



2019



Interdisciplinarni doktorski študijski program Biomedicina  
*Interdisciplinary Doctoral Programme in Biomedicine*

## **Kazalo vsebin / Table of contents**

- 5 Uvod
- 6 *Introduction*
- 7 Podatki o programu /  
*The programme*
- 8 Temeljni cilji programa /  
*Basic programme goal and general competence*
- 9 Prijava in vpis na doktorski študij Biomedicina /  
*Application and enrolment in the Doctoral Programme in Biomedicine*
- 10 Pogoji za vpis in merila za izbiro ob omejitvi vpisa /  
*Admission requirements and criteria for selection*
- 11 Priznavanje znanj in spretnosti, pridobljenih pred vpisom v program /  
*Recognition of knowledge and skills acquired before admission to the programme*
- 12 Šolnina /  
*Tuition Fee*
- 12 Mentorstvo /  
*Mentoring*
- 13 Predmetnik študijskega programa /  
*Programme*
- 15 Kratka predstavitev predmetov /  
*Course presentation*

- 44 Ključ za kodiranje predmetov /  
*Key to course codes*
- 48 Pogoji za napredovanje po programu /  
*Requirements for progression through the programme*
- 48 Načini ocenjevanja /  
*Grading system*
- 49 Pogoji za dokončanje študija in znanstveni naslov /  
*Conditions for completing the programme and doctoral diploma*
- 50 Prehodi med študijskimi programi /  
*Transfer between study programmes*
- 50 Možnosti zaposlitve /  
*Career Prospects*
- 51 Mednarodne izmenjave /  
*International exchanges*
- 51 Programski svet /  
*Programme Council*
- 52 Področni koordinatorji /  
*Field coordinators*
- 54 Dodatne informacije o študiju
- 55 *Additional Information*
- 56 Pravila o organizaciji Interdisciplinarnega doktorskega študija Biomedicina /  
*Organisation*

## Uvod

Področje Biomedicina združuje znanja biokemije in molekularne biologije, farmacije, klinične biokemije in laboratorijske biomedicine, genetike, javnega zdravja, klinične in temeljne medicine, mikrobiologije, nevroznanosti, toksikologije in veterinarske medicine. Potrebo po kakovostnem in sodobnem doktorskem študijskem programu za pridobitev ustreznih znanj s področja znanstvenih ved, ki se razvijajo na različnih članicah Univerze v Ljubljani, narekuje tudi hiter in obsežen razvoj teh področij ter njihov vpliv na kakovost življenja. Zaradi dosedanjih dobrih izkušenj in prednosti interdisciplinarnega pristopa je doktorski študijski program Biomedicina organiziran na univerzitetni ravni. Ker je biomedicinsko področje zelo razvejano in se po posameznih vedah razvija na prvih dveh stopnjah izobraževanja na različnih članicah Univerze v Ljubljani, ga je bilo smiselno organizacijsko in vsebinsko povezati na tretji stopnji. S tem je omogočena povezava učiteljev in raziskovalcev iz posameznih ved, ki tvorijo biomedicinsko področje in povezava raziskovalcev članic Univerze v Ljubljani z raziskovalnimi inštituti.

Poudarek doktorskega študija je na raziskovalnem delu, na interdisciplinarnosti študija in na sodelovanju mednarodno uveljavljenih domačih in tujih strokovnjakov.

Po priporočilih Evropskega združenja univerz (EUA) je predvidena mednarodna izmenjava studentov in objava najmanj enega znanstvenega članka kot končni rezultat raziskovalnega dela. Poseben poudarek je namenjen ustreznemu odnosu med doktorandom in mentorjem. Študentje si mentorje lahko izbirajo med mednarodno priznanimi in uveljavljenimi strokovnjaki ter v skladu s pravili Univerze v Ljubljani in članice, kjer bo doktorand vpisan.

## 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.

## Podatki o programu / The programme

Interdisciplinarni doktorski študijski program Biomedicina traja štiri leta, obsega 240 kreditnih točk in predstavlja po bolonjski shemi program tretje stopnje. Organizirane oblike študija predstavljajo 60 kreditnih točk, preostalih 180 kreditnih točk pa je namenjenih individualnemu raziskovalnemu delu za doktorsko disertacijo, javni predstavitvi rezultatov, pripravi znanstvenega članka, izdelavi in javnemu zagovoru disertacije.

Študijske obveznosti programa so ovrednotene po Evropskem prenosnem kreditnem sistemu (ECTS – European Credit Transfer System), s čimer je omogočena direktna vključitev delov programa v mednarodno izmenjavo z univerzami iz držav, ki sistem ECTS uporabljajo.

Program omogoča pridobitev znanstvenega naslova doktor/doktorica znanosti na naslednjih znanstvenih področjih:

- biokemija in molekularna biologija
- farmacija
- genetika
- javno zdravje
- klinična biokemija in laboratorijska biomedicina
- medicina - klinična usmeritev
- medicina - temeljna usmeritev
- mikrobiologija
- nevroznanost
- toksikologija
- veterinarska medicina

The duration of the Interdisciplinary Doctoral Programme in Biomedicine is four years (240 ECTS credits), and according to the Bologna guidelines this represents the third cycle of the educational scheme. The programme was formed in agreement with all 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 dissertation, public presentation of the results, writing of the scientific article and public dissertation and public defence (180 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

Program organizira in izvaja pet članic Univerze v Ljubljani in trije raziskovalni inštituti:

- **Biotehniška fakulteta**, Jamnikarjeva ulica 101, Ljubljana
- **Fakulteta za farmacijo**, Aškerčeva cesta 7, Ljubljana
- **Fakulteta za kemijo in kemijsko tehnologijo**, Večna pot 113, Ljubljana
- **Medicinska fakulteta**, Vrazov trg 2, Ljubljana
- **Veterinarska fakulteta**, Gerbičeva ulica 60, Ljubljana
- **Institut "Jožef Stefan"**, Jamova cesta 39, Ljubljana
- **Kemijski inštitut**, Hajdrihova 19, Ljubljana
- **Nacionalni inštitut za biologijo**, Večna pot 111, Ljubljana

Raziskovalni inštituti vključujejo v program habilitirane učitelje in znanstvene sodelavce, ki sodelujejo pri organiziranih oblikah pouka in mentorstvih ter nudijo raziskovalno infrastrukturo kandidatom za izdelavo doktorskega dela.

### Temeljni cilji programa / *Basic programme goal and general competence*

Temeljni cilj programa je izobraževanje visoko usposobljenih strokovnjakov za posamezna znanstvena področja. Program je interdisciplinaren in namenjen poglobitvi znanj področij biokemije in molekularne biologije, farmacije, genetike, javnega zdravja, klinične biokemije in laboratorijske biomedicine, klinične in temeljne medicine, mikrobiologije, nevroznanosti, toksikologije in veterinarske medicine.

Po končanem študiju bo doktorand sposoben za kreativno in samostojno znanstveno raziskovalno delo in reševanje znanstvenih problemov bodočih delodajalcev. Pridobil bo sposobnost razumevanja in kritične presoje pri razreševanju zahtevnih in kompleksnih znanstveno-raziskovalnih vprašanj. Usposobljen bo za kreativno ter samostojno obravnavo znanstveno-raziskovalnega problema, kritično presojo raziskovalnih rezultatov, razvoja novih raziskovalnih metod in prenosa novih tehnologij in znanja v prakso.

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

- **Biotechnical Faculty**, Jamnikarjeva ulica 101, Ljubljana
- **Faculty of Pharmacy**, Aškerčeva cesta 7, Ljubljana
- **Faculty of Chemistry and Chemical Technology**, Večna pot 113, Ljubljana
- **Faculty of Medicine**, Vrazov trg 2, Ljubljana
- **Veterinary Faculty**, Gerbičeva ulica 60, Ljubljana
- **The Jožef Stefan Institute**, Jamova cesta 39, Ljubljana
- **The National Institute of Chemistry**, Hajdrihova 19, Ljubljana
- **The National Institute of Biology**, Večna pot 111, Ljubljana

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

The 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 the 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 critical assessment of research results, development of new research methods and transfer of new research methods and knowledge into practice.

### Prijava in vpis na doktorski študij Biomedicina / *Application and enrolment in the Doctoral Programme in Biomedicine*

Število vpisnih mest je za vsako študijsko leto določeno z razpisom za vpis.

Kandidati za vpis v 1. letnik se na študij prijavijo v roku in na način, določenima z Razpisom za vpis v doktorske študijske programe, ki ga Univerza objavi predvidoma v mesecu februarju na spletni strani [www.uni-lj.si](http://www.uni-lj.si).

Vpis v 1. letnik poteka septembra na članicah, koordinatoričah znanstvenih področij. Točni datumi vpisov so objavljeni na spletni strani <https://www.uni-lj.si/studij/doktorski/biomedicina/>.

Vpis in vse postopke v zvezi s pridobitvijo znanstvenega naslova izvede članica, koordinatorica znanstvenega področja. Vpis na znanstvena področja biokemija in molekularna biologija, medicina – klinična usmeritev, medicina – temeljna usmeritev, javno zdravje, nevroznanost je na Medicinski fakulteti, vpis na znanstvena področja farmacija, klinična biokemija in laboratorijska biomedicina ter toksikologija je na Fakulteti za farmacijo, vpis na znanstveno področje genetika je na Biotehniški fakulteti, vpis na znanstveno področje veterinarska medicina je na Veterinarski fakulteti, vpis na znanstveno področje mikrobiologija je izmenično na Medicinski fakulteti in Biotehniški fakulteti.

Kandidat in Univerza v Ljubljani ob vpisu v posamezni letnik doktorskega študijskega programa podpišeta pogodbo o izobraževanju.

Call for enrolment is published on the UL web page (<https://www.uni-lj.si/eng/>) no later than 6 months prior to the start of the academic year. Applicants for admission to the programme can apply according to the instructions in the 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 on the webpage <https://www.uni-lj.si/study/doctoral/biomedicine/>.

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 and public health 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, enrolment in the scientific field of veterinary medicine is held at the Veterinary Faculty and enrolment in the scientific field of microbiology is held at the Faculty of Medicine or the Biotechnical Faculty.

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

## Pogoji za vpis in merila za izbiro ob omejitvi vpisa / *Admission requirements and criteria for selection*

### Pogoji za vpis

V interdisciplinarni doktorski študijski program Biomedicina se lahko vpiše, kdor je končal:

- študijski program 2. stopnje,
- študijski program, ki izobražuje za poklice, urejene z direktivami Evropske unije, ali drugi enoviti magistrski študijski program, ki je ovrednoten s 300 kreditnimi točkami po ECTS,
- študijski program za pridobitev univerzitetne izobrazbe, sprejet pred 11. 6. 2004,
- magisterij znanosti ali študijski program za pridobitev specializacije in je pred tem končal program za pridobitev univerzitetne izobrazbe. Tem kandidatom se na podlagi prošnje skladno z zakonom priznajo študijske obveznosti v obsegu 60 kreditnih točk po ECTS,
- študijski program za pridobitev specializacije, ki je pred tem končal visokošolski strokovni program. Tem kandidatom programski svet doktorskega študija Biomedicina določi dodatne študijske obveznosti za posamezna področja v obsegu od 30 do 60 kreditnih točk po ECTS.

Na doktorski študij se lahko vpišejo tudi diplomanti tujih univerz. Enakovrednost predhodno pridobljene izobrazbe v tujini se ugotavlja v postopku priznavanja tujega izobraževanja za namen nadaljevanja izobraževanja ([http://www.uni-lj.si/studij/koristne\\_informacije/priznavanje\\_tuje\\_izobrazbe/](http://www.uni-lj.si/studij/koristne_informacije/priznavanje_tuje_izobrazbe/)), skladno s Statutom UL.

### Admission 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, if 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. The procedure starts with the candidate's application for study in the Republic of Slovenia, which is submitted in electronic form on the eVŠ web portal. The procedure is run by the authorised person at the University Member (academy or faculty).

### Merila za izbiro ob omejitvi vpisa

V primeru omejitve vpisa bo izbor kandidatov temeljil na:

- uspehu pri študiju 2. stopnje oz. uspehu na novitem magistrskem študijskem programu, ovrednotenem s 300 kreditnimi točkami oz. uspehu na dosedanjem univerzitetnem študiju in
- izbirnem izpitu, pri katerem se med drugim ocenjuje:
  1. objavljen ali v objavo sprejet znanstveni članek v reviji z recenzijo
  2. nagrade in priznanja
  3. strokovna specializacija
  4. in drugo.

Način točkovanja določi Programski svet. V primeru omejitve vpisa bodo izbrani kandidati z večjim skupnim številom zbranih točk.

### Priznavanje znanj in spretnosti, pridobljenih pred vpisom v program / *Recognition of knowledge and skills acquired before admission to the programme*

Znanja in spretnosti, pridobljena s formalnim, z neformalnim ali izkustvenim učenjem pred vpisom v program, se bodo skladno z Merili za akreditacijo študijskih programov, priznavala pri izbiri ob omejitvi vpisa. O priznavanju znanj in spretnosti, ki jih je kandidat pridobil pred vpisom v program, odloča Programski svet oziroma pooblaščen koordinatorski strokovni področja.

Pri priznavanju tovrstnih znanj in spretnosti se upoštevajo:

- strokovna specializacija,
- druga diploma visokošolskega zavoda,
- dosedanje znanstveno raziskovalno delo,
- objavljena znanstvena dela,
- strokovna izpopolnjevanja,
- ustrezne delovne izkušnje.

### Criteria for selection of candidates

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 (achieved 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. other criteria.

Rating is determined by the Programme Council.

Knowledge 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 accreditation of study programmes.

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

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



## Šolnina / Tuition Fee

Šolnina se plačuje za vsako študijsko leto posebej oz. za vsak letnik, ki ga študent vpiše in je določena v ceniku UL za posamezno študijsko leto. Cenik, ki ga sprejme Upravni odbor UL, je objavljen na spletni strani [http://www.uni-lj.si/studij/cenik\\_storitev\\_za\\_studente/](http://www.uni-lj.si/studij/cenik_storitev_za_studente/).

Vpisne stroške, šolnine in druge prispevke ureja Pravilnik o prispevkih in vrednotenju stroškov na UL.

## Možnosti štipendiranja

Več informacij o možnostih štipendiranja najdete na <https://www.uni-lj.si/studij/doktorski/financiranje/>; <https://www.uni-lj.si/stipendije/>; [http://www.uni-lj.si/studij/koristne\\_informacije/vrste\\_stipendij/](http://www.uni-lj.si/studij/koristne_informacije/vrste_stipendij/), in <http://www.sklad-kadri.si/>.

## Mentorstvo / Mentoring

Kandidat pred vpisom izbere mentorja in najkasneje ob vpisu predloži njegovo pisno soglasje o prevzemu mentorstva ter seznam treh njegovih znanstvenih objav s področja predvidene teme kandidatove doktorske disertacije. Mentor oziroma somentor pri izdelavi doktorske disertacije mora imeti veljaven naziv visokošolskega učitelja (docent, izredni, redni profesor) oz. znanstvenega delavca (znanstveni sodelavec, višji znanstveni sodelavec in znanstveni svetnik) in ima izkazano raziskovalno aktivnost z ustrezno znanstveno bibliografijo s področja teme doktorske disertacije. Minimalni pogoji za izkazovanje raziskovalne aktivnosti mentorja so objavljeni na spletni strani UL <https://www.uni-lj.si/studij/doktorski/pravila/>.

Naloga mentorja je usmerjanje študenta pri študiju in zagotavljanje pogojev za delo. Pri raziskavah, vezanih na laboratorijsko delo, mora mentor zagotoviti razpoložljivost raziskovalnih kapacitet oziroma raziskovalne infrastrukture.

Mentor je lahko tudi tuj strokovnjak z nazivom, ki je primerljiv z našimi učiteljskimi oziroma znanstvenimi nazivi.

Seznam potencialnih mentorjev je objavljen na spletni strani <https://www.uni-lj.si/studij/doktorski/biomedicina/mentorstvo/>.

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: <https://www.uni-lj.si/study/doctoral/tuition-fees>.

## Scholarship Opportunities

For information about scholarship opportunities, please visit <https://www.uni-lj.si/study/doctoral/funding>, <https://www.uni-lj.si/study/information/scholarships/> and <http://www.sklad-kadri.si/>.

Prior to enrolment, candidates are required to choose a mentor and submit the mentor's written acceptance of mentorship upon enrolment at the latest. 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'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.

The list of potential mentors is available at <https://www.uni-lj.si/study/doctoral/biomedicine/mentor/>.

## Predmetnik študijskega programa / Programme

Študijski program je sestavljen iz organiziranih oblik študija v obsegu 60 kreditnih točk, preostalih 180 kreditnih točk pa je namenjenih individualnemu raziskovalnemu delu za doktorsko disertacijo.

