduction in regulating cellular processes.

**Module 2: Structure and function of biological molecules**

Included are topics in molecular immunology and proteolysis. Techniques of protein engineering and molecular modelling of proteins for prediction of their function will be presented.

**Module 3: Functional genomics and proteomics**

Included are topics on genome structure, organization and regulation, comparative genomics and principles of global genome analysis. Theoretical principles and experimental approaches of transgenesis, transcriptomics, proteomics, metabolomics, interactomics and bioinformatics will be presented.

Students can sign in all three modules (30 ECTS) or at least two of them while the remaining 10 credits can be selected from modules offered in other core courses.

**Code:** L-1-300

**Course title:** *Algorithms of clinical biochemical diagnostics*

**Contents:**

Course is organized into three modules consisting of eight independent blocks (each 5 ECTS). Student can select any combination of blocks. Each block is independently evaluated by separate score. For this research field each student has to elect 4 to 6 blocks.

**Module 1: Laboratory biomedicine consists of two blocks.**

**Block 1:** Scientific approaches in laboratory medicine, where students will learn the inductive and deductive approaches to problem solving in laboratory medicine. Using model cases, the students will critically evaluate their hypotheses, the credibility of the obtained results and the methodology used.

**Block 2:** Stepwise approach to clinical and biochemical diagnostics with interpretation will introduce students to the use of various mental pathways and stepwise approach in the laboratory diagnostics of common disorders. Based on this knowledge the student will be able to make evidence-based proposals for guidelines patients management.

**Module 2: Molecular markers of diseases consists of three blocks.**

**Block 1:** Common genetic diseases. Students will learn the screening (prenatal and postnatal diagnosis, family and population studies) and confirmatory tests of accumulating or missing metabolites and the correlation of laboratory results with the clinical symptoms of model diseases.

**Block 2:** Immune diseases. Students will learn the laboratory approaches to the diagnosis of immune-mediated diseases and hypersensitivity states using the analytes and tests in primary and targeted search for immune system disorders.





**Block 3:** Malignant disorders. Students will learn the use of biological molecules in the screening tests, tumor markers, extracellular tumor DNA, use of DNA / RNA tests, immunological tests, biosensors and microarrays, preparation of monoclonal antibodies, aptamers, siRNA, RNA/DNA probes and recombinant proteins in the diagnosis of malignancy.

**Module 3: Translational Biomedicine consists of three blocks.**

**Block 1:** Pharmacogenomic diagnostics. Students will learn the approaches to pharmacogenomic diagnostics and individualized therapy, pharmacogenomics of metabolic enzymes, receptors, transporters, miRNA and the direct and reverse pharmacogenomics in drug design, target identification and in preclinical and clinical studies.

**Block 2:** Cellular and Tissue Engineering. Students will understand different approaches in the preparation of complex cell and tissue cultures intended for advanced treatments or as system for testing artificial substances and materials in vitro.

**Block 3:** “Omic” Technologies and Tools (advanced technologies and tools in translational biomedicine. Students will learn about the advanced technologies in the areas of genomics, transcriptomics, proteomics and metabolomics and their implementation to laboratory practice and biomedicine.

**Code:** K-1-500

**Course title:** *Research in clinical medicine*

**Contents:**

The subject is divided in three consecutive modules (each brings 10 ECTS):

**Module 1: Methods in medical research**

Module 1 is uniform for all students of the subject; the other two modules are composed of several thematic blocks which run parallel; the student chooses one thematic block per module. The module Methods in medical research deals with several methods, important in clinical research.

**Module 2: Basic science in medical research**

Basic science in medical research contains five thematic blocks dealing with theoretical background of different areas of clinical research (physiology of cardiovascular system, respiratory physiology, physiology and biomechanics of locomotor system, basic and clinical pharmacology, immunology).

**Module 3: Achievements in clinical research**

Achievements in clinical research contains four thematic blocks, representing research in some clinical fields (cardiovascular medical science, medical science of surgical disciplines, pneumology, medical and clinical immunology).

**Code:** G-1-600

**Course title :** *Genetics*

**Contents:**

The »Genetics« core course is intended to provide students with solid foundations in transmission (Mendelian), microbial, molecular genetics, cytogenetics, population, quantitative, evolutionary genetics, epigenetics, genomics, and in use of bioinformatics tools in genetic analyses.

**Module 1: Genetic concepts I**

covers various basic genetic concepts and fields of biological systems from microbes to mammals.

