



### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Ime predmeta:</b>	Izbrane vsebine in novosti v molekularni biologiji
<b>Course title:</b>	Selected topics and novelties in molecular biology

Študijski program in stopnja Study programme and cycle	Študijska smer Study option	Letnik Year of study	Semester Semester
Splošna medicina, enovit magistrski študijski program		Prvi	2.
General medicine, Uniform master's degree study program		First	2nd

**Vrsta predmeta (obvezni ali izbirni) /  
Course type (compulsory or elective)**

izbirni

elective

**Univerzitetna koda predmeta / University course code:**

Predavanja Lectures	Seminar Seminar	Vaje Tutorial			Klinične vaje Clinical training	Druge oblike študija Other forms of study	Samost. delo Individual work	ECTS
5	40	AV	LV	RV			45	3

**Nosilec predmeta / Course  
coordinator:**

red. prof. dr. Uroš Potočnik

**Jeziki /Languages:**

**Predavanja / Lectures:** slovenski/slovene

**Vaje / Tutorial:** slovenski/slovene

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

**Prerequisites for enrolling in the course or for performing study obligations:**

**Vsebina (kratek pregled učnega načrta):**

DNA struktura in lastnosti, replikacija (prokarionti, eukarionti), rekombinacija DNA, DNA popravljalni mehanizmi, DNA mutacije, struktura in funkcija genov in kromosomov  
RNA struktura in lastnosti, vrste RNA molekul in funkcije, transkripcija (prokarionti, eukarionti), postranskripcijske modifikacije  
Struktura proteinov, sinteza proteinov, posttranslacijske modifikacije proteinov, zvijanje proteinov, transport proteinov  
Regulacija proteinske sinteze: regulacija ekspresije genov pri prokariontih, pri bakteriofagih, pri evkariotskih organizmih (enoceličnih, multicelularnih,

**Content (syllabus outline):**

DNA structure and characteristics, replication (prokaryotes, eukaryotes), recombination, repair and mutations, structure and function of genes and chromosomes,  
RNA structure characteristics: role of different types of RNA, transcription (prokaryotes, eukaryotes), post transcription modification  
Protein structures, synthesis of proteins, translation, posttranslational modifications, protein folding, protein trafficking

povezava z embrionalnim razvojem), regulacija na ravni translacije in posttranslacijska regulacija, Embrionalni razvoj

Celični cikel, proliferacija, diferenciacija celic, apoptoza

Povezovanje celic v tkiva, komunikacija med celicami, signalne poti, receptorji, hormoni

Imunski sistem in avtoimunske bolezni

Virusi, HIV, SARS, DNA diagnostika pri infekcijskih boleznih

Molekularna patologija: molekularni mehanizmi vključeni v nastanek bolezni, od bolezni do gena

metode in eksperimentalne tehnike v molekularni biologiji: izolacija bioloških materialov (DNA, RNA, proteinov) iz kliničnih vzorcev (kri, biopsije, tkivo-resektati) in celičnih kultur, izolacija plazmidne DNA, gelska elektroforeza, pomnoževanje DNA z verižno reakcijo z encimom polimerazo (PCR), analiza genske ekspresije z metodo PCR v realnem času (Taqman), hibridizacija odtisa (southern, northern, western), konstrukcija cDNA in genomskih knjižnic, Rekombinantna DNA tehnologija, kloniranje človekovih genov

Monogenske genetske bolezni, kompleksne genetske bolezni,

Molekularna biologija raka: onkogeni, tumorsko zaviralni geni, dedne oblike, molekulska diagnostika in zdravljenje, biološka zdravila

Vloga molekularne biologije v sodobni družba: etični, sociološki in ekonomski vidiki

Regulation of protein synthesis: transcriptional regulation of gene expression, regulation of translation, posttranslational regulation

Embryonic development

Cell division (meiosis, mitosis)

Cell cycle: proliferation, differentiation, apoptosis

Integration of cells into tissues, communication between cells, signal transduction, receptors, hormone signaling

Immune system

Viruses :HIV, SARS, Avian influence, DNA diagnostics and infection diseases

Molecular pathology: from disease to gene

Methods and experimental techniques in molecular biology: isolation of biological molecules (DNA, RNA, proteins) from clinical samples (blood, biopsy, tissue, resection specimens) and cell cultures; plasmid DNA isolation, Polymerase Chain Reaction (PCR), gene expression analysis using Real time PCR (Taqman); hybridization and blotting (southern, western, northern); cDNA and genomic libraries

Recombinant DNA technology, cloning of human genes

Monogenic (Mendelian) and complex diseases

Molecular biology of cancer: oncogenes, tumor suppressor genes, hereditary cancer, molecular diagnostics and treatment, biological drugs