Članica v celoti organizira in skrbi za izvedbo doktorskega programa s področij, ki jih koordinira, in v sodelovanju z mentorjem skrbi za nemoteno raziskovalno delo študenta.

### Vsebinska struktura programa po letnikih

Struktura izvedbe programa po letnikih je zasnovana tako, da je v začetku prvega in delno drugega letnika večji poudarek na organiziranih oblikah študija, kasneje pa je vedno večji poudarek na raziskovalnem delu in pripravi doktorske disertacije.

#### 1. LETNIK

|                                  |       |
|----------------------------------|-------|
| Temeljni predmet/-i              | 30 KT |
| Individualno raziskovalno delo 1 | 30 KT |

#### 2. LETNIK

|   |       |
|---|-------|
| Izbirni predmet 1                       | 5 KT  |
| Izbirni predmet 2                       | 5 KT  |
| Izbirni predmet 3                       | 5 KT  |
| Predstavitve teme doktorske disertacije | 5 KT  |
| Individualno raziskovalno delo 2        | 40 KT |

#### 3. LETNIK

|                                  |       |
|----------------------------------|-------|
| Individualno raziskovalno delo 3 | 60 KT |
|----------------------------------|-------|

#### 4. LETNIK

|   |       |
|---|-------|
| Individualno raziskovalno delo 4                | 50 KT |
| Predstavitve rezultatov raziskovalnega dela     | 5 KT  |
| Izdelava doktorske disertacije in javni zagovor | 5 KT  |

The programme consists of organised forms of teaching and research. Organised teaching comprises of 60 credits; the remaining 180 credits are intended for individual research work (IRW) for the doctoral dissertation.

Faculty member organize and provides for implementation of the doctoral programme in fields they coordinate and in collaboration with the mentor take care for research work of the student.

### 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 dissertation.

#### YEAR 1

|                            |            |
|----------------------------|------------|
| Core courses               | 30 CREDITS |
| Individual research work 1 | 30 CREDITS |

#### YEAR 2

|   |            |
|---|------------|
| Elective course 1                               | 5 CREDITS  |
| Elective course 2                               | 5 CREDITS  |
| Elective course 3                               | 5 CREDITS  |
| Presentation of the doctoral dissertation topic | 5 CREDITS  |
| Individual research work 2                      | 40 CREDITS |

#### YEAR 3

|                            |            |
|----------------------------|------------|
| Individual research work 3 | 60 CREDITS |
|----------------------------|------------|

#### YEAR 4

|  |            |
|--|------------|
| Individual research work 4                         | 50 CREDITS |
| Presentation of the results of research work       | 5 CREDITS  |
| Completed doctoral dissertation and public defence | 5 CREDITS  |

V prvem letniku doktorand izbere 30 KT iz temeljnih predmetov. Za zagotovitev področja je potreben izbor najmanj 20 KT iz temeljnega predmeta izbranega znanstvenega področja, 10 KT pa si lahko izbere v dogovoru z mentorjem in s koordinatorjem iz modulov drugih temeljnih predmetov. V drugem letniku doktorand izbere izbirne predmete v skupnem obsegu 15 KT. Študent izbirne predmete izbere v dogovoru z mentorjem in glede na področje raziskovalnega dela.

Tretji letnik je namenjen individualnemu raziskovalnemu delu in izdelavi doktorske disertacije v obsegu 60 kreditnih točk.

V četrtem letniku se študenti posvetijo pretežno individualnemu raziskovalnemu delu, objavi znanstvenega članka in izdelavi doktorske disertacije v obsegu 50 kreditnih točk, 10 kreditnih točk pa si pridobijo s predstavitvijo rezultatov raziskovalnega dela ter izdelavo in javnim zagovorom doktorske disertacije.

### Prijava teme doktorske disertacije

Študent prijavi temo doktorske disertacije najkasneje do začetka drugega semestra drugega letnika.

Postopek za prijavo teme doktorske disertacije vodi senat članice, kjer je doktorand vpisan. Temo doktorske disertacije potrdi Senat Univerze v Ljubljani.

### Zagotavljanje mobilnosti

Doktorandi si lahko v dogovoru z mentorjem in s koordinatorjem znanstvenega področja izberejo 10 KT izbirnih vsebin iz drugih programov UL in primerljivih programov tujih univerz.

### Urniki

Urniki temeljnih predmetov so objavljeni na spletni strani <http://www.uni-lj.si/studij/doktorski/biomedicina/predmetnik-urniki/urniki-izvajanja/> v začetku septembra, urniki izbirnih predmetov pa po vpisu, ko je znano, koliko študentov si je izbralo posamezen predmet in v kakšni obliki se bo le-ta izvajal.

In the first year of study, doctoral candidates, within the framework of core courses obtain fundamental theoretical knowledge and expertise of scientific work. 20 ECTS has to be from the core course of scientific field they are enrolled in. In agreement with the mentor and co-ordinator, 10 ECTS can be chosen from other core courses. In the second year of study, students fulfil their obligations arising from the elective course (15 ECTS). The selected courses according to student's research work must be approved by the mentor.

The core of the third year is research work, and preparation of the doctoral dissertation.

In the fourth year, the focus is on individual research work, publication of the scientific article and preparation of the doctoral dissertation. Students also present the results of their research work and defend their doctoral dissertation publicly.

### Registration of topic

Students should register the topic of doctoral dissertation no later than in the beginning of the second semester of the second year of studies.

Registration of topic of doctoral dissertation as well as evaluation of each doctoral dissertation are in the domain of the faculty senate responsible for a given scientific field. The Senate of the University of Ljubljana has to consent to the doctoral dissertation topic and the proposed mentor.

### Mobility

Students are allowed to select 10 ECTS from elective courses from other doctoral programmes at the University of Ljubljana and comparable programmes of foreign universities. The selected courses must be approved by the mentor and the coordinator of the specific scientific field. Elective credits can be selected also from the university pool of the generic skills courses, listed at the web site of the University of Ljubljana.

### Schedules

The core course schedules are published at <https://www.uni-lj.si/study/doctoral/biomedicine/curriculum/schedules-of-courses/> in early September each year. Schedules for elective courses are designed individually.

## Kratka predstavitev predmetov / Course presentation

Program sestavljajo tri vrste predmetov:

- temeljni predmeti,
- izbirni teoretični predmeti,
- izbirni individualno raziskovalni predmeti.

Doktorand skupaj z mentorjem in koordinatorjem znanstvenega področja izbere predmete iz nabora temeljnih in obeh vrst izbirnih predmetov. Za zagotovitev področja je potreben izbor najmanj 20 KT iz temeljnega predmeta izbranega znanstvenega področja, 10 KT pa lahko izbere iz modulov ostalih temeljnih predmetov. Izbirne predmete si izbira glede na raziskovalno področje doktorske disertacije poljubno oziroma v soglasju z mentorjem. Izbor je možen iz nabora predmetov vseh znanstvenih področij in iz predmetnikov drugih primerljivih programov domačih in tujih univerz, ki imajo programe ovrednotene po sistemu ECTS ali drugih sistemih, ki omogočajo primerjavo vrednotenja.

### Temeljni predmeti

Temeljni predmeti so oblikovani glede na znanstvena področja. Vsebine predmetov so izbrane na podlagi raziskovalnega dela nosilcev in izvajalcev predmetov, ki se izkazujejo z najmanj tremi raziskovalnimi članki s področja, ki ga obravnava predmet. Vsako področje je zagotovilo najmanj en obvezni predmet.

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.

### 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.



### Seznam temeljnih predmetov

| Koda    | Znanstveno področje                              | Predmet  |
|---------|--|--|
| B-1-100 | Biokemija in molekularna biologija               | Izbrana poglavja iz biokemije in molekularne biologije |
| F-1-200 | Farmacija  | Farmacevtske znanosti                                  |
| G-1-600 | Genetika   | Genetika   |
| S-1-420 | Javno zdravje                                    | Znanstveni vidiki javnega zdravja                      |
| L-1-300 | Klinična biokemija in laboratorijska biomedicina | Stopenjska klinično-biokemijska diagnostika            |
| K-1-500 | Medicina - klinična usmeritev                    | Raziskave v klinični medicini                          |
| J-1-400 | Medicina - temeljna usmeritev                    | Medicinska celična biologija                           |
| M-1-410 | Mikrobiologija                                   | Izbrana poglavja iz mikrobiologije                     |
| N-1-540 | Nevroznanost                                     | Nevroznanost   |
| T-1-340 | Toksikologija                                    | Toksikologija  |
| V-1-700 | Veterinarska medicina                            | Upravljanje procesov pri zdravih in bolnih živalih     |

### Core courses

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

### Kratka predstavitev temeljnih predmetov

**Koda:** B-1-100

**Naslov:** **Izbrana poglavja iz biokemije in molekularne biologije**

#### Izvajalci:

Ana Plemenitaš (nosilka), Vita Dolžan, Kristina Sepčič, Peter Dovč, Roman Jerala, Marko Dolinar, Marjeta Podobnik, Radovan Komel, Simon Horvat, Gregor Anderluh, Blaž Zupan

#### Kratka vsebina:

Predmet »Izbrana poglavja iz biokemije in molekularne biologije« je razdeljen v tri vsebinske module, ovrednotene s po 10 KT:

#### Modul 1: Izbrani biokemijski procesi in njihovo uravnavanje

Obravnavani bodo metabolizem ksenobiotikov in ROS, biogeneza mitohondrijev, rast, ontogenetski razvoj pri sesalcih, zgradba in funkcionalna asimetrija bioloških membran, lipidne mikrodomene, interakcije proteinov z membranami in prenos signala v funkciji uravnavanja bioloških procesov.

#### Modul 2: Struktura in funkcija bioloških molekul in dizajniranih bioloških sistemov

Obravnavani bodo primeri iz področja molekulske imunologije in proteolize. V tem sklopu bodo obravnavane tudi tehnike proteinskega inženirstva ter molekularno modeliranje proteinov za napovedovanje njihove funkcije.

#### Modul 3: Funkcijska genomika in proteomika

Obravnavane bodo vsebine iz strukture, organizacije in uravnavanja genoma, komparativna genomika, principi globalne genomske analize in eksperimentalni pristopi transgeneze, transkriptomike, proteomike, metabolomike, interaktomike in bioinformatike.

Študenti lahko vpišejo predmet kot celoto (30 KT) ali ločeno po modulih (po 10 KT).

### Short presentation of core courses

**Code:** B-1-100

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

#### Lecturers:

Ana Plemenitaš, Vita Dolžan, Kristina Sepčič, Peter Dovč, Roman Jerala, Marko Dolinar, Marjeta Podobnik, Radovan Komel, Simon Horvat, Gregor Anderluh, Blaž Zupan

#### 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 biochemical 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 and designed biological systems

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.

**Koda:** F-1-200

**Naslov:** **Farmacevtske znanosti**

**Izvajalci:**

Danijel Kikelj (nosilec), Marko Anderluh, Zdenko Časar, Aleš Obreza, Anamarija Zega, Andrej Perdih, Stanislav Gobec, Simona Golič Grdadolnik, Marija Sollner Dolenc, Janez Mravljak, Lucija Peterlin Mašič, Uroš Urleb, Janez Ilaš, Janko Kos, Bojan Doljak, Matjaž Jeras, Boris Rogelj, Borut Štrukelj, Tomaž Bratkovič, Mojca Lunder, Samo Kreft, Damjan Janeš, Nina Kočevar, Iztok Grabnar, Mojca Kerec Kos, Tomaž Vovk, Albin Kristl, Marija Bogataj, Simon Žakelj, Aleš Belič, Stane Srčič, Odon Planinšek, Rok Dreu, Mirjana Gašperlin, Alenka Zvonar, Julijana Kristl, Pegi Ahlin Grabnar, Petra Kocbek, Mitja Kos, Igor Locatelli, Valentina Prevolnik Rupel, Jurij Lah, Tihomir Tomšič, Jurij Trontelj, Franc Vrečer, Izidor Sosič

**Kratka vsebina:**

Predmet »Farmacevtske znanosti« obravnava temelje znanstvenih osnov molekularne farmacevtske kemije, farmacevtske biologije, farmacevtsko tehnoloških operacij, dostavnih sistemov in farmacevtske nanotehnologije, molekularne biofarmacije in farmakokinetike ter socialne farmacije, zdravstvene ekonomike in farmakoepidemiologije.

Predmet je razdeljen v petnajst vsebinsko zaokroženih modulov (po 10 KT). Študenti lahko vpišejo predmet po modulih (po 10 KT) glede na področje svojega raziskovalnega dela.

**Moduli:**

Modul 1.1.: Struktura učinkovin in njihove lastnosti

Modul 1.2.: Tarče učinkovin in vrednotenje interakcij

Modul 1.3.: Metode načrtovanja učinkovin

Modul 2.1.: Biomolekule kot tarče za diagnostiko in terapijo

Modul 2.2.: Biološka in genska zdravila

Modul 2.3.: Zdravila rastlinskega izvora

Modul 3.1.: Farmakokinetika in njen pomen pri odkrivanju in razvoju zdravil

Modul 3.2.: Biofarmacevtska analiza procesov LADME sistema

Modul 3.3.: Farmakokinetično-farmakodinamična analiza

Modul 4.1.: Farmacevtsko tehnološki procesi

Modul 4.2.: Dostavni sistemi učinkovin

Modul 4.3.: Farmacevtska nanotehnologija in nanozdravila

Modul 5.1.: Socialna farmacija

**Code:** F-1-200

**Course title:** **Pharmaceutical sciences**

**Lecturers:**

Danijel Kikelj, Marko Anderluh, Zdenko Časar, Aleš Obreza, Anamarija Zega, Andrej Perdih, Stanislav Gobec, Simona Golič Grdadolnik, Marija Sollner Dolenc, Janez Mravljak, Lucija Peterlin Mašič, Uroš Urleb, Janez Ilaš, Janko Kos, Bojan Doljak, Matjaž Jeras, Boris Rogelj, Borut Štrukelj, Tomaž Bratkovič, Mojca Lunder, Samo Kreft, Damjan Janeš, Nina Kočevar, Iztok Grabnar, Mojca Kerec Kos, Tomaž Vovk, Albin Kristl, Marija Bogataj, Simon Žakelj, Aleš Belič, Stane Srčič, Odon Planinšek, Rok Dreu, Mirjana Gašperlin, Alenka Zvonar, Julijana Kristl, Pegi Ahlin Grabnar, Petra Kocbek, Mitja Kos, Igor Locatelli, Valentina Prevolnik Rupel, Jurij Lah, Tihomir Tomšič, Jurij Trontelj, Franc Vrečer, Izidor Sosič

**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 15 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

Modul 5.2.: Zdravstvena ekonomika

Modul 5.3.: Farmakoepidemiologija

Kratke predstavitve posameznih modulov temeljnega predmeta znanstvenega področja farmacija Farmacevtske znanosti so dostopne na spletni strani <https://www.uni-lj.si/studij/doktorski/biomedicina/predmetnik-urniki/kratka-predstavitev-predmetov/>.

**Koda:** G-1-600

**Naslov:** **Genetika**

**Izvajalci:**

Simon Horvat (nosilec), Branka Javornik, Peter Dovč, Borut Peterlin, Darja Žgur-Bertok, Jernej Jakše, Gregor Gorjanc, Roman Jerala, Tanja Kunej, Uroš Petrovič, Peter Trontelj

**Kratka vsebina:**

Glavni namen predmeta »Genetika« je zagotoviti osnove iz Mendelske, mikrobne, molekularne genetike, citogenetike, populacijske, kvantitativne, evolucijske genetike, epigenetike, genomike in uporabe bioinformacijskih orodij za genetske analize.

**Modul 1: Genetski koncepti I** pokriva različna področja genetike bioloških sistemov ter osnovne genetske koncepte od mikrobov do sesalcev.

**Modul 2: Genetski koncepti II** omogoča poglobitev temeljnih in aplikativnih znanj iz genetike in obravnava koncepte sodobne genomike s poudarkom na analizi strukture in variabilnosti genoma ter uporabo teh znanj v biomedicini in biotehnologiji.

**Modul 3: Bioinformacijska orodja** je namenjen študiju uporabe glavnih bioinformacijskih orodij ter podatkovnih zbirk za genetske, genomske analize ter za razumevanje kompleksnih genomskih interakcij s poudarkom na praktičnem problemskem učenju. Vsebine modulov temeljnega predmeta GENETIKA tako omogočajo študentom, da osvojijo sodobne koncepte in znanstvene pristope klasične genetike ter genomike in pridobljeno znanje aplicirajo pri svojih projektih na modelnih organizmih, mikroorganizmih, domačih živalih, rastlinah, prostoživečih populacijah ali človeku.

Module 5.1.: Social pharmacy

Module 5.2.: Health economics

Module 5.3.: Pharmacoepidemiology

Short presentations of modules of the core course "Pharmaceutical sciences" are available at <https://www.uni-lj.si/study/doctoral/biomedicine/curriculum/course-presentation/>.