**Module 2: Genetic concepts II**

provides an advanced course on theoretical and applied genetics as well as contemporary genomics. Emphasis is on analyses of genome structure or variation and applications in biomedicine and biotechnology.

**Module 3: Bioinformatics tools**

is aimed at teaching students how to efficiently use some of the main bioinformatics tools and databases for genetic, genomic and protein analyses. Emphasis of the module is on practical problem-based projects. In summary, contents covered in the three modules of the genetics core course should provide students with the necessary skills and knowledge of contemporary concepts and scientific approaches used in classical and genomic analyses. Students should be able to apply this knowledge and expertise to tackle their projects on model organisms, microbes, domestic animals, plants, wildlife or humans.

**Code:** M-1-410

**Course title:** *Selected Topics in Microbiology*

**Contents:**

The subject »Selected Topics in Microbiology« deals with complex relationships between microorganisms, between microorganisms and their hosts, and between microorganisms and their natural environment using selected cases and examples.

The subject is divided into three modules each evaluated with 10 credits (ECTS). The students inscribe the subject (30 ECTS) as a combination of three or selection of at least two modules.

**Module 1: Basic medical microbiology**

The structure and function of microorganisms in physiological and pathological circumstances and the mechanisms that underlay the development of human microbial diseases will be presented.

**Module 2: Clinical microbiology**

Diagnostic algorithms in clinical microbiology, critical interpretation of the results of microbiological testing, most frequent errors made when ordering microbiological tests and their medical and economic consequences and problems with communication between the laboratory and clinicians will be presented.

**Module 3: Microbial identification, diversity, and evolution**

Traditional, molecular and polyphasic taxonomy, microbial diversity (bacterial and archaeal diversity as well as the diversity of eukaryotic microorganisms i.e. algal, fungal and diversity of protists) along with topics from molecular evolution will be presented.





**Code:** N-1-540

**Course title:** *Neuroscience*

**Contents:**

The course entitled Neuroscience reviews updated knowledge and research implementing findings from basic and clinical neuroscience that are of importance for the development of new methods of diagnosis, treatment and rehabilitation of neurological, psychiatric and neurosurgical diseases. It deals with neurobiology at the molecular, cellular and systemic level, as well as with the neurological, neurosurgical and psychiatric diseases, including ethical considerations. Students will get acquainted with research of Slovenian researchers in the field. They will present areas where they achieve tangible results at the global level. This will be followed by project-oriented and seminar work. Presentation of the seminars will be devoted to learning the skills of communicating research results to peer researchers, as well as to researchers from other fields of science and through the mass media. The course will include demonstration of laboratory procedures and pertaining state of the art equipment. The student will gain skills and competences for a systematic approach to the study of complex neuroscientific problems with the full exploitation of the methodological potential.

**Module 1: Basic neuroscience**

**Module 2: Clinical neuroscience module**

which consists of three thematic sections, entitled Neurology, Psychiatry and Psychology.

**Code:** F-1-200

**Course title:** *Pharmaceutical sciences*

**Contents:**

The core course "Pharmaceutical sciences" deals with scientific principles of medicinal chemistry, pharmaceutical biology, pharmaceutical technological operations, delivery systems and pharmaceutical nanotechnology, molecular biopharmacy and health economics, social pharmacy, pharmacoeconomics and pharmacoepidemiology.

The core course comprises 15 independent modules, each equivalent to 10 ECTS. The students can select a combination of modules (10 ECTS each) depending on their research topic.

**Modules:**

**Module 1.1: Drug structure and their properties**

**Module 1.2: Drug targets and interactions**

**Module 1.3: Drug design methodologies**

**Module 2.1: Biomolecules as targets for diagnosis and therapy**

**Module 2.2: Biological and gene medical products**

**Module 2.3: Herbal medicines**

**Module 3.1: Pharmacokinetics and its role in drug discovery and development**

**Module 3.2: Biopharmaceutical analysis of LADME processes**

**Module 3.3: Pharmacokinetic-pharmacodynamic analysis.**

**Module 4.1: Pharmaceutical manufacturing processes**

**Module 4.2: Drug delivery systems**

**Module 4.3: Pharmaceutical nanotechnology and nanomedicines**

**Module 5.1: Social pharmacy**

**Module 5.2: Health economics**

**Module 5.3: Pharmacoepidemiology**

**Code:** S-1-420

**Course title:** *Research aspects of public health*

**Contents:**

The course consists of two modules, 10 ECTS each.