Molecular biology and society: ethical and economical aspects

### Temeljni literatura in viri / Reading materials:

1. Molecular biology of the cell. Alberts, Bruce. 7th ed., international student ed. New York : W. W. Northon & Company, cop. 2022 ISBN - 978-0-393-88485-2. COBISS.SI-ID – 121551363.
2. The cell : a molecular approach. Cooper, Geoffrey M. 8th ed. New York ; Oxford : Sinauer Associates, cop. 2019
3. ISBN - 978-1-6053-5863-5. COBISS.SI-ID – 1541941188.
4. Essential cell biology, Alberts, Bruce. 5th ed., international student ed. New York (NY) : W.W. Norton and Company, cop. 2019, ISBN - 978-0-393-68039-3; 0-393-68039-8, COBISS.SI-ID – 4026644.
5. Genetics and genomics in medicine. Strachan, Tom ; Lucassen, Anneke, 2nd ed. Boca Raton ; Abingdon : CRC Press, cop. 2023, ISBN - 978-0-367-49081-2, COBISS.SI-ID – 145048579.

### Cilji in kompetence:

Predmet bo nudil študentom poglobitev razumevanja bistvenih molekularnih in bioloških procesov v celici, tkivih, organih in celotnem organizmu. Poseben poudarek bo na razumevanju patoloških sprememb v molekularnih procesih pri nastanku, razvoju in zdravljenju bolezni. Predstavljene bodo osnovne metode in eksperimentalne tehnike v molekularni biologiji in molekularni patologiji ter njihova uporaba pri raziskavah in preiskavah molekularnih

### Objectives and competences:

Student will have deep understanding of molecular and biological processes in cells, tissues, organs and whole human organism during health and disease. The focus will be on molecular mechanisms during disease development and treatment. Student will learn most important molecular biology and molecular pathology laboratory methods for diagnostics, biomarker discovery, novel drug development and individualized treatment based on patients genetic makeup.

označevalcev v diagnostiki, prognozi, načrtovanju novih zdravil in individualiziranem zdravljenju

### Predvideni študijski rezultati:

Študenti analizirajo osnovne molekularno-biološke procese v celici, tkivih organih in celotnem organizmu. Pojasnijo delovanje humanega genoma in osnove dedovanja. Opišejo aplikativno uporabnost molekularne biologije v rekombinantni DNA tehnologiji. Znajo primerjati in povezati spremembe v strukturi in funkciji biomolekul, ki sodelujejo v molekularnih procesih človeškega telesa, s pojavom bolezenskih stanj. Opišejo testiranje različne genetske spremembe z molekularno-biološkimi metodami. Pojasnijo načine komunikacija med celicami in mehanizme imunske obrambe.

Prenesljive/ključne spretnosti in drugi atributi:  
Študenti interpretirajo rezultate nekaterih molekularno-bioloških tehnik v biomedicini.

### Intended learning outcomes:

Students analyse basic molecular biological processes in the cell, tissues, organs and the whole organism. They explain the workings of the human genome and the basics of inheritance. They describe the applied use of molecular biology in recombinant DNA technology. They are able to correlate changes in the structure and function of biomolecules involved in the molecular processes of the human body to the occurrence of diseases. They describe how different genetic changes are tested for by using molecular biological methods. They explain cell-to-cell communication and immune defence mechanisms.

Transferable/key skills and other attributes:  
Students interpret the results of some molecular biology techniques in biomedicine.

### Metode poučevanja in učenja:

- Predavanje
- Seminar

### Learning and teaching methods:

- Lectures
- Seminar

### Načini ocenjevanja:

Delež  
(v %)  
/  
Share  
(in %)

### Assessment methods:

<p>Način (pisni izpit, ustno izpraševanje, naloge, projekt)</p> <p>seminar</p> <p>pisni izpit</p> <p>ŠTUDIJSKE OBVEZNOSTI ŠTUDENTOV:</p> <p>-študenti napišejo seminar na izbrano tematiko in ustno predstavijo seminar s kratkim predavanjem</p> <p>-pisni izpit</p> <p>POGOJI ZA PRISTOP K POSAMEZNEMU PREVERJANJU ZNANJA:</p> <p>Opravljen seminar je pogoj za pristop k pisnemu izpitu.</p>	<p>40</p> <p>60</p>	<p>Type (examination, oral, coursework, project):</p> <p>seminar</p> <p>written exam</p> <p>ACADEMIC OBLIGATIONS OF STUDENTS:</p> <p>-students should write an essay on selected topic and give oral presentation (seminar)</p> <p>-written exam</p> <p>REQUIREMENTS FOR ACCESS TO INDIVIDUAL KNOWLEDGE CHECKING:</p> <p>Students should complete seminar in order to approach to the written exam.</p>
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## Reference nosilca / Course coordinator's references:

GOLE, Boris, PERNAT DROBEŽ, Cvetka, JEZERNIK, Gregor, POTOČNIK, Uroš. The expression IL1B correlates negatively with the clinical response to adalimumab in Crohn's disease patients : an ex vivo approach using peripheral blood mononuclear cells. *Life Sciences*. [Online ed.]. 2023, [v tisku][27 str.], ilustr. ISSN 1879-0631.