**Code:** G-1-600

**Course title :** **Genetics**

**Lecturers:**

Simon Horvat, Branka Javornik, Peter Dovč, Borut Peterlin, Darja Žgur-Bertok, Jernej Jakše, Gregor Gorjanc, Roman Jerala, Tanja Kunej, Uroš Petrovič, Peter Trontelj

**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.

**Koda:** S-1-420

**Naslov:** **Znanstveni vidiki javnega zdravja**

**Izvajalci:**

Igor Švab (nosilec), Marjan Bilban, Irena Klavs, Vesna Švab, Helena Burger, Maja Sočan, Lijana Zaletel Kragelj, Ivan Eržen, Majda Pahor, Danica Rotar Pavlič, Marko Kolšek, Polona Selič, Andrej Starc, Janez Žibert

**Kratka vsebina:**

Predmet sestavljata dva modula po 10 KT.

**Modul 1: Determinante zdravja in bolezni**

Biološka osnova javnozdravstvenih problemov, determinante zdravja (življenjski slog, poklicne determinante zdravja), izbrani problemi, (poseben poudarek bo na raku, depresiji, psihosocialni rehabilitaciji psihoz in bolezenskih odvisnosti), ogrožene skupine prebivalstva, metodologija raziskovanja na tem področju.

**Modul 2: Metodologija javnozdravstvenih ukrepov**

Zdravstveni sistemi in zdravstvena politika, kakovost zdravstvene službe, promocija zdravja, zdravstvena nega, sistem preventive (cepljenje, presejanja, epidemiološko spremljanje zdravstvenih pojavov), primarno zdravstveno varstvo, metode rehabilitacije, metodologija raziskovanja na tem področju

**Koda:** L-1-300

**Naslov:** **Stopenjska klinično-biokemijska diagnostika**

**Izvajalci:**

Janja Marc (nosilka), Borut Božič, Darko Černe, Janko Kos, Irena Mlinarič Raščan, Matjaž Jeras, Barbara Ostanek

**Kratka vsebina:**

Predmet je razdeljen v tri module oziroma osem vsebinsko zaokroženih sklopov ovrednotenih s po 5 ECTS. Pri vpisu predmeta študent izbere različno kombinacijo sklopov. Posamezni sklop je zaokrožena celota in ločeno ocenjena. Za vpis na to smer izbere študent 4 do 6 sklopov.

**Modul 1 (Laboratorijska biomedicina)** sestavljata dva sklopa.

V **Sklopu 1: Znanstveni pristopi v laboratorijski medicini bodo** študenti na modelnih primerih kritično vrednotili postavljene hipoteze, verodostojnost dobljenih rezultatov ter uporabljeno metodologijo.

**Code:** S-1-420

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

**Lecturers:**

Igor Švab, Marjan Bilban, Irena Klavs, Vesna Švab, Helena Burger, Maja Sočan, Lijana Zaletel Kragelj, Ivan Eržen, Majda Pahor, Danica Rotar Pavlič, Marko Kolšek, Polona Selič, Andrej Starc, Janez Žibert

**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, quality of care, health promotion, nursing, prevention (vaccination, screening, epidemiological monitoring), primary care, rehabilitation, research methodology.

**Code:** L-1-300

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

**Lecturers:**

Janja Marc, Borut Božič, Darko Černe, Janko Kos, Irena Mlinarič Raščan, Matjaž Jeras, Barbara Ostanek

**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 have 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.

V **Sklopu 2: Stopenjska klinično-biokemijska diagnostika z interpretacijo se bodo** študenti seznanili s stopenjskim pristopom pri laboratorijski diagnostiki, naučili identificirati vprašanja, izbirati teste in oceniti izid za bolnika da bodo sposobni pripraviti na dokazih temelječe predloge za npr. smernice k obravnavi bolnikov.

**Modul 2 (Molekulski označevalci bolezni)** sestavljajo 3 sklopi.

**Sklop 1: Pogoste bolezni z genetsko osnovo**, kjer se študenti seznanijo s presejalnimi testi (prenatalna in postnatalna diagnostika, družinske in populacijske študije); s potrditvenimi testi na ravni kopičenja ali pomanjkanja presnovkov in vzporejanja s klinično sliko na modelnih primerih bolezni.

**Sklop 2: Imunsko pogojene bolezni:** Študent spozna laboratorijske pristope v diagnostiki imunsko pogojenih bolezni in preobčutljivostnih stanj, z analiti in preiskavami v osnovnem in usmerjenem iskanju motenj imunskega sistema.

**Sklop 3: Maligne bolezni:** Študent spozna uporabo bioloških molekul v presejalnih testih; tumorske kazalce, zunajcelične tumorske DNA; uporabo DNA/RNA testov, imunskih testov, biosenzorjev in biočipov; pripravo monoklonskih protiteles, aptamerov, siRNA, RNA/DNA sond in rekombinantnih proteinov za diagnostiko malignih bolezni.

**Modul 3 (Translacijska biomedicina)** sestavljajo trije sklopi.

**Sklop 1: Farmakogenomska diagnostika:** Študent spozna pristope v farmakogenomski diagnostiki in v individualizirani terapiji osnovane na farmakogenomiki metabolizirajočih encimov, receptorjev, transporterjev, miRNA. Spozna direktno in reverzno farmakogenomiko v projektu načrtovanja zdravil; pri identifikaciji tarč, v predkliničnih in kliničnih študijah.

**Sklop 2: Celični in tkivni inženiring** omogoča razumevanje različnih pristopov pri pripravi celičnih in kompleksnih tkivnih kultur, namenjenih tako naprednemu zdravljenju kot testnim sistemom za preskušanje delovanja učinkovin in snovi in vitro.

**Sklop 3: Tehnologije in orodja OMIC (ali Naprednejše tehnologije in orodja v translacijski biomedicini):** Študenti se bodo seznanili z naprednejšimi tehnologijami na področjih genomike, transkriptomike, proteomike in metabolomike in njihovo uporabo v laboratorijski biomedicini.

**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.



**Koda:** K-1-500

**Naslov:** Raziskave v klinični medicini

**Izvajalci:**

Matej Podbregar, Žarko Finderle (nosilca), Lovro Stanovnik, Mirta Koželj, Mitja Košnik, Vladimir Smrkolj, Vito Starc, Alojz Ihan, Vita Dolžan, Juš Kšela, Mitja Lainščak, Tomaž Marš, Tadeja Pintar, Sergej Pirkmajer, Damjana Rozman, Janez Stare, Mišo Šabovič, Dušan Štajer, Katarina Šurlan Popović, Igor Švab, Aleš Tomažič, Samo Zver

Predmet je razdeljen v tri vsebinske module, ovrednotene s po 10 KT. Modul 1 in 2 sta enovita, modul 3 pa je razdeljen na več tematskih sklopov, ki potekajo vzporedno in izmed katerih doktorand izbere dva.

#### **Modul 1: Osnove medicinskih raziskav**

Etika v raziskovalnem delu, predstavitev raziskav in nastop, medicina, temelječa na dokazih, priprava projekta, zaščita intelektualne lastnine, financiranje raziskav, pisanje in analiza člankov, značilnosti kliničnega raziskovalnega dela, celični in živalski modeli.

#### **Modul 2: Metode v kliničnih raziskavah**

Zbiranje podatkov, pristranost, reprezentativnost, kvalitativne metode, izvedba anket, sodobne statistične metode, informacijske metode.

#### **Modul 3: Dosežki v kliničnih raziskavah**

Dosežki v kliničnih raziskavah vsebujejo 12 sklopov, ki predstavijo raziskave v nekaterih kliničnih področjih (kardiovaskularne medicinske vede, medicinske vede operativnih strok, slikovne metode, genetske metode, imunologija in alergologija, fiziologija kardiovaskularnega sistema, fiziologija dihanja, fiziologija in biodinamika lokomotornega sistema, temeljna in klinična farmakologija ter razvoj novih zdravil, urgentna in intenzivna medicina, hematologija in onkologija, hiperbarična medicina).

**Code:** K-1-500

**Course title:** Research in clinical medicine

**Lecturers:**

Matej Podbregar, Žarko Finderle (nosilca), Lovro Stanovnik, Mirta Koželj, Mitja Košnik, Vladimir Smrkolj, Vito Starc, Alojz Ihan, Vita Dolžan, Juš Kšela, Mitja Lainščak, Tomaž Marš, Tadeja Pintar, Sergej Pirkmajer, Damjana Rozman, Janez Stare, Mišo Šabovič, Dušan Štajer, Katarina Šurlan Popović, Igor Švab, Aleš Tomažič, Samo Zver

The subject is divided in three thematic modules (each brings 10 ECTS). Module 3 is divided into several thematic blocks, which take place simultaneously. The doctoral student chooses two of three thematic blocks.

#### **Module 1: Fundamentals in medical research**

This module deals with ethics in research work, presentation of research and performance, evidence-based medicine, project preparation, intellectual property protection, research funding, writing and analysis of articles, characteristics of clinical research, cell and animal models.

#### **Module 2: Methods in clinical research**

Data collection, bias, representativeness, qualitative methods, conducting surveys, modern statistical methods, information methods.

#### **Module 3: Achievements in clinical research**

The module consists of individual thematic blocks (5 ECTS each), a doctoral candidate chooses two of the blocks, or instead one module (10 credits) from the scientific fields of medicine - basic orientation, biochemistry, microbiology or neuroscience.

Thematic blocks are: Imaging methods, Genetic methods, Immunology and allergology, Physiology of the cardiovascular system, Physiology of respiration, Physiology and biomechanics of the locomotor system, Basic and clinical pharmacology, Cardiovascular medical sciences, Emergency and intensive medicine, Hematology and oncology, Medical sciences of operative disciplines, Hyperbaric medicine.

**Koda:** J-1-400

**Naslov:** Medicinska celična biologija

**Izvajalci:**

Rok Romih (nosilec), Irma Virant Klun, Gregor Serša, Tadej Battelino, Damjana Rozman, Peter Veranič, Mateja Erdani Kreft, Maja Čemažar, Katarina Trebušak Podkrajšek, Borut Peterlin, Danijel Petrovič, Vita Dolžan, Alojz Ihan, Janez Žgajnar, Marko Goličnik, Maruša Debeljak

**Kratka vsebina:**

Predmet Medicinska celična biologija omogoča poglobitev temeljnih znanj o zgradbi in delovanju celic, o spremembah na celičnem in molekularnem nivoju med patološkimi procesi ter nadgradnjo teh znanj na področjih, ki so pomembna v medicini. Predmet sestoji iz obveznega modula Temeljni medicinske celične biologije in štirih izbirnih modulov: Celična biologija v humani reprodukciji, Biologija maligno spremenjenih celic in translacijska onkologija, Celična biologija v klinični genetiki in Sistemska medicina večfaktorskih bolezni.

#### **Modul 1: Temeljni medicinske celične biologije**

Osnovni modul obravnava celično-biološke in molekularne mehanizme normalnega in nenormalnega poteka celičnega ciklusa ter celične smrti, pomen medceličnih povezav med razvojem in diferenciacijo ter motnje v njihovi zgradbi in delovanju, pomen celičnih predelkov biosintetske in endocitotske poti ter vezikularnih transportov v normalnih pogojih in v primerih nekaterih bolezni, vloge peroksisomov in mitohondrijev, zgradbo in pomen citoskeleta med celično diferenciacijo in pri nastanku obolenj.

#### **Modul 2: Celična biologija v humani reprodukciji**

Modul obravnava celične mehanizme razvoja gonad, oogeneze, folikuloogeneze, spermatogeneze, oploditve in razvoja zarodka. Študentje se seznanijo z asistirano reprodukcijo in problematiko matičnih celic.

#### **Modul 3: Biologija maligno spremenjenih celic in translacijska onkologija**

Študenti se seznanijo s biološkimi osnovami maligno spremenjenih celic. Poglobljeno se obravnavajo karcinogeneza, značilnosti in tarče terapevtskih pristopov v onkologiji ter dognanja na področju translacijske onkologije.

**Code:** J-1-400

**Course title:** Medical Cell Biology

**Lecturers:**

Rok Romih, Irma Virant Klun, Gregor Serša, Tadej Battelino, Damjana Rozman, Peter Veranič, Mateja Erdani Kreft, Maja Čemažar, Katarina Trebušak Podkrajšek, Borut Peterlin, Danijel Petrovič, Vita Dolžan, Alojz Ihan, Janez Žgajnar, Marko Goličnik, Maruša Debeljak

**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: Reproductive biology *in vivo* and *in vitro***

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.

#### Modul 4: Celična biologija v klinični genetiki

V sklopu 4. modula študenti obravnavajo genetske okvare na različnih področjih delovanja celice s poudarkom na njihovem pomenu pri razvoju bolezni. Takšna znanja so pomembna pri celoviti diagnostični obravnavi bolnikov, pri odločitvah o načinih zdravljenja, spremljanju poteka in napovedovanju bolezni ter pri genetskem svetovanju.

#### Modul 5: Sistemska medicina večfaktorskih bolezni

Modul 5 sestavlja delo na projektu večfaktorske bolezni, ki je izbran glede na najnovejša znanstvena spoznanja in raziskovalni interes študijske skupine. Poudarek študija je na sistemskih pristopih po-genomske dobe, računanju z velikimi skupinami podatkov, statistiki, modeliranju podatkov in pomenu globalnih genomskih raziskav za prediktivno in personalizirano medicino.

**Koda:** M-1-410

**Naslov:** **Izbrana poglavja iz mikrobiologije**

#### Izvajalci:

Srečko Koren (nosilec), Tatjana Avšič Županc, Alojz Ihan, Manica Mueller Premru, Miroslav Petrovec, Mario Poljak, Katja Seme, Gorazd Avguštin, Nina Gunde Cimerman, Tomaž Accetto, Neža Čadež, Blaž Stres, Polona Zalar

#### Kratka vsebina:

Predmet »Izbrana poglavja iz mikrobiologije« obravnava na izbranih primerih kompleksne odnose med mikroorganizmi, med mikroorganizmi in njihovimi gostitelji ter med mikroorganizmi in naravnim okoljem, ki ga naseljujejo.

Predmet je razdeljen v tri vsebinske module ovrednotene s po 10 KT. Študenti vpišejo predmet (30 KT) kot kombinacijo treh ali izbor najmanj dveh modulov.

#### Modul 1: Temeljna medicinska mikrobiologija

Predstavljeni bodo temeljni mehanizmi parazitskega obstajanja mikrobov in posledičnega razvoja bolezenskih procesov v človeškem organizmu.

#### Modul 2: Klinična mikrobiologija

Predstavljeni bodo diagnostični algoritmi v klinični mikrobiologiji, kritična interpretacija rezultatov mikrobioloških preiskav, napake pri naročanju mikrobioloških preiskav in njihove medicinske in ekonomske posledice ter problemi pri komunikaciji med laboratorijem in lečečim zdravnikom.

#### 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:** M-1-410

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

#### Lecturers:

Srečko Koren, Tatjana Avšič Županc, Alojz Ihan, Manica Mueller Premru, Miroslav Petrovec, Mario Poljak, Katja Seme, Gorazd Avguštin, Nina Gunde Cimerman, Tomaž Accetto, Neža Čadež, Blaž Stres, Polona Zalar

#### 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.

#### Modul 3: Mikrobna identifikacija, pestrost in evolucija

Predstavljeni bodo tradicionalna, molekularna in polifazna taksonomija, področje mikrobne raznolikosti (tako bakterijske, arhejske kot biodiverzitet evkariontskih mikroorganizmov, t.j. gliv, praživali in alg) in področje molekularne evolucije.

**Koda:** N-1-540

**Naslov:** **Nevroznanost**

#### Izvajalci:

Zvezdan Pirtošek (nosilec), Mara Bresjanac, Fajko Bajrovič, Roman Bošnjak, Leja Dolenc Grošelj, Alojz Ihan, Marko Kreft, Mojca Kržan, Gregor Majdič, David Neubauer, Peter Pregelj, Borut Prestor, Janja Pretnar Oblak, Simon Podnar, Zoran Rodi, Uroš Rot, Saša Šega, Dušan Šuput, Janez Zidar, Robert Zorec, Marko Živin, Jurij Bon, Ivan Bratko, Dejan Georgiev, Milica Gregorič Kramberger, Maja Kojović, Urban Kordeš, Blaž Koritnik, Christina Manoulidiou, Tomaž Marš, Grega Repovš, Boris Rogelj, Maja Trošt

#### Kratka vsebina:

Predmet Nevroznanost podaja pregled znanj in raziskav temeljne in kliničnih nevroznanosti (nevrobiologija na molekularni, celični in sistemski ravni, ustroj centralnega in perifernega živčevja z anatomskega in histološkega vidika, razvoj in plastičnost živčevja v fizioloških in patofizioloških razmerah, delovanje senzoričnih in motoričnih sistemov, uravnavanje fizioloških funkcij, neurofarmakološki pristopi, vedenjska in kognitivna nevroznanost, nevrološke, nevrokirurške, psihiatrične bolezni, vključno z etičnimi razmisleki).