**Module 1: Determinants of health and disease**

Biological background of health problems, determinants of health (lifestyle, work environment), selected health problems (mainly cancer and mental health), groups at risk, research methodology.

**Module 2: Methodology of public health interventions**

Health systems and health policy, health planning, quality of care, health promotion, prevention (vaccination, screening, epidemiological monitoring), primary care, rehabilitation, research methodology.

**Code:** T-1-340

**Course title:** *Toxicology*

**Contents:**

Understanding the mechanisms how chemicals disrupt biological targets is increasingly important in deciding on the safe use of chemical in the workplace and in everyday life.

The course attempts to introduce on the selected cases: mechanisms of transport of compounds across the cell membrane and toxic effects of compounds on it; the role of metabolism in the formation of reactive metabolites that covalently interact with macromolecules of cells; the role of radicals and substances capable of redox reactions to generate oxidative stress in cells; mechanisms of necrotic and apoptotic cell death induced by compounds; specific/nonspecific activation of enzymes and receptors caused by xenobiotics; toxic effects of compounds on mitochondria and peroxisomes, and energy state of cells; specific and nonspecific interactions (covalent/noncovalent) of substances with macromolecules in relation to the toxic effects of compounds (genotoxicity, immunotoxicity, etc.); mechanisms of toxic action of various groups of xenobiotics, which occur in the environment in different groups of organisms (bacteria, animals, plants, fungi); the application of biosensors and biomarkers for evaluation of the toxicity of compounds in conjunction with the corrupting effects on individual organisms, populations, community and ecosystem.

The course is divided into three independent modules, each equivalent to 10 ECTS. Students can sign in all three modules (30 ECTS) or at least two of them while the remaining 10 credits can be selected from modules offered in other core courses.

**Module 1: Relationship between structure and toxicity**

Covalent and noncovalent interactions of xenobiotics with macromolecules in living cells will be presented and formation of reactive oxygen compounds will be discussed in relation with genotoxic and immunotoxic effects of the compounds. Biotransformation reactions of the substance (functionalisation and conjugation) will be explained, and the consequences of the presence of their products in different tissues will be discussed. The role of radicals in the cell will be presented and the groups of substances that allow their forma-



tion will be discussed. We will also present some of the xenobiotics that non-specifically or specifically interact with cell macromolecules. Basic understanding of toxicological tests, including the quantum mechanic methods and bimolecular simulations that allow toxicity prediction of substances will be presented.

#### **Module 2: Influence of toxic compounds on processes within cell**

Discussed The effects of substances on the transport across membranes will be discussed, and the mechanisms of necrotic and apoptotic cell death induced by xenobiotics will be explained. The toxicity of a substance caused by the activation / suppression of cytokine and nuclear receptors will be described. The examples of xenobiotics that interfere with the processes of energy and interact with mitochondria and peroxisomes, immune system and genetic material will be presented.

#### **Module 3: Influence of toxic compounds on environment and ecosystems**

In this module will be presented: effects of xenobiotic on suborganism, organism, population and ecosystem level; extrapolation of toxicological data from molecular and physiological levels to higher levels of biological organization; bioavailability of xenobiotics and other harmful substances in soil and water; biotransformation way of some important groups of xenobiotics and other harmful substances in soil and water; path intake of residues of drugs and their metabolites in the environment, their behavior (adsorption/desorption, distribution, decomposition) and their toxic effects in the environment; the possibility of bio-accumulation and toxic effects of residues of substances in aquatic and terrestrial organisms in the environment.

**Code:** V-1-700

**Course title:** *Regulation processes in healthy and diseased animals*

#### **Module 1: Regulation of basic processes in animals**

It deals with morphological and functional characteristics of animal cell, cell as hereditary carrier, cell response to environment influence, intercellular communication and regulation of genetic expression, defensive and metabolic mechanisms of cells, in vitro cell investigation, homeostasis and homeoresis, neuro-hormonal regulation of physiological processes, neural and endocrine regulation of digestion and metabolism, regulation of blood parameters, regulation of blood circulation and respiration, adaptation to body aggravation, regulation of excretion, regulation of body temperature, link between endocrine, nerve and immune system, mechanisms of nerve and sensual perception in domestic animals, progenesis, fecundation and early embryonic development in domestic animals.