<https://doi.org/10.1016/j.lfs.2023.121822>, <https://www.sciencedirect.com/science/article/pii/S0024320523004563>, DOI: 10.1016/j.lfs.2023.121822. [COBISS.SI-ID 154108931], [JCR, SNIP]

financer: ARRS, Programi, P3-0427, SI, Sistemski pristopi k raziskavam človeškega genoma za personalizirano medicino kroničnih imunskih bolezni; ARRS, Projekti, J3-9258, SI, Molekularno genetski bioznačevalci in mehanizmi neodzivnosti na biološko zdravljenje z anti-TNF bolnikov s kroničnimi imunskimi boleznimi  
kategorija: 1A1 (Z, A', A1/2)

JURGEC, Staša, JEZERNIK, Gregor, GORENJAK, Mario, BÜDEFELD, Tomaž, POTOČNIK, Uroš. Meta-analytic comparison of global RNA transcriptomes of acute and chronic myeloid leukemia cells reveals novel gene candidates governing myeloid malignancies. *Cancers*. 2022, vol. 14, issue 19, str. [1]-17, ilustr. ISSN 2072-6694.

<https://doi.org/10.3390/cancers14194681>, <https://www.mdpi.com/2072-6694/14/19/4681>, DOI:

10.3390/cancers14194681. [COBISS.SI-ID 123193347], [JCR, SNIP, WoS do 14. 4. 2023: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,20, Scopus do 30. 3. 2023: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,20]

financer: ARRS, Programi, P3-0067, SI, Farmakologija in farmakogenomika; ARRS, Programi, P3-0427, SI, Sistemski pristopi k raziskavam človeškega genoma za personalizirano medicino kroničnih imunskih bolezni  
kategorija: 1A1 (Z, A', A1/2);

SKOK, Kristijan, GRADIŠNIK, Lidija, ČELEŠNIK, Helena Sabina, MILOJEVIĆ, Marko, POTOČNIK, Uroš, JEZERNIK, Gregor, GORENJAK, Mario, SOBOČAN, Monika, TAKAČ, Iztok, KAVALAR, Rajko, MAVER, Uroš. MFUM-BrTNBC-1, a newly established patient-derived triple-negative breast cancer cell line : molecular characterisation, genetic stability, and comprehensive comparison with commercial breast cancer cell lines. *Cells*. 2022, vol. 11, issue 1, str. [1]-23, ilustr. ISSN 2073-4409. <https://doi.org/10.3390/cells11010117>, <https://www.mdpi.com/2073-4409/11/1/117>, DOI:

10.3390/cells11010117. [COBISS.SI-ID 91552259], [JCR, SNIP, WoS do 25. 5. 2023: št. citatov (TC): 2, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0,10]

financer: ARRS, Programi, P3-0036, SI, Bio-psiho-socialni model kvalitete življenja; ARRS, Programi, I0-0029, SI, Infrastrukturalna dejavnost Univerze v Mariboru; ARRS, Projekti, J3-9272, SI, Identifikacija molekularnih bioznačevalcev za napoved kliničnega poteka in zasevanja pri pacientkah s trojno negativnim rakom dojke; ARRS, Projekti, L4-1843, SI, Inovativni afinitetni sistem za ločevanje populacij krvnih celic; Financer: University Medical Center Maribor (Grant/Award Number: IRP 2018/01-10)

kategorija: 1A2 (Z, A1/2);

1 JEZERNIK, Gregor, GORENJAK, Mario, POTOČNIK, Uroš. Gene ontology analysis highlights biological processes influencing non-response to anti-TNF therapy in rheumatoid arthritis. *Biomedicines*. [Online ed.]. 2022, vol. 10, issue 8, str. [1]-27, ilustr. ISSN 2227-9059. <https://doi.org/10.3390/biomedicines10081808>, <https://www.mdpi.com/2227-9059/10/8/1808>, DOI: 10.3390/biomedicines10081808. [COBISS.SI-ID 116944899], [JCR, SNIP, WoS, Scopus]

financer: ARRS, Programi, P3-0067, SI, Farmakologija in farmakogenomika; ARRS, Programi, P3-0427, SI, Sistemski pristopi k raziskavam človeškega genoma za personalizirano medicino kroničnih imunskih bolezni; ARRS, Projekti, J3-9258, SI, Molekularno genetski bioznačevalci in mehanizmi neodzivnosti na biološko zdravljenje z anti-TNF bolnikov s kroničnimi imunskimi boleznimi

kategorija: 1A2 (Z, A1/2);

HERNANDEZ-PACHECO, Natalia, GORENJAK, Mario, JURGEC, Staša, BERCE, Vojko, POTOČNIK, Uroš, et al. Combined analysis of transcriptomic and genetic data for the identification of loci involved in glucocorticosteroid response in asthma. *Allergy*. [Online ed.]. April 2021, vol. 76, iss. 4, str. 1238-1243. ISSN 1398-9995.

<https://onlinelibrary.wiley.com/doi/10.1111/all.14552>, DOI: 10.1111/all.14552. [COBISS.SI-ID 26320899], [JCR, SNIP]

kategorija: 1A1 (Z, A", A', A1/2);