Predmet je razdeljen v dva vsebinska modula ovrednotena s po 10 KT. Študenti lahko vpišejo predmet kot celoto (20 KT).

Predmet je razdeljen v dva modula po 10KT.

#### Modul 1: Temeljna nevroznanost

#### Modul 2: Klinična nevroznanost

#### 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**

#### Lecturers:

Zvezdan Pirtošek, Mara Bresjanac, Fajko Bajrovič, Roman Bošnjak, Leja Dolenc Grošelj, Alojz Ihan, Marko Kreft, Mojca Kržan, Gregor Majdič, David Neubauer, Peter Pregelj, Borut Prestor, Janja Pretnar Oblak, Simon Podnar, Zoran Rodi, Uroš Rot, Saša Šega, Dušan Šuput, Janez Zidar, Robert Zorec, Marko Živin, Jurij Bon, Ivan Bratko, Dejan Georgiev, Milica Gregorič Kramberger, Maja Kojović, Urban Kordeš, Blaž Koritnik, Christina Manoulidiou, Tomaž Marš, Grega Repovš, Boris Rogelj, Maja Trošt

#### Contents:

The course entitled »Neuroscience« reviews updated knowledge and research in neurobiology at molecular, cellular and systemic levels, anatomy and histology of central and peripheral nervous systems, development and plasticity of the nervous system in physiological and pathological conditions, function of sensory and motor systems, regulation of physiological functions, neuropharmacology, behavioural and cognitive neuroscience, neurological, neurosurgical and psychiatric diseases including ethical considerations.

The course is divided into two independent modules, each equivalent to 10 ECTS. Students can sign in both modules (20 ECTS).

#### Module 1: Basic neuroscience

#### Module 2: Clinical neuroscience



**Koda:** T-1-340

**Naslov:** Toksikologija

**Izvajalci:**

Marija Sollner Dolenc (nosilka), Irena Mlinarič Raščan, Damjana Drobne, Domen Leštan, Janez Mavri, Lucija Peterlin Mašič, Žiga Jakopin

**Kratka vsebina:**

Razumevanje mehanizmov, kako snovi povzročijo toksični učinek v živih organizmih, je vse bolj pomembno pri odločanju o varni uporabi snovi na delovnem mestu in v vsakdanjem življenju. Predmet zato poskuša predstaviti na izbranih primerih: mehanizme transporta snovi skozi celične membrane in toksični vpliv spojin nanj; vlogo metabolizma pri nastajanju reaktivnih presnovkov, ki kovalentno interagirajo z makromolekulami celic; vlogo radikalov in snovi sposobnih redoks reakcij na generiranje oksidativnega stresa v celicah; mehanizme nekrotične in apoptotične celične smrti povzročene s spojinami; specifično/nеспециfično aktivacijo encimov in receptorjev povzročeno s ksenobiotiki; toksični vpliv spojin na mitohondrije in peroksisome ter energetsko stanje celice; specifične, nespecifične interakcije (kovalentne/nekovalentne) snovi z makromolekulami v povezavi s toksičnimi učinki spojin (genotoksičnost, imunotoksičnost itd.); mehanizme toksičnega delovanja posameznih skupin ksenobiotikov, ki se pojavljajo v okolju na različne skupine organizmov (bakterije, živali, rastline, glive); vlogo biosenzorjev in biomarkerjev za vrednotenje toksičnosti spojin v povezavi s kvantnim učinkom na posamezne populacije organizmov, združbo in ekosistem.

Predmet je razdeljen v tri vsebinske module ovrednotene s po 10 KT. Študenti lahko vpišejo predmet kot celoto (30 KT) ali ločeno po modulih (po 10 KT), vendar morajo vpisati s področja vsaj 20 KT.

**Modul 1: Povezava med strukturo in toksičnostjo snovi**

Obravnavane bodo kovalentne in nekovalentne interakcije ksenobiotikov z makromolekulami celic v živih organizmih ter tvorba reaktivnih kisikovih spojin ter s tem povezani genotoksični in imunotoksični učinki spojin. Razložene bodo biotransformacijske reakcije snovi- funkcionalizacije in konjugacije ter posledice prisotnosti njihovih produktov v različnih tkivih. Obravnavana bo vloga radikalov v celici in predstavljene skupine snovi, ki omogočajo njihovo nastajanje. Predstavljene bodo tudi nekatere skupine ksenobiotikov, ki nespecifično ali specifično interagirajo z makromolekulami celic. Študent bo spoznal osnovne toksikološke teste, vključno s kvantnomehanskimi metodami in biomolekularnimi simulacijami, ki omogočajo napovedovanje toksičnosti snovi.

**Code:** T-1-340

**Course title:** Toxicology

**Lecturers:**

Marija Sollner Dolenc, Irena Mlinarič Raščan, Damjana Drobne, Domen Leštan, Janez Mavri, Lucija Peterlin Mašič, Žiga Jakopin

**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 formation 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**

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**

This module presents: 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.

**Koda:** V-1-700

**Naslov:** **Upravljanje procesov pri zdravih in bolnih živalih**

**Izvajalci:**

Milka Vrecl Fazarinc (nosilka), Gregor Majdič, Nina Čebulj-Kadunc, Jelka Zabavnik Piano, Robert Frangež, Breda Jakovac Strajn, Polona Juntas, Martina Klinkon Ogrinec, Andrej Kirbiš, Urška Jamnikar Ciglencečki, Petra Zrimšek in Mitja Gombač

**Kratka vsebina:**

Predmet je razdeljen v tri vsebinske module, ovrednotene s po 10 KT.

#### **Modul 1: Upravljanje temeljnih procesov pri živalih**

Obravnava morfološko-funkcionalne lastnosti živalske celice, celico kot nosilko dednosti, prenos dednih informacij na potomce, upravljanje izražanja genov in celično signalizacijo. Obravnava tudi biokemične in fiziološke procese ter njihovo nevro-endokrino upravljanje za ohranjanje homeostaze in odzivnosti organizma na različne vplive iz okolja. Študentom omogoči tudi razširitev znanj o prognezi, oploditvi in zgodnjem embrionalnem razvoju pri domačih živalih ter seznanitev s sodobnimi raziskovalnimi metodami.

#### **Modul 2: Motnje homeostaze in bolezenski procesi**

Poglobljeno obravnava poglavitne vzroke motenj in temeljne patofiziološke procese v organizmih, katerih poznavanje je podlaga za razumevanje razvoja, postavitve klinične diagnoze in terapije različnih bolezni. Študentu omogoča, da s pridobljenim znanjem po morfoloških spremembah v organih, tkivih in celicah prepozna nenormalno delovanje organizma ter mu daje znanje, ki prispeva k boljšemu razumevanju delovanja škodljivih dejavnikov in odzivanja organizma nanje v bolezenskih procesih. Obravnava tudi medsebojno povezovanje sprememb biokemijskih parametrov za ugotavljanje motenj v delovanju organskih sistemov, motenj presnove mineralov, elektrolitov, acido-baznega ravnotežja in procesov pri živalih, povezane z alimentarnimi zastrupitvami.

#### **Modul 3: Varna hrana**

V okviru modula 3 študentje nadgradijo znanje in razumevanje pozitivnega in negativnega vpliva interakcij med človekom in živaljo s poudarkom na uživanju živil živalskega izvora z uporabo epidemioloških in statističnih orodij, oceno analize tveganja, novih znanj s področja tehnologije meso in mlečno predelovalne industrije, kakor tudi industrije predelave rib, školjk, rakov, žab, jajc, medu in izdelkov iz omenjenih primarnih surovin.

**Code:** V-1-700

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

**Lecturers:**

Milka Vrecl Fazarinc, Gregor Majdič, Nina Čebulj-Kadunc, Jelka Zabavnik Piano, Robert Frangež, Breda Jakovac Strajn, Polona Juntas, Martina Klinkon Ogrinec, Andrej Kirbiš, Urška Jamnikar Ciglencečki, Petra Zrimšek in Mitja Gombač

**Contents:**

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

Module 1 deals with morphological and functional characteristics of animal cell, cell as hereditary carrier, transfer of hereditary information on offspring, regulation of gene expression and cell signaling. It also covers biochemical and physiological processes and their neuroendocrine regulation crucial for maintenance of homeostasis and responsiveness of the organism to various environmental influences. It also enables students to expand their knowledge of progenesis, fertilization and early embryonic development in domestic animals, and to become acquainted with modern research methods.

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

Module 2 deals in depth with main causes for disturbances and basic pathophysiological processes in organisms, important in developing and understanding of the mechanisms of disease and establishing clinical diagnosis and disease therapy. It enables recognition of organism dysfunction through morphological alterations in organs, tissues and cells and contribute to better understanding of organism response to the impact of harmful factors in disease processes. It also deals with the interconnection between changes in the biochemical parameters and the function of organ systems, mineral and electrolyte metabolism disturbances and the assessment of acid-bases balance and changes associated with the alimentary intoxications.

#### **Module 3: Food safety**

In module 3, students gain knowledge and understanding of positive and negative effect of interaction between human and animals, with an emphasis on consuming products of animal origin, using epidemiological and statistical tools to estimate the risk, gain 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.

## **Izbirni predmeti**

Vsako znanstveno področje je predlagalo več izbirnih predmetov. Doktorandi lahko izbirajo med izbirnimi teoretičnimi in izbirnimi individualno raziskovalnimi predmeti, ki so ovrednoteni s 5 KT. V dogovoru z mentorjem in koordinatorjem področja lahko izberejo 10 KT izbirnih vsebin iz drugih programov UL, primerljivih programov tujih univerz in iz predmetov, ki jih razpisuje Univerza v Ljubljani in omogočajo osvajanje posebnih znanj in spretnosti (»generic skills«). Izbirni teoretični predmeti obravnavajo znanstvene vsebine, ki jih s svojim raziskovalnim delom proučujejo učitelji posameznih predmetov. Študij se izvaja v organiziranih oblikah ali z individualnimi konzultacijami. Način izvedbe izbirnih teoretičnih predmetov je odvisen od števila študentov, ki si posamezni predmet izberejo.

Izbirni individualno raziskovalni predmeti se izvajajo v raziskovalnih ustanovah v laboratorijih, oddelkih, klinikah in drugih raziskovalnih enotah. Kandidati, ki si nameravajo izbrati individualno raziskovalni predmet, se o tem predhodno dogovorijo z nosilci predmetov. Zaradi individualnega dela s študentom je pri predmetih število doktorandov omejeno s kapaciteto.

## **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 also 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 webpage of University of Ljubljana ([http://bit.ly/doktorski\\_studij](http://bit.ly/doktorski_studij)).

## Seznam izbirnih teoretičnih predmetov

|    | <b>Predmet</b>  | <b>Nosilec</b>          | <b>Koda</b> |
|----|---|-------------------------|-------------|
| 1  | Analitika učinkovin in metabolitov v biosistemih        | Albin Kristl            | F-2-202     |
| 2  | Avtoimunost   | Borut Božič             | L-2-301     |
| 3  | Biofizika makromolekul in membran                       | Janez Štrancar          | F-2-923     |
| 4  | Biogena zdravila  | Damjan Janeš            | F-2-203     |
| 5  | Biokemija bioloških membran                             | Igor Križaj             | B-2-903     |
| 6  | Biologija stresa  | Damjana Drobne          | T-2-344     |
| 7  | Biomolekularna termodinamika                            | Jurij Lah               | B-2-800     |
| 8  | Celična fiziologija                                     | Robert Zorec            | B-2-105     |
| 9  | Celično in tkivno inženirstvo v naprednem zdravljenju   | Matjaž Jeras            | F-2-204     |
| 10 | Elektronska paramagnetna resonanca v bioloških sistemih | Janez Štrancar          | F-2-922     |
| 11 | Elektroporacija v biologiji, biotehnologiji in medicini | Damijan Miklavčič       | J-2-441     |
| 12 | Etologija in metode raziskovanja obnašanja živali       | Martin Dobeic           | V-2-704     |
| 13 | Farmaceutska biotehnologija                             | Borut Štrukelj          | F-2-205     |
| 14 | Farmaceutska komunikologija                             | Mitja Kos               | F-2-206     |
| 15 | Farmaceutska ovojnina                                   | Stane Srčič             | F-2-234     |
| 16 | Farmaceutske oblike za uporabo v veterinarski medicini  | Stane Srčič             | F-2-207     |
| 17 | Farmakoeconomika  | Mitja Kos               | F-2-208     |
| 18 | Farmakogenetika in osebna medicina                      | Vita Dolžan             | B-2-104     |
| 19 | Farmakogenomika v farmaciji                             | Irena Mlinarič - Raščan | F-2-209     |

## Elective theoretical courses

|    | <b>Course</b>  | <b>Code</b> |
|----|--|-------------|
| 1  | Advanced drug delivery systems                               | F-2-229     |
| 2  | Advanced molecular genetics                                  | B-2-902     |
| 3  | Analysis of drugs and metabolites in biosystems              | F-2-202     |
| 4  | Animals in experiment  | V-2-708     |
| 5  | Applied microbial enzymatics                                 | M-2-617     |
| 6  | Autoimmunity   | L-2-301     |
| 7  | Biochemistry of biological membranes                         | B-2-903     |
| 8  | Biogenic medicines   | F-2-203     |
| 9  | Biomolecular thermodynamics                                  | B-2-800     |
| 10 | Biophysics of macromolecules and membrane                    | F-2-923     |
| 11 | Cell and tissue engineering in advanced therapies            | F-2-204     |
| 12 | Cell physiology  | B-2-105     |
| 13 | Chosen chapters from drug analysis                           | F-2-217     |
| 14 | Clinical biochemistry – selected topics                      | L-2-302     |
| 15 | Clinical pharmacokinetics                                    | F-2-225     |
| 16 | Communicology in pharmacy                                    | F-2-206     |
| 17 | Compounds with multiple mode of action                       | F-2-240     |
| 18 | Cosmetology – selected topics                                | F-2-219     |
| 19 | Design and analysis of clinical and epidemiological research | J-2-466     |

|    | <b>Predmet</b>   | <b>Nosilec</b>      | <b>Koda</b> |
|----|--|---------------------|-------------|
| 20 | Farmakometrika   | Mitja Kos           | F-2-210     |
| 21 | Farmakoterapija  | Mojca Kerec Kos     | F-2-201     |
| 22 | Fiziologija in ekologija gliv                              | Nina Gunde-Cimerman | M-2-618     |
| 23 | Industrijska farmacevtska kemija                           | Stanislav Gobec     | F-2-237     |
| 24 | Industrijski razvoj farmacevtskih oblik                    | Janez Kerč          | F-2-215     |
| 25 | Interakcije farmacevtskih oblik v biosistemih              | Marija Bogataj      | F-2-216     |
| 26 | Izbrana poglavja iz analize zdravil                        | Aleš Obreza         | F-2-217     |
| 27 | Izbrana poglavja iz fizikalne farmacije                    | Stane Srčič         | F-2-218     |
| 28 | Izbrana poglavja iz klinične biokemije                     | Janja Marc          | L-2-302     |
| 29 | Izbrana poglavja iz kozmetologije                          | Mirjana Gašperlin   | F-2-219     |
| 30 | Izbrana poglavja iz sinteze zdravilnih učinkovin           | Danijel Kikelj      | F-2-220     |
| 31 | Izbrane teme v oromaksilofacialnem področju                | Nataša Ihan Hren    | K-2-535     |
| 32 | Kakovost zdravil   | Aleš Krbavčič       | F-2-224     |
| 33 | Klinična farmakokinetika                                   | Iztok Grabnar       | F-2-225     |
| 34 | Makromolekularna kristalografija                           | Dušan Turk          | F-2-920     |
| 35 | Medicinska biofizika                                       | Jure Derganc        | J-2-442     |
| 36 | Medicinska virologija                                      | Mario Poljak        | M-2-413     |
| 37 | Metode študija strukture in lastnosti zdravilnih učinkovin | Andrej Perdih       | F-2-921     |
| 38 | Metode za določanje pojavov na mejnih površinah            | Odon Planinšek      | F-2-226     |