#### **Module 2: Disruption of homeostasis and disease processes**

It deals with basic reasons for disturbances and elementary pathophysiological processes in organisms significant for comprehension of disease development and definition of clinical diagnosis and therapy; recognition of altered organism functioning by morphological changes of tissues and better understanding of organism reactions in sickness; biochemical parameters as indicators of liver, kidney, muscle, gastrointestinal tract; mineral and electrolyte metabolism and estimation of acid-bases balance; changes of processes in animals due to nutritional admission of harmful substances, pathogenic microorganisms, micotoxins, natural toxic substances, healing supplements and radionuclides and their regulation.



### Module 3: Food safety

The purpose of education is to gain knowledge and understanding of positive and negative effect of interaction between man and animal, with an emphasis on eating foods of animal origin, using epidemiological and statistical tools to estimate the risk, gain of new knowledge in the technology of meat and dairy processing industries, as well as fish processing industry, clams, crabs, frogs, eggs, honey and products from these commodities.

### 15. 3 Elective courses

The various scientific fields offer a great variety of elective courses. The candidate can choose between elective theoretical courses and elective individual research courses evaluated with 5 credits. The courses are offered by professors who are at the same time leading scientists in their respective scientific fields. Elective individual research courses are offered by researchers who can accept doctoral candidates in their laboratories, where they can acquire up-to-date scientific technologies and approaches to experimental work. A total of 10 elective credits can be selected from the university pool of generic skills courses, listed at the web page of University of Ljubljana ([www.uni-lj.si](http://www.uni-lj.si)).

#### Elective theoretical courses

Course	Code
1 Analysis of drugs and metabolites in biosystems	F-2- 202
2 Autoimmunity	L-2- 301
3 Biophysics of macromolecules and membrane	F-2- 923
4 Biogenic Medicines	F-2- 203
5 Biochemistry of biological membranes	B-2- 903
6 The biology of stress	T-2- 344
7 Biomolecular thermodynamics	B-2- 800
8 Cell physiology	B-2- 105
9 Cell and tissue engineering in advanced therapies	F-2- 204
10 Electron paramagnetic resonance in biological systems	F-2- 922
11 Electroporation based technologies and treatments	J-2- 441
12 Ethology and reserach methods in animal behaviour	V-2- 704
13 Pharmaceutical biotechnology	F-2- 205
14 Communicology in Pharmacy	F-2- 206
15 Pharmaceutical packaging	F-2- 234
16 Veterinary dosage forms	F-2- 207
17 Pharmacoeconomics	F-2- 208
18 Pharmacogenetics and personalized medicine	B-2- 104
19 Pharmacogenomics in pharmaceutical practice	F-2- 209
20 Pharmacometrics	F-2- 210
21 Pharmacotherapy	F-2- 201
22 Physiology and ecology of fungi	M-2- 618
23 Industrial medicinal chemistry	F-2- 237
24 Industrial development of dosage forms	F-2- 215
25 Interactions of drug delivery systems in biosystems	F-2- 216
26 Chosen chapters from drug analysis	F-2- 217
27 Topics from Physical Pharmacy	F-2- 218
28 Clinical biochemistry – selected topics	L-2- 302





## Elective theoretical courses

Course	Code
29 Cosmetology – selected topics	F-2- 219
30 Selected topics in drug synthesis	F -2- 220
31 Quality of medicaments	F-2- 224
32 Clinical pharmacokinetics	F-2- 225
33 Macromolecular crystallography	F-2- 920
34 Medical biophysics	J-2- 442
35 Medical virology	M-2- 413
36 Methods of structure and properties determination of drugs	F-2- 921
37 Methods for determination of phenomena at interfaces	F-2- 226
38 The Methodology of Scientific Research	V-2- 705
39 Microbiology of the gut	M-2- 616
40 Molecular bioinformatics	B-2- 901
41 Molecular biology in veterinary medicine	V-2- 706
42 Molecular mechanisms of cancer	B-2- 107
43 Monoclonal antibodies - the overview and their use in research, diagnostics and therapy	B-2- 106
44 Mutagenesis and genetic toxicology	T-2- 940
45 Design of biodiagnostics and biosensors	L-2- 303
46 Design and synthesis of enzyme inhibitors	F-2- 227
47 Quality assurance and validations in pharmaceutical production	F-2- 214
48 Drug design	F-2- 230
49 Advanced molecular genetics	B-2- 902
50 Advanced drug delivery systems	F-2- 229
51 High resolution optical microscopy – confocal microscopy	J-2- 440
52 Entrepreneurship in medicine	B-2- 108
53 Probiotics	M-2- 619
54 Quality of care assessment research methods	S-2- 423
55 Reactive metabolites of xenobiotics	T-2- 345
56 Synthesis and analysis of chiral drugs	F-2- 239
57 Social pharmacy with pharmacoepidemiology	F-2- 238
58 Drug stability	F-2- 235
59 Steroid hormones and hormone dependent diseases	B-2- 109
60 Transport and metabolism of drugs in biosystems	F-2- 236
61 Compounds with multiple mode of action	F-2- 240
62 Thermal analysis of pharmaceuticals	F-2- 228
63 Applied microbial enzymatics	M-2- 617
64 Veterinary ecology and biosecurity	V-2- 707
65 Protein Folding and Aggregation	B-2- 905
66 Animals in experiment	V-2- 708