|    | <b>Course</b>  | <b>Code</b> |
|----|--|-------------|
| 20 | Design and synthesis of enzyme inhibitors                  | F-2-227     |
| 21 | Design of biodiagnostics and biosensors                    | L-2-303     |
| 22 | Drug design  | F-2-230     |
| 23 | Drug stability   | F-2-235     |
| 24 | Electron paramagnetic resonance in biological systems      | F-2-922     |
| 25 | Electroporation based technologies and treatments          | J-2-441     |
| 26 | Entrepreneurship in medicine                               | B-2-108     |
| 27 | Ethology and research methods in animal behaviour          | V-2-704     |
| 28 | High resolution optical microscopy – confocal microscopy   | J-2-440     |
| 29 | Industrial development of dosage forms                     | F-2-215     |
| 30 | Industrial medicinal chemistry                             | F-2-237     |
| 31 | Interactions of drug delivery systems in biosystems        | F-2-216     |
| 32 | Introduction to data mining                                | B-2-126     |
| 33 | Light and electron microscopy                              | J-2-465     |
| 34 | Macromolecular crystallography                             | F-2-920     |
| 35 | Medical biophysics   | J-2-442     |
| 36 | Medical virology   | M-2-413     |
| 37 | Methods for determination of phenomena at interfaces       | F-2-226     |
| 38 | Methods of structure and properties determination of drugs | F-2-921     |

|    | <b>Predmet</b>  | <b>Nosilec</b>       | <b>Koda</b> |
|----|---|----------------------|-------------|
| 39 | Metodologija znanstvenoraziskovalnega dela  | Jelka Zabavnik Piano | V-2-705     |
| 40 | Mikrobiologija prebavnega trakta  | Gorazd Avguštin      | M-2-616     |
| 41 | Molekularna bioinformatika  | Roman Jerala         | B-2-901     |
| 42 | Molekularna biologija v veterinarski medicini   | Jelka Zabavnik Piano | V-2-706     |
| 43 | Molekularni mehanizmi nastanka in razvoja raka  | Gregor Serša         | B-2-107     |
| 44 | Monoklonska protitelesa - pregled področja in njihova uporaba v raziskavah, diagnostiki in terapiji | Vladka Čurin Šerbec  | B-2-106     |
| 45 | Mutageneza in genetska toksikologija  | Metka Filipič        | T-2-940     |
| 46 | Načrtovanje biodiagnostikov in biosenzorjev   | Janko Kos            | L-2-303     |
| 47 | Načrtovanje in analiza kliničnih in epidemioloških raziskav   | Lara Lusa            | J-2-466     |
| 48 | Načrtovanje in sinteza encimskih inhibitorjev   | Stanislav Gobec      | F-2-227     |
| 49 | Načrtovanje kakovosti in validacij v farmacevtski proizvodnji                                       | Stane Srčič          | F-2-214     |
| 50 | Načrtovanje zdravilnih učinkovin  | Danijel Kikelj       | F-2-230     |
| 51 | Napredna molekulska genetika  | Jože Pungerčar       | B-2-902     |
| 52 | Napredni dostavni sistemi učinkovin   | Julijana Kristl      | F-2-229     |
| 53 | Optična mikroskopija visoke ločljivosti - konfokalna mikroskopija                                   | Marko Kreft          | J-2-440     |
| 54 | Perinatologija  | Ksenija Geršak       | K-2-536     |

|    | <b>Course</b>   | <b>Code</b> |
|----|---|-------------|
| 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 | Perinatology  | K-2-536     |
| 46 | Pharmaceutical biotechnology  | F-2-205     |
| 47 | Pharmaceutical packaging  | F-2-234     |
| 48 | Pharmacoeconomics   | F-2-208     |
| 49 | Pharmacogenetics and personalized medicine  | B-2-104     |
| 50 | Pharmacogenomics in pharmaceutical practice   | F-2-209     |
| 51 | Pharmacometrics   | F-2-210     |
| 52 | Pharmacotherapy   | F-2-201     |
| 53 | Physiology and ecology of fungi   | M-2-618     |
| 54 | Probiotics  | M-2-619     |

|    | <b>Predmet</b>  | <b>Nosilec</b>        | <b>Koda</b> |
|----|---|-----------------------|-------------|
| 55 | Podjetništvo v medicini                                       | Mateja Drnovšek       | B-2-108     |
| 56 | Probiotiki  | Romana Marinšek Logar | M-2-619     |
| 57 | Raziskovanje na področju vrednotenja kakovosti dela zdravnika | Marija Petek Šter     | S-2-423     |
| 58 | Reaktivni metaboliti ksenobiotikov                            | Lucija Peterlin Mašič | T-2-345     |
| 59 | Sinteza in analiza kiralnih učinkovin                         | Danijel Kikelj        | F-2-239     |
| 60 | Socialna farmacija s farmakoepidemiologijo                    | Mitja Kos             | F-2-238     |
| 61 | Stabilnost zdravil  | Robert Roškar         | F-2-235     |
| 62 | Steroidni hormoni in od hormonov odvisne bolezni              | Tea Lanišnik Rižner   | B-2-109     |
| 63 | Svetlobna in elektronska mikroskopija                         | Rok Romih             | J-2-465     |
| 64 | Transport in metabolizem učinkovin v biosistemih              | Albin Kristl          | F-2-236     |
| 65 | Učinkovine z multiplim delovanjem                             | Janez Ilaš            | F-2-240     |
| 66 | Uporaba termične analize v farmaciji                          | Stane Srčič           | F-2-228     |
| 67 | Uporabna mikrobna encimatika                                  | Romana Marinšek Logar | M-2-617     |
| 68 | Uvod v podatkovno rudarjenje                                  | Blaž Zupan            | B-2-126     |
| 69 | Veterinarska ekologija in biovarnost                          | Martin Dobeic         | V-2-707     |
| 70 | Zvijanje in agregacija proteinov                              | Eva Žerovnik          | B-2-905     |
| 71 | Živali v poskusu  | Mitja Gombač          | V-2-708     |

|    | <b>Course</b>  | <b>Code</b> |
|----|--|-------------|
| 55 | Protein folding and aggregation                                | B-2-905     |
| 56 | Quality assurance and validations in pharmaceutical production | F-2-214     |
| 57 | Quality of care assessment research methods                    | S-2-423     |
| 58 | Quality of medicaments   | F-2-224     |
| 59 | Reactive metabolites of xenobiotics                            | T-2-345     |
| 60 | Selected topics from oromaxillofacial field                    | K-2-535     |
| 61 | Selected topics in drug synthesis                              | F -2-220    |
| 62 | Social pharmacy with pharmacoepidemiology                      | F-2-238     |
| 63 | Steroid hormones and hormone dependent diseases                | B-2-109     |
| 64 | Synthesis and analysis of chiral drugs                         | F-2-239     |
| 65 | The biology of stress  | T-2-344     |
| 66 | The methodology of scientific research                         | V-2-705     |
| 67 | Thermal analysis of pharmaceuticals                            | F-2-228     |
| 68 | Topics from physical pharmacy                                  | F-2-218     |
| 69 | Transport and metabolism of drugs in biosystems                | F-2-236     |
| 70 | Veterinary dosage forms  | F-2-207     |
| 71 | Veterinary ecology and biosecurity                             | V-2-707     |



## Seznam izbirnih individualno raziskovalnih predmetov

|    | Predmet   | Nosilec               | Koda    |
|----|---|-----------------------|---------|
| 1  | Alergologija  | Mitja Košnik          | K-3-501 |
| 2  | Analiza genoma in transkriptoma   | Damjana Rozman        | B-3-119 |
| 3  | Analiza skeletne mišice   | Vika Smerdu           | J-3-452 |
| 4  | Asociacijske in funkcijske študije v celotnem genomu človeka                | Uroš Potočnik         | G-3-610 |
| 5  | Biofizika bioloških procesov, celic in tkiv                                 | Zoran Arsov           | F-3-925 |
| 6  | Biokemijski označevalci: razvoj in uporaba v kliniki                        | Joško Osredkar        | L-3-317 |
| 7  | Biologija in boleznj čebelje družine  | Vlasta Jenčič         | V-3-709 |
| 8  | Biologija tumorjev  | Gregor Serša          | J-3-444 |
| 9  | Biološke implikacije napačnega zvijanja in agregacije proteinov             | Eva Žerovnik          | B-3-911 |
| 10 | Biološke implikacije agregacije proteinov                                   | Eva Žerovnik          | B-3-910 |
| 11 | Biotehnološki procesi v farmaciji   | Borut Štrukelj        | F-3-245 |
| 12 | Bolezni in zdravstveno varstvo rib  | Vlasta Jenčič         | V-3-710 |
| 13 | Bolezni ptic, malih sesalcev in plazilcev                                   | Joško Račnik          | V-3-711 |
| 14 | Celične elektrofiziološke metode  | Robert Zorec          | N-3-546 |
| 15 | Celične kulture v raziskavah in regenerativni medicini                      | Mateja Erdani Kreft   | J-3-463 |
| 16 | Celični modeli stresa   | Irina Milisav Ribarič | J-3-453 |
| 17 | Dedne bolezni kože - molekularne tehnike diagnostike in proučevanja bolezni | Mirjana Liovic        | B-3-118 |

## Elective individual research courses

|    | Course title   | 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 misfolding 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 |

|    | Predmet  | Nosilec                   | Koda    |
|----|--|---------------------------|---------|
| 18 | Delo z izoliranimi organi  | Katarina Černe            | J-3-462 |
| 19 | Dermatologija psov in mačk   | Tina Kotnik               | V-3-712 |
| 20 | Detekcija in lokalizacija molekul v celicah  | Peter Veranič             | J-3-457 |
| 21 | Diagnostična in eksperimentalna citologija   | Margareta Strojjan Fležar | J-3-456 |
| 22 | Diagnostična mikrobiologija  | Mario Poljak              | M-3-414 |
| 23 | Diagnostika in intenzivna terapija nevroloških bolezni pri novorojenčku                                  | David Neubauer            | N-3-547 |
| 24 | Določanje izražanja določenih beljakovin v vzorcih kultur skeletnih mišičnih celic z metodo Western Blot | Sergej Pirkmajer          | J-3-448 |
| 25 | Ehokardiografija   | Mirta Koželj              | K-3-502 |
| 26 | Eksperimentalna epigenetika  | Alja Videtič Paska        | B-3-115 |
| 27 | Eksperimentalna imunologija  | Alojz Ihan                | K-3-504 |
| 28 | Eksperimentalna nevroendokrinologija   | Gregor Majdič             | V-3-713 |
| 29 | Eksperimentalna reološka analitika   | Mirjana Gašperlin         | F-3-249 |
| 30 | Eksperimentalna virologija   | Tatjana Avšič-Županc      | M-3-415 |
| 31 | Eksperimentalne metode biofizike   | Janez Štrancar            | F-3-924 |
| 32 | Eksperimentalne metode pri študiju kompleksnih mikrobnih združb in njihovih interakcij                   | Gorazd Avguštin           | M-3-620 |
| 33 | Eksperimentalne metode v farmakogenomiki   | Vita Dolžan               | B-3-110 |
| 34 | Eksperimentalne metode v laboratorijski biomedicini  | Darko Černe               | L-3-309 |
| 35 | Eksperimentalne metode v raziskavah naravne imunosti   | Roman Jerala              | B-3-908 |

|    | Course title  | Code    |
|----|---|---------|
| 18 | Clinical neurosonology methods for cerebrovascular blood flow study                                 | N-3-549 |
| 19 | Community care  | S-3-427 |
| 20 | Comparative genomics  | G-3-613 |
| 21 | Comparative odontology and periodontal medicine   | V-3-727 |
| 22 | Comparison of fluorescence and electron microscopy applications in protein research in immune cells | B-3-904 |
| 23 | Concepts of genomic data integration  | G-3-609 |
| 24 | Congenital heart disease  | K-3-516 |
| 25 | Contemporary methods in small animal emergency medicine   | V-3-729 |
| 26 | Cryomethods in biomedicine  | J-3-443 |
| 27 | Dermatology of dogs and cats  | V-3-712 |
| 28 | Design and experimental research of cancer diseases   | B-3-113 |
| 29 | Detection and localisation of molecules in cells  | J-3-457 |
| 30 | Determination of specific protein expression in skeletal muscle cells with western blot             | J-3-448 |
| 31 | Development of biomarkers and their clinical application  | L-3-317 |
| 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 |



|    | <b>Predmet</b>  | <b>Nosilec</b>         | <b>Koda</b> |
|----|---|------------------------|-------------|
| 36 | Eksperimentalne metode v raziskavah strukture nukleinskih kislin    | Janez Plavec           | B-3-116     |
| 37 | Eksperimentalne metode v stomatološki protetiki                     | Peter Jevnikar         | K-3-529     |
| 38 | Eksperimentalne metode za proučevanje biokemije steroidnih hormonov | Tea Lanišnik Rižner    | B-3-122     |
| 39 | Eksperimentalne metode za raziskave možganskih bolezni              | Marko Živin            | N-3-545     |
| 40 | Elektrokardiografija visoke ločljivosti                             | Vito Starc             | K-3-503     |
| 41 | Encimska kataliza   | Jure Stojan            | B-3-124     |
| 42 | Evolucijska genomika  | Dušan Kordiš           | B-3-909     |
| 43 | Farmakoekonomika  | Mitja Kos              | F-3-256     |
| 44 | Farmakologija in toksikologija                                      | Silvestra Kobal        | V-3-714     |
| 45 | Farmakološko in toksikološko preskušanje zdravil                    | Metoda Lipnik-Štangelj | K-3-505     |
| 46 | Farmakoterapija   | Mojca Kerec Kos        | F-3-255     |
| 47 | Funkcijska slikanja z MRI   | Dušan Šuput            | N-3-557     |
| 48 | Funkcionalna analiza proteinov pri prenosu signala                  | Aljoša Bavec           | B-3-112     |
| 49 | Gastroenterološka kirurgija   | Mirko Omejc            | K-3-506     |
| 50 | Gastrointestinalna problematika konj                                | Peter Kruljc           | V-3-715     |
| 51 | Genetika, funkcijska genomika in sistemska biologija kvasovk        | Uroš Petrovič          | G-3-930     |
| 52 | Genomske analize kompleksnih lastnosti                              | Gregor Gorjanc         | G-3-606     |
| 53 | Glikozilacija proteinov   | Gregor Gunčar          | B-3-805     |
| 54 | Gojitev in zdravstveno varstvo divjadi                              | Gorazd Vengušt         | V-3-716     |

|    | <b>Course title</b>  | <b>Code</b> |
|----|--|-------------|
| 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     |
| 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 | Evidence based work in nursing and health service  | S-3-429     |
| 45 | Evolutionary genomics  | B-3-909     |
| 46 | Experimenat methods in laboratory medicine   | L-3-309     |
| 47 | Experimental approaches in molecular genetics diagnostic of inborn disorders                 | G-3-611     |
| 48 | Experimental approaches in the study of complex microbial communities and their interactions | M-3-620     |
| 49 | Experimental epigenetics   | B-3-115     |
| 50 | Experimental immunology  | K-3-504     |
| 51 | Experimental methods for studying biochemistry of steroid hormones                           | B-3-122     |
| 52 | Experimental methods for the research of brain disease                                       | N-3-545     |
| 53 | Experimental methods in biophysics   | F-3-924     |
| 54 | Experimental methods in pharmacogenomics   | B-3-110     |

|    | <b>Predmet</b>   | <b>Nosilec</b>      | <b>Koda</b> |
|----|--|---------------------|-------------|
| 55 | Hemostaza  | Mojca Stegnar       | K-3-526     |
| 56 | Humana citogenetika  | Nadja Kokalj Vokač  | G-3-608     |
| 57 | Imunohistokemija   | Mija Meznarič       | J-3-451     |
| 58 | Imunološke metode v veterini                                     | Tadej Malovrh       | V-3-717     |
| 59 | Imunska reakcija v raziskavah in diagnostiki                     | Saša Čučnik         | L-3-306     |
| 60 | Inhibitorji encimsko kataliziranih reakcij                       | Brigita Lenarčič    | B-3-801     |
| 61 | Internistični ali kirurški problemi pri prežvekovalcih           | Jože Starič         | V-3-718     |
| 62 | Izbrana poglavja iz analize zdravil                              | Aleš Obreza         | F-3-250     |
| 63 | Izbrana poglavja iz hematologije                                 | Helena Podgornik    | L-3-304     |
| 64 | Izbrane diagnostične imunološke metode                           | Alojz Ihan          | K-3-508     |
| 65 | Izbrane metode v farmakokinetiki                                 | Mojca Kržan         | K-3-507     |
| 66 | Izbrane raziskovalne metode v medicini športa                    | Helena Lenasi       | K-3-528     |
| 67 | Izbrane vsebine iz klinične biokemije                            | Janja Marc          | L-3-313     |
| 68 | Izbrani primeri iz humane genetike                               | Damjan Glavač       | G-3-605     |
| 69 | Izbrani primeri iz medicinske genetike                           | Damjan Glavač       | B-3-125     |
| 70 | Jedrska magnetna resonanca pri raziskavah bioloških makromolekul | Janez Plavec        | B-3-907     |
| 71 | Karakterizacija in identifikacija mikrogliv                      | Nina Gunde-Cimerman | M-3-621     |
| 72 | Kardiovaskularna dinamika  | Borut Kirn          | K-3-509     |