### Elective individual research courses

Course	Code
1 Allergology	K-3- 501
2 Basic of molecular virology	V-3- 726
3 Biological implications of protein aggregation	B-3- 910
4 Biological implications of protein mis-folding and aggregation	B-3- 911
5 Biology and diseases of honeybee society	V-3- 709
6 Biophysics of biological processes, cells and tissues	F-3- 925
7 Biotechnological processes in pharmacy	F-3- 245
8 Breeding and health care of wild animals	V-3- 716
9 Cardiovascular dynamics	K-3- 509
10 Cell cultures in research studies and regenerative medicine	J-3- 463
11 Cell electrophysiological methods	N-3- 546
12 Cellular models of stress	J-3- 453
13 Characterization and identification of microfungi	M-3- 621
14 Clinical aspects of human reproduction	K-3- 511
15 Clinical biochemistry – selected contents	L-3- 313
16 Clinical cardiac electrophysiology	K-3- 512
17 Clinical neurophysiological methods for assessment of muscles and the nervous system	N-3- 548
18 Clinical neurosonology methods for cerebrovascular blood flow study	N-3- 549
19 Combinatorial chemistry	F-3- 246
20 Community care	S-3- 427
21 Comparative genomics	G-3- 613
22 Comparative odontology and periodontal medicine	V-3- 727
23 Comparison of fluorescence and electron microscopy applications in protein research in immune cells	B-3- 904
24 Concepts of genomic data integration	G-3- 609
25 Congenital heart disease	K-3- 516
26 Contemporary methods in small animal emergency medicine	V-3- 729
27 Cryomethods in biomedicine	J-3- 443
28 Dermatology of dogs and cats	V-3- 712
29 Design and experimental research of cancer diseases	B-3- 113
30 Detection and localisation of molecules in cells	J-3- 457
31 Determination of specific proteins expression in skeletal muscle cells with Western Blot	J-3- 448
32 Diagnostic and experimental cytology	J-3- 456
33 Diagnostic microbiology	M-3- 414
34 Diagnostics and intensive therapy of neurological diseases in newborn	N-3- 547
35 Diseases and fish health management	V-3- 710
36 Diseases of birds, small mammals and reptiles	V-3- 711
37 Drug stability	F-3- 254
38 Echocardiography	K-3- 502
39 Experimental techniques in dental prosthodontics	K-3- 529
40 Electronic analog circuitry for physiological and pathophysiological studies	K-3- 517