|    | <b>Course title</b>   | <b>Code</b> |
|----|---|-------------|
| 55 | Experimental methods in innate immunity                                   | B-3-908     |
| 56 | Experimental methods in studies of nucleic acid structure                 | B-3-116     |
| 57 | Experimental neuroendocrinology   | V-3-713     |
| 58 | Experimental rheological analysis   | F-3-249     |
| 59 | Experimental virology   | M-3-415     |
| 60 | Extracellular vesicles - biological relevance and clinical potential      | B-3-127     |
| 61 | Food safety   | V-3-724     |
| 62 | Functional MRI  | N-3-557     |
| 63 | Functional protein analysis in signal transduction                        | B-3-112     |
| 64 | Gastroenterologic surgery   | K-3-506     |
| 65 | Gastrointestinal problems in horses                                       | V-3-715     |
| 66 | Genome analysis of complex traits   | G-3-606     |
| 67 | Genome and transcriptoem analyses   | B-3-119     |
| 68 | Genome editing and regulating gene expression using TALEs and CRISPR/Cas9 | G-3931      |
| 69 | Genomewide association and functional analysis in human                   | G-3-610     |
| 70 | Haematology – selected topics   | L-3-304     |
| 71 | Health care of pigs   | V-3-739     |
| 72 | Health care of ruminants  | V-3-740     |

|    | <b>Predmet</b>  | <b>Nosilec</b>        | <b>Koda</b> |
|----|---|-----------------------|-------------|
| 73 | Kirurgija in oftalmologija  | Vladimira Erjavec     | V-3-719     |
| 74 | Klinična kardialna elektrofiziologija                                       | Peter Rakovec         | K-3-512     |
| 75 | Klinične nevrofiziološke metode za preiskavo mišic in živčnega sistema      | Blaž Koritnik         | N-3-548     |
| 76 | Klinične nevrosonološke metode za študij možganskega krvnega obtoka         | Bojana Žvan           | N-3-549     |
| 77 | Klinika humane reprodukcije   | Bojana Pinter         | K-3-511     |
| 78 | Koncepti integracije genomskih podatkov                                     | Tanja Kunej           | G-3-609     |
| 79 | Kriometode v biomedicini  | Rok Romih             | J-3-443     |
| 80 | Kvalitativne metode na področju raziskovanja vedenja, povezanega z zdravjem | Marko Kolšek          | S-3-424     |
| 81 | Kvalitativno raziskovanje s pomočjo intervjujev                             | Danica Rotar Pavlič   | S-3-425     |
| 82 | Makromolekularne interakcije  | Gregor Anderluh       | B-3-906     |
| 83 | Matične celice: od proteomike do celičnih terapij                           | Uroš Rajčević         | B-3-117     |
| 84 | Mehanizmi uravnavanja izražanja genov prokariotov                           | Darja Žgur-Bertok     | G-3-612     |
| 85 | Mestnospecifična mutageneza »homemade«                                      | Darja Žgur-Bertok     | B-3-120     |
| 86 | Metode določanja reaktivnih metabolitov ksenobiotikov                       | Marija Sollner Dolenc | T-3-348     |
| 87 | Metode in modeli celičnega preizkušanja                                     | Irena Mlinarič Raščan | L-3-305     |
| 88 | Metode za študij funkcije posamezne celice                                  | Robert Zorec          | J-3-445     |

|    | <b>Course title</b>  | <b>Code</b> |
|----|--|-------------|
| 73 | Hemostasis   | K-3-526     |
| 74 | Hereditary disorders of the skin – molecular techniques for disease diagnosis and research | B-3-118     |
| 75 | High resolution electrocardiography  | K-3-503     |
| 76 | High resolution optical microscopy – confocal microscopy                                   | J-3-446     |
| 77 | Homemade site directed mutagenesis   | B-3-120     |
| 78 | Human cytogenetics   | G-3-608     |
| 79 | Hygiene and pathology of animal nutrition  | V-3-725     |
| 80 | Immune reaction in research and diagnostics  | L-3-306     |
| 81 | Immunohistochemistry   | J-3-451     |
| 82 | Inhibitors of enzyme-catalyzed reactions   | B-3-801     |
| 83 | Intracellular signalling mediated by receptor and non-receptor protein kinases             | J-3-458     |
| 84 | Macromolecular interactions  | B-3-906     |
| 85 | Mammary gland: a model for genetic, developmental and cell biology studies                 | G-3-604     |
| 86 | Methods for determination of antithrombotic efficiency of agents                           | F-3-247     |
| 87 | Methods for determination of reactive metabolites of xenobiotics                           | T-3-348     |
| 88 | Methods in single cell physiology  | J-3-445     |

|     | <b>Predmet</b>   | <b>Nosilec</b>         | <b>Koda</b> |
|-----|--|------------------------|-------------|
| 89  | Metode za študij membranskih beljakovin in integritete bioloških membran na modelu biogeneze mitohondrijev | Irina Milisav Ribarič  | J-3-454     |
| 90  | Metode za ugotavljanje antitrombotičnih lastnosti učinkovin  | Mojca Božič Mijovski   | F-3-247     |
| 91  | Metode zdravljenja onkoloških obolenj v veterinarski medicini  | Nataša Tozon           | V-3-720     |
| 92  | Mikrobiologija   | Andrej Pengov          | V-3-721     |
| 93  | Mikrobiološke tehnike  | Matjaž Ocepek          | V-3-722     |
| 94  | Mikromanipulacija posameznih celic   | Jure Derganc           | J-3-459     |
| 95  | Mlečna žleza: model za genetske, razvojne in celične raziskave   | Peter Dovč             | G-3-604     |
| 96  | Molekularna analiza in samomorilno vedenje   | Alja Videtič Paska     | B-3-114     |
| 97  | Molekularna diagnostika  | Damjan Glavač          | J-3-461     |
| 98  | Molekularna diagnostika v laboratorijski biomedicini   | Barbara Ostanek        | L-3-316     |
| 99  | Molekularna genetika hormonskih in presnovnih bolezni  | Tadej Battelino        | B-3-123     |
| 100 | Molekularne metode v farmakologiji   | Metoda Lipnik-Štangelj | K-3-513     |
| 101 | Morfologija in funkcija perifernih živcev  | Simon Podnar           | N-3-550     |
| 102 | Morfometrične analize celic in tkiv  | Milka Vrecl Fazarinc   | V-3-723     |
| 103 | Motnje dihanja v spanju in motnje spanja v razvojnem obdobju   | David Neubauer         | N-3-551     |
| 104 | Na dokazih podprto delo v zdravstveni negi in zdravstvu  | Brigita Skela Savič    | S-3-429     |

|     | <b>Course title</b>  | <b>Code</b> |
|-----|--|-------------|
| 89  | Methods and models in cell-based assays                            | L-3-305     |
| 90  | Microbiology   | V-3-721     |
| 91  | Microbiology techniques  | V-3-722     |
| 92  | Molecular analysis and suicidal behavior                           | B-3-114     |
| 93  | Molecular diagnostics  | J-3-461     |
| 94  | Molecular diagnostics in laboratory biomedicine                    | L-3-316     |
| 95  | Molecular genetics of hormone in metabolic disorders               | B-3-123     |
| 96  | Molecular methods in pharmacology                                  | K-3-513     |
| 97  | Monitoring of DNA amplification in real time                       | G-3-607     |
| 98  | Morphology and function of peripheral nerves                       | N-3-550     |
| 99  | Morphometric analysis of cells and tissues                         | V-3-723     |
| 100 | Neurochemical methods  | N-3-553     |
| 101 | Neurology and neurophysiology during early developmental age       | N-3-554     |
| 102 | Nuclear magnetic resonance in studies of biological macromolecules | B-3-907     |
| 103 | Numerical modeling of processes in biophysics                      | J-3-460     |
| 104 | Nutrigenomics  | L-3-315     |

|     | <b>Predmet</b>   | <b>Nosilec</b>         | <b>Koda</b> |
|-----|--|------------------------|-------------|
| 105 | Načela in tehnike v biokemiji in molekularni biologiji                   | Miha Pavšič            | B-3-802     |
| 106 | Načrtovanje in eksperimentalni pristop k raziskovanju onkoloških bolezni | Petra Hudler           | B-3-113     |
| 107 | Načrtovanje in zagotavljanje kakovosti v medicinskih laboratorijih       | Joško Osredkar         | L-3-307     |
| 108 | Načrtovanje peptidomimetikov   | Marija Sollner Dolenc  | F-3-248     |
| 109 | Nadzor živil   | Andrej Kirbiš          | V-3-724     |
| 110 | Nevrofiziološki študij delovanja vidnega sistema                         | Jelka Breclj           | N-3-552     |
| 111 | Nevrokemične metode  | Tomaž Marš             | N-3-553     |
| 112 | Nevrologija in nevrofiziologija zgodnjega obdobja                        | David Neubauer         | N-3-554     |
| 113 | Numerično modeliranje procesov v biofiziki                               | Bojan Božič            | J-3-460     |
| 114 | Nutricijska patologija in higiena prehrane živali                        | Breda Jakovac Strajn   | V-3-725     |
| 115 | Nutrigenomika  | Nataša Karas Kuželički | L-3-315     |
| 116 | Onkološka kirurgija  | Nikola Bešič           | K-3-514     |
| 117 | Optična mikroskopija visoke ločljivosti - konfokalna mikroskopija        | Marko Kreft            | J-3-446     |
| 118 | Osnove molekularne virologije  | Ivan Toplak            | V-3-726     |
| 119 | Osteosinteza   | Vladimir Smrkolj       | K-3-515     |
| 120 | Patobiokemični mehanizmi in modeli                                       | Samo Ribarič           | L-3-308     |
| 121 | Presejalni testi za Downov sindrom                                       | Joško Osredkar         | J-3-447     |
| 122 | Primerjalna genomika   | Jernej Jakše           | G-3-613     |

|     | <b>Course title</b>   | <b>Code</b> |
|-----|---|-------------|
| 105 | Osteosynthesis  | K-3-515     |
| 106 | Pathobiochemical mechanisms and models                          | L-3-308     |
| 107 | Pharmacoeconomics   | F-3-256     |
| 108 | Pharmacological and toxicological testing of drugs              | K-3-505     |
| 109 | Pharmacology and toxicology                                     | V-3-714     |
| 110 | Pharmacotherapy   | F-3-255     |
| 111 | Plant toxins and poisonous plants                               | T-3-349     |
| 112 | Poultry health and protection                                   | V-3-738     |
| 113 | Preparation of skeletal muscle cell culture                     | J-3-449     |
| 114 | Principles and techniques in biochemistry and molecular biology | B-3-802     |
| 115 | Problems in ruminant medicine or surgery                        | V-3-718     |
| 116 | Protein glycosylation   | B-3-805     |
| 117 | Protein structure   | B-3-804     |
| 118 | Qualitative methods on health behaviour research                | S-3-424     |
| 119 | Qualitative research through interviews                         | S-3-425     |
| 120 | Quality design and quality assurance in medical laboratories    | L-3-307     |
| 121 | Rational design of peptidomimetics                              | F-3-248     |
| 122 | Reactive oxygen and nitrogen species in biological systems      | F-3-244     |

|     | <b>Predmet</b>   | <b>Nosilec</b>               | <b>Koda</b> |
|-----|--|------------------------------|-------------|
| 123 | Primerjalna odontologija s paradontalno medicino   | Zlatko Pavlica               | V-3-727     |
| 124 | Primerjava uporabe fluorescenčne in elektronske mikroskopije pri raziskavah proteinov v imunskih celicah | Tina Zavašnik Bergant        | B-3-904     |
| 125 | Priporočila o izvajanju hitrih testov ob bolniku   | Joško Osredkar               | K-3-527     |
| 126 | Priprava celičnih kultur skeletnih mišic   | Tomaž Marš                   | J-3-449     |
| 127 | Prirojene srčne napake   | Mirta Koželj                 | K-3-516     |
| 128 | Pristopi k molekularno genetski diagnostiki prirojnih bolezni  | Katarina Trebušak Podkrajšek | G-3-611     |
| 129 | Rastlinski strupi in strupene rastline   | Samo Kreft                   | T-3-349     |
| 130 | Raziskovalni pristop k diagnostiki in terapiji možganskožilnih bolezni                                   | Janja Pretnar Oblak          | N-3-556     |
| 131 | Raziskovanje v promociji zdravja   | Lijana Zaletel - Kragelj     | S-3-426     |
| 132 | Reaktivne kisikove in dušikove spojine v bioloških sistemih  | Janez Mravljak               | F-3-244     |
| 133 | Rekombinantni proteini   | Marko Dolinar                | B-3-803     |
| 134 | Reprodukcija s porodništvom  | Marjan Kosec                 | V-3-728     |
| 135 | Simulacija patofizioloških in fizioloških stanj s pomočjo elektronskega analognega vezja                 | Samo Ribarič                 | K-3-517     |
| 136 | Skupnostna obravnava   | Vesna Švab                   | S-3-427     |
| 137 | Sledenje pomnoževanja DNA v realnem času   | Kristina Gruden              | G-3-607     |
| 138 | Sodobne metode v urgentni medicini malih živali  | Alenka Seliškar              | V-3-729     |
| 139 | Somnologija in polisomnografske metode za preučevanje motenj   | Leja Dolenc Grošelj          | N-3-555     |

|     | <b>Course title</b>   | <b>Code</b> |
|-----|---|-------------|
| 123 | Recombinant proteins  | B-3-803     |
| 124 | Recommendations on the implementation of point-of-care tests            | K-3-527     |
| 125 | Regulation of gene expression – experimental approaches                 | B-3-121     |
| 126 | Regulation of gene expression of prokaryotes                            | G-3-612     |
| 127 | Reproduction and obstetrics   | V-3-728     |
| 128 | Research approach to diagnostics and therapy of cerebrovascular disease | N-3-556     |
| 129 | Research designs in health promotion                                    | S-3-426     |
| 130 | Screening tests for Down syndrome                                       | J-3-447     |
| 131 | Selected cases in medical genetics                                      | B-3-125     |
| 132 | Selected cases in human genetics  | G-3-605     |
| 133 | Selected immunological methods  | K-3-508     |
| 134 | Selected methods applied in sports medicine                             | K-3-528     |
| 135 | Selected methods in pharmacokinetics                                    | K-3-507     |
| 136 | Selected topics from drug analysis                                      | F-3-250     |
| 137 | Silencing of specific genes using sirna approach                        | J-3-455     |
| 138 | Single cell micromanipulation   | J-3-459     |
| 139 | Skeletal muscle analysis  | J-3-452     |

|     | <b>Predmet</b>  | <b>Nosilec</b>             | <b>Koda</b> |
|-----|---|----------------------------|-------------|
| 140 | Specialna veterinarska patologija                                 | Polona Juntos              | V-3-730     |
| 141 | Stabilnost zdravil  | Robert Roškar              | F-3-254     |
| 142 | Stereologija in kvantitativna analiza slike                       | Andrej Cör                 | J-3-450     |
| 143 | Stigmatizacija duševnih motenj                                    | Vesna Švab                 | S-3-428     |
| 144 | Struktura proteinov   | Gregor Gunčar              | B-3-804     |
| 145 | Študij vpliva učinkovin na mikrocirkulacijo pri človeku           | Ksenija Cankar             | K-3-518     |
| 146 | Toksikokinetika   | Iztok Grabnar              | T-3-346     |
| 147 | Toksikologija na molekularni skali                                | Janez Mavri                | T-3-941     |
| 148 | Toksikološko preizkušanje novih učinkovin                         | Marija Sollner Dolenc      | T-3-347     |
| 149 | Ultrasonografija malih živali                                     | Aleksandra Domanjko Petrič | V-3-731     |
| 150 | Uravnavanje izražanja genov - eksperimentalni pristopi            | Damjana Rozman             | B-3-121     |
| 151 | Urejanje genoma in izražanja genov na osnovi TALE ter CRISPR/Cas9 | Roman Jerala               | G-3-931     |
| 152 | Uroginekologija   | Adolf Lukanovič            | K-3-519     |
| 153 | Utišanje specifičnih genov s pomočjo metode siRNA                 | Katarina Miš               | J-3-455     |
| 154 | Veterinarska anesteziologija                                      | Alenka Seliškar            | V-3-732     |
| 155 | Veterinarska diagnostična citopatologija                          | Polona Juntos              | V-3-733     |

|     | <b>Course title</b>   | <b>Code</b> |
|-----|---|-------------|
| 140 | Sleep medicine and polysomnographic recordings for evaluation of sleep disorders  | N-3-555     |
| 141 | Sleep-related breathing disorders and sleep disorders during development  | N-3-551     |
| 142 | Small animal ultrasonography  | V-3-731     |
| 143 | Special veterinary pathology  | V-3-730     |
| 144 | Stem cells: from proteomics to cell therapies   | B-3-117     |
| 145 | Stereology and quantitative image analysis  | J-3-450     |
| 146 | Stigma of mental disorders  | S-3-428     |
| 147 | Study of drug effects on human microcirculation   | K-3-518     |
| 148 | Surgery and ophthalmology   | V-3-719     |
| 149 | Surgical oncology   | K-3-514     |
| 150 | Techniques for studying membrane proteins and assessing the membrane integrity on the model of mitochondrial biogenesis | J-3-454     |
| 151 | Toxicokinetics  | T-3-346     |
| 152 | Toxicological testing of new drugs  | T-3-347     |
| 153 | Toxicology on molecular scale   | T-3-941     |
| 154 | Treatment methods of cancer in veterinary medicine  | V-3-720     |
| 155 | Tumor biology   | J-3-444     |

|     | <b>Predmet</b>   | <b>Nosilec</b>             | <b>Koda</b> |
|-----|--|----------------------------|-------------|
| 156 | Veterinarska kardiologija  | Aleksandra Domanjko Petrič | V-3-734     |
| 157 | Veterinarska ortopedija in nevrokirurgija  | Bojan Zorko                | V-3-737     |
| 158 | Veterinarska rentgenologija  | Bojan Zorko                | V-3-736     |
| 159 | Veterinarska laboratorijska medicina - klinična patologija                       | Martina Klinkon Ogrinec    | V-3-735     |
| 160 | Z dokazi podprta laboratorijska biomedicina                                      | Janja Marc                 | L-3-314     |
| 161 | Zdravstveno varstvo perutnine  | Olga Zorman Rojs           | V-3-738     |
| 162 | Zdravstveno varstvo prašičev   | Marina Štrukelj            | V-3-739     |
| 163 | Zdravstveno varstvo prežvekovalcev   | Jožica Ježek               | V-3-740     |
| 164 | Znotrajcelično signaliziranje prek receptorskih in nerekceptorskih protein-kinaz | Sergej Pirkmajer           | J-3-458     |
| 165 | Zunajcelični vezikli-vloga v patogenezi in klinični potencial                    | Metka Lenassi              | B-3-127     |

|     | <b>Course title</b>                                     | <b>Code</b> |
|-----|---|-------------|
| 156 | Urogynecology   | K-3-519     |
| 157 | Veterinary anaesthesiology                              | V-3-732     |
| 158 | Veterinary cardiology                                   | V-3-734     |
| 159 | Veterinary diagnostic cytopathology                     | V-3-733     |
| 160 | Veterinary immunology methods                           | V-3-717     |
| 161 | Veterinary laboratory medicine - clinical pathology     | V-3-735     |
| 162 | Veterinary orthopedic and neurosurgery                  | V-3-737     |
| 163 | Veterinary radiology                                    | V-3-736     |
| 164 | Work with isolated organs                               | J-3-462     |
| 165 | Yeast genetics, functional genomics and systems biology | G-3-930     |



## Ključ za kodiranje predmetov / Key to course codes

Predmeti so kodirani s črko in dvema števkama. Črka predstavlja znanstveno področje Biomedicine, prva številka predstavlja vrsto predmeta, druga številka pa zaporedno številko predmeta, pri čemer prva številka trimesnega števila predmeta označuje lokacijo, kjer se predmet izvaja.

### Področja:

G - genetika  
 B - biokemija in molekularna biologija  
 F - farmacija  
 L - klinična biokemija in laboratorijska biomedicina  
 K - medicina - klinična usmeritev  
 J - medicina - temeljna usmeritev  
 M - mikrobiologija  
 N - nevroznanost  
 V - veterinarska medicina  
 S - javno zdravje  
 T - toksikologija

### Vrste predmetov:

1 - temeljni predmeti  
 2 - izbirni teoretični predmeti  
 3 - izbirni individualno raziskovalni predmeti

### Lokacije:

1 – MF - biokemija in molekularna biologija  
 2 – FFA - farmacija  
 3 – FFA - klinična biokemija in laboratorijska biomedicina, toksikologija  
 4 – MF - medicina – temeljna, javno zdravje in mikrobiologija  
 5 – MF, KC, OI, Psihiatrična klinika – medicina – klinična, nevroznanost  
 6 – BF - mikrobiologija, genetika  
 7 – VF - veterinarska medicina  
 8 – FKKT- za predmete, ki se izvajajo na FKKT  
 9 – Raziskovalni inštituti (IJS, NIB, KI) - za predmete, ki se izvajajo na enem od inštitutov

*Tako sodi npr. predmet s kodo B-2-940 v področje biokemije in molekularne biologije (B), je izbirni teoretični predmet (2) in se izvaja v enem od raziskovalnih inštitutov (9).*

The 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).*

## TEMELJNI PREDMETI po modulih in tematskih sklopih

|         |  |
|---------|--|
| B-1-100 | <b>Izbrana poglavja iz biokemije in molekularne biologije:</b>               |
| B-1-101 | 1 Izbrani biokemijski procesi in njihovo uravnavanje                         |
| B-1-102 | 2 Struktura in funkcija bioloških molekul in dizajniranih bioloških sistemov |
| B-1-103 | 3 Funkcijska genomika in proteomika  |
| F-1-200 | <b>Farmaceutske znanosti</b>   |
| F-1-211 | 1. 1 Struktura učinkovin in njihove lastnosti                                |
| F-1-212 | 1. 2 Tarče učinkovin in vrednotenje interakcij                               |
| F-1-213 | 1. 3 Metode načrtovanja učinkovin  |
| F-1-221 | 2. 1 Biomolekule kot tarče za diagnostiko in terapijo                        |
| F-1-222 | 2. 2 Biološka in genska zdravila   |
| F-1-223 | 2. 3 Zdravila rastlinskega izvora  |
| F-1-231 | 3. 1 Farmakokinetika in njen pomen pri odkrivanju in razvoju zdravil         |
| F-1-232 | 3. 2 Biofarmaceutska analiza procesov LADME sistema                          |
| F-1-233 | 3. 3 Farmakokinetično-farmakodinamična analiza                               |
| F-1-241 | 4. 1 Farmaceutsko tehnološki procesi   |
| F-1-242 | 4. 2 Dostavni sistemi učinkovin  |
| F-1-243 | 4. 3 Farmaceutska nanotehnologija in nanozdravila                            |
| F-1-251 | 5. 1 Socialna farmacija  |
| F-1-252 | 5. 2 Zdravstvena ekonomika   |
| F-1-253 | 5. 3 Farmakoepidemiologija   |
| L-1-300 | <b>Stopenjska klinično-biokemijska diagnostika</b>                           |
| L-1-310 | 1. Laboratorijska biomedicina  |
| L-1-311 | 1. 1 Znanstveni pristopi v LM  |
| L-1-312 | 1. 2 Stopenjska KB diagnostika z interpretacijo                              |

## CORE COURSES:

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|---------|--|
| B-1-100 | <b>Selected advanced topics in Biochemistry and Molecular biology</b>              |
| B-1-101 | 1 Selected biochemical processes with regulatory mechanisms                        |
| B-1-102 | 2 Structure and function of biological molecules and designed biological systems   |
| B-1-103 | 3 Functional genomics and proteomics   |
| F-1-200 | <b>Pharmaceutical sciences</b>   |
| 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 | <b>Algorithms of clinical biochemical diagnostics</b>                              |
| 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 |



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| L-1-320 | 2. Molekulski označevalci bolezni   |
| L-1-321 | 2. 1 Pogoste bolezni z genetsko osnovo  |
| L-1-322 | 2. 2 Imunsko pogojene bolezni   |
| L-1-323 | 2. 3 Maligne bolezni  |
| L-1-330 | 3. Translacijska biomedicina  |
| L-1-331 | 3. 1 Farmakogenomska diagnostika  |
| L-1-332 | 3. 2 Celični in tkivni inženiring   |
| L-1-333 | 3. 3 Tehnologije in orodja OMIC (ali Naprednejše tehnologije in orodja v translacijski biomedicini) |

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| T-1-340 | <b>Toksikologija</b>                             |
| T-1-341 | 1. Povezava med strukturo in toksičnostjo snovi  |
| T-1-342 | 2. Toksičnost snovi na procese v celici          |
| T-1-343 | 3. Vpliv toksičnih snovi na okolje in ekosisteme |

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| J-1-400 | <b>Medicinska celična biologija</b>                                 |
| J-1-401 | 1. Temelji medicinske celične biologije                             |
| J-1-402 | 2. Celična biologija v humani reprodukciji                          |
| J-1-403 | 3. Biologija maligno spremenjenih celic in translacijska onkologija |
| J-1-404 | 4. Celična biologija v klinični genetiki                            |
| J-1-405 | 5. Sistemska medicina večfaktorskih bolezni                         |

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|---------|--|
| M-1-410 | <b>Izbrana poglavja iz mikrobiologije</b>        |
| M-1-411 | 1. Temeljna medicinska mikrobiologija            |
| M-1-412 | 2. Klinična mikrobiologija                       |
| M-1-615 | 3. Mikroba identifikacija, pestrost in evolucija |

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| S-1-420 | <b>Znanstveni vidiki javnega zdravja</b>  |
| S-1-421 | 1. Determinante zdravja in bolezni        |
| S-1-422 | 2. Metodologija javnozdravstvenih ukrepov |
| K-1-500 | <b>Raziskave v klinični medicini</b>      |

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|---------|---|
| 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) |

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| T-1-340 | <b>Toxicology</b>   |
| 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 |

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|---------|--|
| J-1-400 | <b>Medical Cell Biology</b>                                |
| J-1-401 | 1. Fundamentals of medical cell biology                    |
| J-1-402 | 2. Reproductive biology <i>in vivo</i> and <i>in vitro</i> |
| 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            |

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|---------|---|
| M-1-410 | <b>Selected Topics in Microbiology</b>                |
| M-1-411 | 1. Basic medical microbiology                         |
| M-1-412 | 2. Clinical microbiology                              |
| M-1-615 | 3. Microbial identification, diversity, and evolution |

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| S-1-420 | <b>Research aspects of public health</b>      |
| S-1-421 | 1. Determinants of health and disease         |
| S-1-422 | 2. Methodology of public health interventions |
| K-1-500 | <b>Research in clinical medicine</b>          |

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| K-1-510  | 1. Osnove medicinskih raziskav                        |
| K-1-520  | 2. Metode v kliničnih raziskavah                      |
| K-1-530  | 3. Dosežki v kliničnih raziskavah                     |
| K-1-531  | 3. 1 Kardiovaskularne medicinske vede                 |
| K-1-532  | 3. 2 Medicinske vede operativnih strok                |
| K-1-533  | 3. 3 Slikovne metode                                  |
| K-1-534  | 3. 4 Genetske metode                                  |
| K-1-535  | 3. 5 Imunologija in alergologija                      |
| K-1-536  | 3. 6 Fiziologija kardiovaskularnega sistema           |
| K-1-537  | 3. 7 Fiziologija dihanja                              |
| K-1-538  | 3. 8 Fiziologija in biomehanika lokomotornega sistema |
| K-1-539  | 3. 9 Temeljna in klinična farmakologija               |
| K-1-5310 | 3. 10 Hematologija in onkologija                      |
| K-1-5311 | 3. 11 Urgentna in intenzivna medicina                 |
| K-1-5312 | 3. 12 Razvoj in uvajanje novih zdravil                |

|         |                          |
|---------|--------------------------|
| N-1-540 | <b>Nevroznanost</b>      |
| N-1-541 | 1. Temeljna nevroznanost |
| N-1-542 | 2. Klinična nevroznanost |

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|---------|---------------------------|
| G-1-600 | <b>Genetika</b>           |
| G-1-601 | 1. Genetski koncepti I.   |
| G-1-602 | 2. Genetski koncepti II.  |
| G-1-603 | 3. Bioinformatična orodja |

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|---------|---|
| V-1-700 | <b>Uravnavanje procesov pri zdravih in bolnih živalih</b> |
| V-1-701 | 1. Uravnavanje temeljnih procesov pri živalih             |
| V-1-702 | 2. Motnje homeostaze in bolezenski procesi                |
| V-1-703 | 3. Varna hrana  |

|          |  |
|----------|--|
| K-1-510  | 1. Fundamentals in medical research                  |
| K-1-520  | 2. Methods in medical research                       |
| 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 Imaging methods                                 |
| K-1-534  | 3. 4 Genetics methods                                |
| K-1-535  | 3. 5 Immunology and allergology                      |
| K-1-536  | 3. 6 Physiology of cardiovascular system             |
| K-1-537  | 3. 7 Respiratory physiology                          |
| K-1-538  | 3. 8 Physiology and biomechanics of locomotor system |
| K-1-539  | 3. 9 Basic and clinical pharmacology                 |
| K-1-5310 | 3. 10 Hematology and oncology                        |
| K-1-5311 | 3. 11 Emergency and intensive medicine               |
| K-1-5312 | 3. 12 Hyperbaric medicine                            |

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|---------|--------------------------|
| N-1-540 | <b>Neuroscience</b>      |
| N-1-541 | 1. Basic neuroscience    |
| N-1-542 | 2. Clinical neuroscience |

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|---------|-------------------------|
| G-1-600 | <b>Genetics</b>         |
| G-1-601 | 1. Genetic concepts I   |
| G-1-602 | 2. Genetic concepts II  |
| G-1-603 | 3. Bioinformatics tools |

|         |   |
|---------|---|
| V-1-700 | <b>Regulation processes in healthy and diseased animals</b> |
| 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  |

## Pogoji za napredovanje po programu / *Requirements for progression through the programme*

Pogoj za napredovanje iz 1. v 2. letnik doktorskega študija Biomedicina so opravljene študijske obveznosti v obsegu najmanj 45 KT. Od tega doktorand opravi najmanj 20 KT iz temeljnega predmeta.

V 3. letnik doktorskega študija se lahko vpišejo študenti, ki so opravili vse študijske obveznosti 1. in 2. letnika in imajo potrditev pozitivne ocene Komisije za spremljanje doktorskega študenta o ustreznosti teme doktorske disertacije na senatu članice.

V 4. letnik se lahko vpišejo študenti, ki imajo opravljene vse študijske obveznosti prvih treh letnikov in potrditev teme doktorske disertacije na Senatu UL.

Pogoj za ponavljanje prvega letnika je opravljenih najmanj 10 KT iz temeljnega predmeta in 20 KT iz individualnega raziskovalnega dela.

Pogoj za ponavljanje drugega letnika so opravljene vse študijske obveznosti prvega letnika.

Pogoj za ponavljanje tretjega letnika so opravljene vse študijske obveznosti prvega in drugega letnika.

## Načini ocenjevanja / *Grading system*

V skladu s Statutom Univerze v Ljubljani se uspeh na izpitu ocenjuje z ocenami od 5 do 10, pri čemer za pozitivno oceno šteje ocena od 6 do 10. Študijske obveznosti se lahko ocenjujejo tudi z ocenami: opravil z odliko, opravil ali ni opravil.

Po programu bodo izpiti pisni in ustni, ocenjuje pa se tudi priprava in ustna predstavitev seminarjev.

In order to progress from the 1st to the 2nd year, successful completion of at least 45 credits, of which at least 20 credits must derive from core courses, is required.

Students who have completed all organized study requirements in the first and second year and have the confirmation of the positive assessment of the doctoral dissertation topic by their expert committee for evaluation of the doctoral dissertation from the senate of the Faculty at which the student is enrolled, may progress to the third year of doctoral study.

Students who have completed all obligations from the first three years of study and obtained the confirmation of the proposed doctoral dissertation topic by the University Senate may advance to the fourth 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 the core course and 20 from individual research work.

If the student wishes to repeat the second year, he/she must fulfil all study obligations of the first year.

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

According to the programme, exams are written and oral. In accordance with the Statute of University of Ljubljana examination results are graded from 5 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.

## Pogoji za dokončanje študija in znanstveni naslov / *Conditions for completing the programme and doctoral diploma*

### Pogoji za dokončanje študija

Pogoj za dokončanje študija in pridobitev znanstvenega naslova doktor/doktorica znanosti je, da kandidat uspešno opravi vse s programom določene študijske obveznosti in uspešno zagovarja doktorsko disertacijo. Obveznost doktoranda je objava najmanj enega znanstvenega članka s področja doktorata v reviji, ki jo indeksira SCI oz. SSCI. Doktorand mora biti prvi avtor članka. Dokazilo o objavljenem oz. v objavo sprejetem članku mora doktorand predložiti najkasneje ob oddaji doktorske disertacije v oceno. Članice, izvajalke študija, lahko predpišejo tudi objavo več člankov in faktor vpliva.

### Doktorska disertacija

Doktorska disertacija je samostojen in izviren prispevek na znanstvenemu področju teme doktorske disertacije. Doktorska disertacija je napisana v slovenskem jeziku z obsežnim povzetkom v angleškem jeziku.

Senat UL lahko izjemoma odobri izdelavo disertacije v angleškem jeziku v primeru, če je kandidat tujec, če sta tujca kandidator mentor ali somentor ali, če je tujec član komisije.