### Elective individual research courses

Course	Code
41 Electrophysiologic study of the visual system	N-3- 552
42 Enzyme catalysis	B-3- 124
43 Evidence-based laboratory medicine	L-3- 314
44 Evolutionary genomics	B-3- 909
45 Experimental methods in laboratory medicine	L-3- 309
46 Experimental approaches in molecular genetics diagnostic of inborn disorders	G-3- 611
47 Experimental approaches in the study of complex microbial communities and their interactions	M-3- 620
48 Experimental epigenetics	B-3- 115
49 Experimental immunology	K-3- 504
50 Experimental methods for studying biochemistry of steroid hormones	B-3- 122
51 Experimental Methods for the research of Brain Disease	N-3- 545
52 Experimental methods in Biophysics	F-3- 924
53 Experimental methods in pharmacogenomics	B-3- 110
54 Experimental methods in innate immunity	B-3- 908
55 Experimental methods in studies of nucleic acid structure	B-3- 116
56 Experimental neuroendocrinology	V-3- 713
57 Experimental rheological analysis	F-3- 249
58 Experimental virology	M-3- 415
59 Experimental approach in studies of signal transduction	B-3- 111
60 Food safety	V-3- 724
61 Functional MRI	N-3- 557
62 Functional protein analysis in signal transduction	B-3- 112
63 Gastroenterologic surgery	K-3- 506
64 Gastrointestinal problems in horses	V-3- 715
65 Genome analysis of complex traits	G-3- 606
66 Genome and transcriptome analyses	B-3- 119
67 Genomewide association and functional analysis in human	G-3- 610
68 Haematology – selected topics	L-3- 304
69 Health care of pigs	V-3- 739
70 Health care of ruminants	V-3- 740
71 Hemostasis	K-3- 526
72 Hereditary disorders of the skin – molecular techniques for disease diagnosis and research	B-3- 118
73 High resolution electrocardiography	K-3- 503
74 High resolution optical microscopy – confocal microscopy	J-3- 446
75 Homemade site directed mutagenesis	B-3- 120
76 Human cytogenetics	G-3- 608
77 Hygiene and pathology of animal nutrition	V-3- 725
78 Immune reaction in research and diagnostics	L-3- 306
79 Immunohistochemistry	J-3- 451
80 Inhibitors of enzyme-catalyzed reactions	B-3- 801
81 Intracellular signalling mediated by receptor and non-receptor protein kinases	J-3- 458





### Elective individual research courses

Course	Code
82 Macromolecular interactions	B-3- 906
83 Mammary gland: a model for genetic, developmental and cell biology studies	G-3- 604
84 Methods for determination of antithrombotic efficiency of agents	F-3- 247
85 Methods for determination of reactive metabolites of xenobiotics	T-3- 348
86 Methods in single cell physiology	J-3- 445
87 Methods and models in cell-based assays	L-3- 305
88 Microbiology	V-3- 721
89 Microbiology techniques	V-3- 722
90 Molecular analysis and suicidal behavior	B-3- 114
91 Molecular diagnostics	J-3- 461
92 Molecular diagnostics in laboratory biomedicine	L-3- 316
93 Molecular genetics of hormone in metabolic disorders	B-3- 123
94 Molecular methods in pharmacology	K-3- 513
95 Monitoring of DNA amplification in real time	G-3- 607
96 Morphology and function of peripheral nerves	N-3- 550
97 Morphometric analysis of cells and tissues	V-3- 723
98 Neurochemical methods	N-3- 553
99 Neurology and neurophysiology during early developmental age	N-3- 554
100 Nuclear magnetic resonance in studies of biological macromolecules	B-3- 907
101 Numerical modeling of processes in biophysics	J-3- 460
102 Nutrigenomics	L-3- 315
103 Osteosynthesis	K-3- 515
104 Pathobiochemical mechanisms and models	L-3- 308
105 Pharmacoeconomics	F-3- 256
106 Pharmacological and toxicological testing of drugs	K-3- 505
107 Pharmacology and Toxicology	V-3- 714
108 Pharmacotherapy	F-3- 255
109 Plant toxins and poisonous plants	T-3- 349
110 Poultry health and protection	V-3- 738
111 Preparation of skeletal muscle cell culture	J-3- 449
112 Principles and techniques in biochemistry and molecular biology	B-3- 802
113 Problems in ruminant medicine or surgery	V-3- 718
114 Protein glycosylation	B-3- 805
115 Protein structure	B-3- 804
116 Qualitative methods on health behaviour research	S-3- 424
117 Qualitative research through interviews	S-3- 425
118 Quality design and quality assurance in medical laboratories	L-3- 307
119 Rational design of peptidomimetics	F-3- 248
120 Reactive oxygen and nitrogen species in biological systems	F-3- 244
121 Recombinant proteins	B-3- 803
122 Recommendations on the implementation of point-of-care tests	K-3- 527