Zagovor doktorata je javen, kar se zagotovi z javno objavo praviloma sedem dni pred zagovorom. Na predlog članice, kjer je kandidat uspešno zagovarjal doktorsko disertacijo, rektor opravi promocijo za doktorja znanosti.

### 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 dissertation. The doctoral candidate must publish at least one scientific article based on the research presented in the doctoral dissertation 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 before the candidate hands in the doctoral dissertation for assessment.

### Doctoral dissertation

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

The defence of the doctoral dissertation is public, which is ensured by publishing a notice of the defence, usually seven days before the defence.

After the public defence of the doctoral dissertation and following a nomination by the member, where the candidate has successfully defended the doctoral dissertation, the Rector performs the promotion for the doctor of science.

## Znanstveni naslov

Diplomanti interdisciplinarnega doktorskega študijskega programa Biomedicina z uspešno opravljenim zagovorom doktorske disertacije pridobijo znanstveni naslov doktor/doktorica znanosti.

## Prehodi med študijskimi programi / *Transfer between study programmes*

Za prehod med programi se štejeta prenehanje študentovega izobraževanja v študijskem programu, v katerega se je vpisal, in nadaljevanje izobraževanja v doktorskem programu Biomedicina. Prošnje kandidatov za prehod na doktorski študij Biomedicina bo individualno obravnaval Programski svet v skladu z Merili za prehode med študijskimi programi in Statutom Univerze v Ljubljani.

## Možnosti zaposlitve / *Career Prospects*

Možnosti za zaposlitev diplomantov doktorskega študijskega programa Biomedicina so zelo široke. Bodoči doktorji znanosti se lahko zaposlijo na pedagoškem in raziskovalnem področju in so pomembni za obnovo kadrov na slovenskih univerzah in drugih izobraževalnih oziroma raziskovalnih ustanovah, v farmacevtski industriji, zdravstvenih zavodih, v javni upravi, državnih uradih ter podjetjih, ki se ukvarjajo z raziskovanjem. Lahko pa se zaposlijo tudi v drugih ustanovah, ki zaposlujejo najvišje izobražene strokovnjake in raziskovalce.

## 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 doktor/doktorica znanosti («Doctor of Science»).

Transfer 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.

The 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.

## Mednarodne izmenjave / *International exchange*

Interdisciplinarni doktorski študijski program Biomedicina je zasnovan tako, da omogoča mednarodno izmenjavo na vseh ravneh izvedbe programa, od raziskovalnega in eksperimentalnega dela do izmenjave predmetov primerljivih programov drugih univerz na podlagi mednarodnih pogodb in bilateralnih dogovorov. Mednarodna izmenjava je mogoča tudi preko sodelovanja gostujočih profesorjev na članicah izvajalkah študija in sodelovanja v programih mobilnosti za študente (Erasmus, Socrates, Ceepus in drugih). Program je odprt tudi za tuje študente. Sodelovanje z drugimi visokošolskimi in raziskovalnimi ustanovami v tujini poteka v okviru znanstveno raziskovalnih projektov, s sodelovanjem tujih profesorjev pri posameznih predmetih, (so)mentorstvih in sodelovanju pri ocenjevanju in zagovorih doktorskih disertacij.

Univerza v Ljubljani sodeluje s številnimi tujimi univerzami, s katerimi ima sklenjene sporazume o sodelovanju in v okviru katerih poteka mednarodno sodelovanje tudi na področju biomedicine. O primerljivosti kakovosti predmetov programov drugih univerz odloča programski svet. Mednarodna izmenjava poteka na podlagi mednarodnih pogodb in dogovorov, podpisanih s strani Univerze v Ljubljani in njenih članic.

## Programski svet / *Programme Council*

Programski svet šteje enajst članov. Sestavljajo ga po dva člana s Fakultete za farmacijo, Medicinske fakultete in Veterinarske fakultete, po en član z Biotehniške fakultete in Fakultete za kemijo in kemijsko tehnologijo ter po en član z vsakega od sodelujočih raziskovalnih inštitutov. Predstavnike predlagajo senati članic in znanstveni sveti raziskovalnih inštitutov. Na predlog senatov članic in znanstvenih svetov člane programskega sveta imenuje Senat univerze. Programski svet vodi predsednik, ki ima svojega namestnika. Mandatna doba predsednika je štiri leta in se lahko ponovi. Sedež programskega sveta je na Univerzi v Ljubljani.

The 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.

The 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.

## Področni koordinatorji / *Field coordinators*

### **Biokemija in molekularna biologija:**

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 namestnica: prof. dr. Vita DOLŽAN, tel.: 01 543 76 70  
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### **Farmacija:**

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 namestnica: prof. dr. Mirjana GAŠPERLIN, tel.: 01 476 96 34  
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### **Genetika:**

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 namestnik: prof. dr. Jernej JAKŠE, tel.: 01 320 32 80  
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### **Javno zdravje:**

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 namestnik: prof. dr. Lijana ZALETEL KRAGELJ,  
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### **Klinična biokemija in laboratorijska biomedicina:**

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### **Medicina – klinična usmeritev:**

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### **Medicina – temeljna usmeritev:**

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## Dodatne informacije o študiju

**Spletna stran:** <https://www.uni-lj.si/studij/doktorski/biomedicina/>

### Referati za podiplomski študij članic, koordinatoric znanstvenih področij

| Fakulteta  | Področja  | Kontakt                         | Telefon                      | E-pošta  |
|--|---|---------------------------------|------------------------------|--|
| <b>Biotehniška fakulteta,</b><br>Jamnikarjeva 101, Ljubljana<br><a href="http://www.bf.uni-lj.si">www.bf.uni-lj.si</a>     | Genetika<br>Mikrobiologija  | Vesna Ješe<br>Janežič           | 01 320 30 27                 | <a href="mailto:vesna.jesejanezic@bf.uni-lj.si">vesna.jesejanezic@bf.uni-lj.si</a>   |
| <b>Medicinska fakulteta,</b><br>Vrazov trg 2, Ljubljana<br><a href="http://www.mf.uni-lj.si">www.mf.uni-lj.si</a>          | Biokemija in molekularna biologija<br>Medicina – klinična usmeritev<br>Medicina – temeljna usmeritev<br>Mikrobiologija<br>Nevroznanost<br>Javno zdravje | Milena Bavčar<br>Maruša Vukelič | 01 543 77 24<br>01 543 78 19 | <a href="mailto:milena.bavcar@mf.uni-lj.si">milena.bavcar@mf.uni-lj.si</a><br><a href="mailto:marusa.vukelic@mf.uni-lj.si">marusa.vukelic@mf.uni-lj.si</a> |
| <b>Fakulteta za farmacijo,</b><br>Aškerčeva cesta 7, Ljubljana<br><a href="http://www.ffa.uni-lj.si">www.ffa.uni-lj.si</a> | Farmacija<br>Klinična biokemija in laboratorijska<br>biomedicina<br>Toksikologija   | Tanja Kadunc                    | 01 476 95 06                 | <a href="mailto:tanja.kadunc@ffa.uni-lj.si">tanja.kadunc@ffa.uni-lj.si</a>   |
| <b>Veterinarska fakulteta,</b><br>Gerbičeva ulica 60, Ljubljana<br><a href="http://www.vf.uni-lj.si">www.vf.uni-lj.si</a>  | Veterinarska medicina   | Biljana<br>Grubišič             | 01 477 91 47                 | <a href="mailto:biljana.grubisic@vf.uni-lj.si">biljana.grubisic@vf.uni-lj.si</a>   |

**Služba za doktorski študij UL**  
(Univerza v Ljubljani, Kongresni trg 12, Ljubljana)

[doktorski.studij@uni-lj.si](mailto:doktorski.studij@uni-lj.si)

## Additional Information

**Webpage:** <https://www.uni-lj.si/study/doctoral/biomedicine/>

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

| Faculty   | Fields  | Contact                         | Phone                                | E-mail   |
|---|---|---------------------------------|--------------------------------------|--|
| <b>Biotechnical Faculty,</b><br>Jamnikarjeva 101, Ljubljana<br><a href="http://www.bf.uni-lj.si">www.bf.uni-lj.si</a>   | Genetics<br>Microbiology  | Vesna Ješe Janežič              | +386 1 320 30 27                     | <a href="mailto:vesna.jesejanezic@bf.uni-lj.si">vesna.jesejanezic@bf.uni-lj.si</a>   |
| <b>Faculty of Medicine,</b><br>Vrazov trg 2, Ljubljana<br><a href="http://www.mf.uni-lj.si">www.mf.uni-lj.si</a><br>Vrazov trg 2, Ljubljana<br><a href="http://www.mf.uni-lj.si">www.mf.uni-lj.si</a> | Biochemistry and Molecular<br>Biology<br>Clinical Medicine<br>Basic Medicine<br>Microbiology<br>Neuroscience<br>Public Health | Milena Bavčar<br>Maruša Vukelič | +386 1 543 77 24<br>+386 1 543 78 19 | <a href="mailto:milena.bavcar@mf.uni-lj.si">milena.bavcar@mf.uni-lj.si</a><br><a href="mailto:marusa.vukelic@mf.uni-lj.si">marusa.vukelic@mf.uni-lj.si</a> |
| <b>Faculty of Pharmacy,</b><br>Aškerčeva cesta 7, Ljubljana<br><a href="http://www.ffa.uni-lj.si">www.ffa.uni-lj.si</a>   | Pharmacy<br>Clinical Biochemistry and<br>Laboratory Biomedicine<br>Toxicology   | Tanja Kadunc                    | +386 1 476 95 06                     | <a href="mailto:tanja.kadunc@ffa.uni-lj.si">tanja.kadunc@ffa.uni-lj.si</a>   |
| <b>Veterinary Faculty,</b><br>Gerbičeva ulica 60, Ljubljana<br><a href="http://www.vf.uni-lj.si">www.vf.uni-lj.si</a>   | Veterinary Medicine   | Biljana Grubišič                | +386 1 477 91 47                     | <a href="mailto:biljana.grubisic@vf.uni-lj.si">biljana.grubisic@vf.uni-lj.si</a>   |

**Office for Doctoral Studies of the UL**  
(University of Ljubljana, Kongresni trg 12, Ljubljana, Slovenia)

[doktorski.studij@uni-lj.si](mailto:doktorski.studij@uni-lj.si)



## Pravila o organizaciji Interdisciplinarnega doktorskega študija Biomedicina / Organisation

Interdisciplinarni doktorski študij Biomedicina urejajo Pravila, s katerimi sta določena način in organizacija izvedbe doktorskega študijskega programa:

1. Univerza objavi skupni razpis za vpis v doktorske študijske programe 3. stopnje, ki opredeljuje trajanje študija, vpisne pogoje, kraj izvajanja, način študija in število vpisnih mest za doktorski študijski program Biomedicina.
2. Univerza zbere prijave in jih preda Programskemu svetu.
3. Kandidat pred vpisom izbere mentorja z izbranega znanstvenega področja in skupaj izbere predmete ter opredelita raziskovalni program. Predmetnik poleg mentorja podpiše še koordinator znanstvenega področja.
4. Kandidat in Univerza v Ljubljani ob vpisu v 1. letnik doktorskega študija podpišeta pogodbo o izobraževanju.
5. Vpis in vse postopke v zvezi s pridobitvijo znanstvenega naslova izvede članica, koordinatorica znanstvenega področja.
6. Članica v celoti organizira in skrbi za izvedbo doktorskega programa s področij, ki jih koordinira:
  - Senatu UL predlaga člane Programskega sveta,
  - imenuje koordinatorja področja,
  - vodi evidence v zvezi s študijem in študenti,
  - organizira in skrbi za izvedbo predavanj in ostalih študijskih obveznosti pri svojih predmetih (izvajalci, prostor, urniki, obveščanje izvajalcev in študentov idr.),
  - v sodelovanju z mentorjem organizira in dogovori izvedbo študijskih obveznosti, ki jih izvajajo druge fakultete (izbirni predmeti),
  - poda poročilo o izvedbi programa posameznega področja Programskemu svetu.

The interdisciplinary Doctoral Programme in Biomedicine adheres to principles of Rules and Regulations on Doctoral Studies dealing with its mode and implementation as follows:

1. University of Ljubljana publishes the Call for Enrolment into the Doctoral Programme in Biomedicine. The Call for Enrolment has to adhere to the Statute of the University of Ljubljana and includes guidelines for scientific fields selection as well as information on available number of study places.
2. The applications are collected at the University of Ljubljana and submitted to the Programme Council.
3. Students are obliged to find a mentor from the chosen scientific field and together they select courses and specify the research programme. The selection of courses is signed by mentor and scientific field coordinator.
4. Upon enrolment in each year of study, the candidate and the University of Ljubljana sign a contract that regulates all details of the study.
5. The enrolment and all procedures necessary to obtain the doctoral degree are in the domain of the faculty that coordinates the respective scientific field.
6. Each coordinating faculty takes up the whole responsibility for organisation and implementation of the courses of coordinated scientific fields:
  - Propose members of the Programme Council to the Senate of the University of Ljubljana,
  - Name coordinators of scientific fields,
  - Keep records of study processes and students,
  - Organise and take care of implementation of the courses of coordinated scientific fields (lecturers, schedules, lecture rooms, informing),
  - In collaboration with mentors organise elective courses from other faculties,
  - Report to the Programme Council.

7. Postopek za prijavo teme doktorske disertacije vodi Senat članice, kjer je kandidat vpisan. Temo doktorske disertacije potrdi Senat Univerze v Ljubljani.
8. Na predlog članice, kjer je kandidat uspešno zagovarjal doktorsko disertacijo, opravi rektor promocijo za doktorja znanosti.
9. Organi in odločanje  
Programski svet:  
Sestava je opredeljena v točki »Programski svet« predstavitevnega zbornika.  
Pristojnosti programskega sveta:
  - zbere prijave in sprejme sklepe o izbiri kandidatov,
  - seznam sprejetih kandidatov posreduje članicam, koordinaticam znanstvenih področij,
  - pripravlja in sprejema poročila o izvajanju študija,
  - koordinira postopke za vključitev novih predmetov in morebitne spremembe študijskega programa,
  - sprejema delovni načrt doktorskega študija Biomedicina,
  - analizira učinkovitost izvajanja študija in predlaga ukrepe za izboljšave,
  - odloča o individualnih vlogah in vprašanih študentov s področja študija,
  - skrbi za povezovanje in sodelovanje vseh izvajalcev,
  - odloča o strokovnih vprašanih v okviru pristojnosti,
  - sprejme pravila o organizaciji in finančnem poslovanju doktorskega študija Biomedicina.

Pristojnosti koordinatorja področja:

- skrbi za redno izvajanje študijskega procesa,
- skrbi za koordinacijo dela s študenti, mentorji in predavatelji,
- zagotovi pravočasno nadomeščanje odsotnega učitelja v študijskem procesu,
- nadzoruje izpopolnjevanje in posodabljanje študijskih programov, tako da daje
- predloge senatu matične fakultete,
- sopolpisuje predmetnike študentov,
- sodeluje pri pripravi letnih poročil o izvajanju študijskega programa.

Pravila o postopkih za pridobitev naslova doktor znanosti na interdisciplinarnem doktorskem študijskem programu Biomedicina so objavljena na spletni strani <http://www.uni-lj.si/studij/doktorski/biomedicina/pravila-obrazci/>.

7. Registration of topic as well as evaluation of each doctoral dissertation are in the domain of the faculty senate responsible for a given study scientific field. The Senate of the University of Ljubljana has to consent to the doctoral dissertation topic and the proposed mentor(s).
8. The University of Ljubljana awards the doctoral diploma to the candidate upon fulfillment of all study requirements.
9. Description of regulatory bodies and decision-making process: Programme Council membership is described in the part »Programme Council«. Programme Council's responsibilities are:
  - Review of applications, selection of candidates.
  - Notification of responsible faculty as to the names of selected candidates.
  - Reports on study programme implementation.
  - Coordination of procedures for introduction of new courses and changes in the existing programme.
  - Analysis of efficiency in meeting the planned study programme goals.
  - Decision-making with regard to individual candidate applications and questions concerning the doctoral programme.
  - Facilitation of co-operation among lecturers.
  - Decision-making on expert issues.
  - Confirmation of Rules and Regulations concerning financial management of the programme.

Field co-ordinators have the following responsibilities:

- Facilitation of regular study process. On-time schedule preparation.
- Coordination of work among students, mentors and lecturers.
- On-time replacement of absent lecturers (in cooperation with relevant participating institutions).
- Responsibility for improvement and updating of scientific field courses in agreement with the Programme Council (in the process, co-ordinators play an advisory role).
- Approves candidate's selection of courses.
- Collaborates in preparation of year reports of implementation of the programme.

Rules about procedures for obtaining scientific title of doktor/doktorica znanosti ("Doctor of Science") in the interdisciplinary doctoral programme in Biomedicine are published at <https://www.uni-lj.si/study/doctoral/biomedicine/rules-forms/rules-title-adquisition/>.

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