### Elective individual research courses

Course	Code
123 Regulation of gene expression - experimental approaches	B-3- 121
124 Regulation of gene expression of prokaryotes	G-3- 612
125 Reproduction and Obstetrics	V-3- 728
126 Research approach to diagnostics and therapy of cerebrovascular disease	N-3- 556
127 Research designs in health promotion	S-3- 426
128 Screening tests for Down syndrome	J-3- 447
129 Selected cases in medical genetics	B-3- 125
130 Selected cases in human genetics	G-3- 605
131 Selected immunological methods	K-3- 508
132 Selected methods applied in sports medicine	K-3- 528
133 Selected methods in pharmacokinetics	K-3- 507
134 Selected topics from drug analysis	F-3- 250
135 Silencing of specific genes using sirna approach	J-3- 455
136 Single cell micromanipulation	J-3- 459
137 Skeletal muscle analysis	J-3- 452
138 Sleep medicine and polysomnographic recordings for evaluation of sleep disorders	N-3- 555
139 Sleep-related breathing disorders and sleep disorders during development	N-3- 551
140 Small animal ultrasonography	V-3- 731
141 Special veterinary pathology	V-3- 730
142 Stem cells: from proteomics to cell therapies	B-3- 117
143 Stereology and quantitative image analysis	J-3- 450
144 Stigma of mental disorders	S-3- 428
145 Study of drug effects on human microcirculation	K-3- 518
146 Surgery and ophthalmology	V-3- 719
147 Surgical oncology	K-3- 514
148 Techniques for studying membrane proteins and assessing the membrane integrity on the model of mitochondrial biogenesis	J-3- 454
149 Toxicokinetics	T-3- 346
150 Toxicological testing of new drugs	T-3- 347
151 Toxicology on molecular scale	T-3- 941
152 Treatment methods of cancer in veterinary medicine	V-3- 720
153 Tumor biology	J-3- 444
154 Urogynecology	K-3- 519
155 Veterinary anaesthesiology	V-3- 732
156 Veterinary cardiology	V-3- 734
157 Veterinary diagnostic cytopathology	V-3- 733
158 Veterinary immunology methods	V-3- 717
159 Veterinary laboratory medicine - clinical pathology	V-3- 736
160 Veterinary orthopedic and neurosurgery	V-3- 735
161 Veterinary radiology	V-3- 737
162 Work with isolated organs	J-3- 462
163 Yeast genetics, functional genomics and systems biology	G-3- 930



# 16 Key to course codes

## 16 Key to course codes

**T**he courses are coded with a capital letter and two numbers. The capital letter indicates the scientific field or a combination of fields. The first number indicates the type of the course and the second one consists of three digits, the first indicating the location and the last two the consecutive number of the course.

### *Scientific fields:*

- G** Genetics
- B** Biochemistry and Molecular Biology
- F** Pharmacy
- L** Clinical Biochemistry and Laboratory Biomedicine
- J** Basic Medical Science
- K** Clinical Medicine
- M** Microbiology
- N** Neuroscience
- V** Veterinary Medicine
- S** Public Health
- T** - Toxicology

### *Types of courses:*

- 1** core courses
- 2** elective theoretical courses
- 3** elective individual research courses

### *Course locations:*

- 1** Faculty of Medicine - Biochemistry and Molecular Biology
- 2** Faculty of Pharmacy - Pharmacy
- 3** Faculty of Pharmacy - Clinical Biochemistry and Laboratory Biomedicine, Toxicology
- 4** Faculty of Medicine - Basic Medical Science, Public Health, Microbiology
- 5** Faculty of Medicine, University Medical Centre Ljubljana, Institut of Oncology Ljubljana, University Psychiatric Hospital Ljubljana - Clinical Medicine, Neuroscience
- 6** Biotechnical Faculty - Microbiology, Genetics
- 7** Veterinary Faculty - Veterinary Medicine
- 8** Faculty of Chemistry and Chemical Technology
- 9** Research institutes: Josef Stefan Institute, Chemical Institute, National Institute of Biology

Hence, the course bearing the code B-2-940 belongs in the area of biochemistry and molecular biology (B), is an elective theoretical course (2) and is carried out at a research institute (9).

### *Core courses:*

#### **B-1-100 Selected advanced topics in Biochemistry and Molecular biology**

- B-1-101 1 Selected metabolic processes with regulatory mechanisms
- B-1-102 2 Structure and function of biological molecules
- B-1-103 3 Functional genomics and proteomics

#### **F-1-200 Pharmaceutical sciences**

- F-1-211 1. 1 Drug structure and their properties
- F-1-212 1. 2 Drug targets and interactions
- F-1-213 1. 3 Drug design methodologies
  
- F-1-221 2. 1 Biomolecules as targets for diagnosis and therapy
- F-1-222 2. 2 Biological and gene medical products
- F-1-223 2. 3 Herbal medicines
  
- F-1-231 3. 1 Pharmacokinetics and its role in drug discovery and development
- F-1-232 3. 2 Biopharmaceutical analysis of LADME processes
- F-1-233 3. 3 Pharmacokinetic-pharmacodynamic analysis
  
- F-1-241 4. 1 Pharmaceutical manufacturing processes
- F-1-242 4. 2 Drug delivery systems
- F-1-243 4. 3 Pharmaceutical nanotechnology and nanomedicines
  
- F-1-251 5. 1 Social pharmacy
- F-1-252 5. 2 Health economics
- F-1-253 5. 3 Pharmacoepidemiology



**L-1-300 Algorithms of clinical biochemical diagnostics**

- L-1-310 1 Laboratory biomedicine
- L-1-311 1. 1 Scientific approaches in laboratory medicine
- L-1-312 1. 2 Stepwise approach to clinical and biochemical diagnostics with interpretation
- L-1-320 2 Molecular markers of diseases
- L-1-321 2. 1 Common genetic diseases
- L-1-322 2. 2 Immune diseases
- L-1-323 2. 3 Malignant disorders
- L-1-330 3. Translational Biomedicine
- L-1-331 3. 1 Pharmacogenomic diagnostics
- L-1-332 3. 2 Cellular and Tissue Engineering
- L-1-333 3. 3 Omic" Technologies and Tools  
(advanced technologies and tools in translational biomedicine)

**T-1-340 Toxicology**

- T-1-341 1. Relationship between structure and toxicity
- T-1-342 2. Influence of toxic compounds on processes within cell
- T-1-343 3. Influence of toxic compounds on environment and ecosystems

**J-1-400 Medical Cell Biology**

- J-1-401 1. Fundamentals of medical cell biology
- J-1-402 2. Reproductive biology in vivo and in vitro
- J-1-403 3. Biology of Malignant Cells and Translational Oncology
- J-1-404 4. Cell biology in clinical genetics
- J-1-405 5. Systems medicine of multifactorial disorders

**M-1-410 Selected Topics in Microbiology**

- M-1-411 1. Basic medical microbiology
- M-1-412 2. Clinical microbiology
- M-1-615 3. Microbial identification, diversity, and evolution

**S-1-420 Research aspects of public health**

- S-1-421 1. Determinants of health and disease
- S-1-422 2. Methodology of public health interventions

**K-1-500 Research in clinical medicine**

- K-1-510 1. Methods in medical research
- K-1-520 2. Basic science in medical research
- K-1-521 2. 1 Physiology of cardiovascular system
- K-1-522 2. 2 Respiratory physiology
- K-1-523 2. 3 Physiology and biomechanics of locomotor system
- K-1-524 2. 4 Basic and clinical pharmacology
- K-1-525 2. 5 Immunology
- K-1-530 3. Achievements in clinical research
- K-1-531 3. 1 Cardiovascular medical science
- K-1-532 3. 2 Medical science of surgical disciplines
- K-1-533 3. 3 Pneumology
- K-1-534 3. 4 Scientific principles of medical and clinical immunology

**N-1-540 Neuroscience**

- N-1-541 2. Basic neuroscience
- N-1-542 3. 1 Clinical Neuroscience – Neurology
- N-1-543 3. 2 Clinical Neuroscience – Psychiatry
- N-1-544 3. 3 Clinical Neuroscience - Psychology

**G-1-600 Genetics**

- G-1-601 1. Genetic concepts I
- G-1-602 2. Genetic concepts II
- G-1-603 3. Bioinformatics tools

**V-1-700 Regulation processes in healthy and diseased animals**

- V-1-701 1. Regulation of basic processes in animals
- V-1-702 2. Disruption of homeostasis and disease processes
- V-1-703 3. Food safety

# 17 Programme Council

## 18 Field coordinators

### 17 Programme Council

**T**he Programme Council consists of members of each faculty and research institute. Representatives are proposed by the faculty senates and confirmed by University Senate for a period of four years. The Council is chaired by the chairman, who has a deputy. The president's mandate is four years and can be repeated. The seat of the Programme Council is at the University of Ljubljana.

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# 19 Additional information

## 19 Additional Information

### *Webpage*

[http://www.uni-lj.si/studij/studijski\\_programi/podiplomski\\_studij\\_3\\_stopnja/biomedicina/](http://www.uni-lj.si/studij/studijski_programi/podiplomski_studij_3_stopnja/biomedicina/)

*Postgraduate studies offices at the University members coordinating individual scientific fields*

### **Biotechnical Faculty**

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Biomedicine

Toxicology

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Basic Medicine

Public Health

Neuroscience

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Univerza    Universitas  
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