

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	BIOMAKROMOLEKULE V INDUSTRIJI IN MEDICINI
Course Title:	BIOMACROMOLECULES IN INDUSTRY AND MEDICINE

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	3.	2.
USP Biochemistry, 1 st Cycle	/	3 rd	2 nd

Vrsta predmeta / Course Type:

izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30LV	/	/	75	5

Nosilec predmeta / Lecturer:

doc. dr. Miha Pavšič / Dr. Miha Pavšič, Assistant Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Pridobivanje in proizvodnja proteinov ter drugih bioloških makromolekul – naravni viri, pregled sistemov za proizvodnjo rekombinantnih proteinov v velikem merilu, priprava polisaharidov.
Posebni biopolimeri – polihidroksialkanoati, poliaminokisliline.
Modifikacija (kemijske, metabolične in post-translacijske modifikacije) in funkcionalizacija biomakromolekul ter proteinski inženiring (usmerjena evolucija, dizajn *de novo*) z namenom doseganja specifičnih lastnosti (katalitična aktivnost, stabilnost, vezava).
Encimi kot biokatalizatorji – proizvodnja hrane in pijač, biogoriv, tekstila in čistil.

Content (Syllabus outline):

Extraction and production of proteins and other biological macromolecules – natural sources, overview of systems for large scale recombinant protein production, production of polysaccharides.
Special biopolymers – polyhydroxyalkanoates, polyamino acids.
Modification (chemical, metabolic and post-translational modifications) and functionalization of biomacromolecules, and protein engineering (directed evolution, design *de novo*) with the aim to deliver specific properties (catalytic activity, stability, binding).

Uporaba biomakromolekul v medicini – tkivni inženiring, regenerativna medicina, 3D-tiskanje bioaktivnih struktur, terapevtske učinkovine in dostava zdravil.

Biopolimeri v industriji in agronomiji – prehrabena industrija (hrana in pakiranje hrane), moderni materiali, zaščita semen in rastlin, hranila, uporaba v živinoreji.

Biomakromolekule in okoljske tehnologije – biorazgradljivost, remediacija okolja in trajnostni vidiki.

Patenti in inovacije v biotehnologiji ter zaščita intelektualne lastnine.

Enzymes as biocatalysts – production of food and beverages, biofuels, textile and cleaning agents.

Biomacromolecules in medicine – tissue engineering, regenerative medicine, 3D printing of bioactive structures, pharmaceuticals and drug delivery.

Biopolymers in industry and agriculture – food industry (food and food packaging), modern materials, protection of seeds and plants, livestock feed and farming.

Biomacromolecules and environmental technologies – biodegradability, remediation and sustainability.

Patents and innovations in biotechnology, and protection of intellectual property.

Temeljna literatura in viri / Readings:

- Navodila za vaje in tekoča znanstvena literatura. / Protocols for practicals and current scientific literature.

- Gary Walsh. Proteins: Biochemistry and Biotechnology. 2. izdaja. Wiley Blackwell, 2014.

- Wolfgang Aehle. Enzymes in Industry: Production and Applications. 3. izdaja. Wiley, 2007. (izbrana poglavja / selected chapters)

- Sabu Thomas, Sreeraj Gopi, Augustine Amalraj. Biopolymers and Their Industrial Applications: From Plant, Animal, and Marine Sources, to Functional Products. 1. izdaja. Wiley, 2020. (izbrana poglavja / selected chapters)

Cilji in kompetence:

Predmet daje pregled uporabe biomakromolekul v različnih vejah industrije, medicini in tudi v vsakdanjem življenju. Po opravljenih obveznostih bodo študenti znali kritično ovrednotiti prednosti biomakromolekul z vidika njihove priprave, posebnih funkcionalnosti in okoljskih vidikov.

Objectives and Competences:

The subject provides an overview of the use of biomacromolecules in various industrial branches, medicine and also in everyday life. Upon completing the course, the students will be able to critically evaluate the advantages of biomacromolecules from the productional, functional and environmental aspects.

Predvideni študijski rezultati:

Znanje in razumevanje

Poznavanje načinov pridobivanja bioloških makromolekul, njihovih prednosti in načinov uporabe.

Uporaba

Pridobljeno znanje predstavlja razširitev osnovnega biokemijskega znanja s poudarkom

Intended Learning Outcomes:

Knowledge and Comprehension

Knowledge on production of biological macromolecules, their advantages and use.

Application

Acquired knowledge broadens the basic biochemical knowledge with emphasis on

na industrijski in medicinski vrednosti biomakromolekul.	industrial and medical value of biomacromolecules.
<u>Refleksija</u> Študenti bodo zraven navedenega znanja pridobili sposobnost kritičnega razmišljanja o aplikativnih vidikih.	<u>Analysis</u> Students will, besides gaining the listed knowledge, develop ability to critically think about applicative aspects.
<u>Prenosljive spretnosti</u> Samostojno in skupinsko delo na vajah ter pri pripravi seminarjev, sposobnost uporabe znanstvene literature in drugih virov, predstavljanje in debatiranje.	<u>Skill-transference Ability</u> Individual and group work at practicals and at seminar preparation, ability to use scientific literature and other sources, presentation and debating.

Metode poučevanja in učenja:

Predavanja, laboratorijske vaje, individualni in skupinski seminarji.

Learning and Teaching Methods:

Lectures, laboratory practicals, and individual and group seminars.

Načini ocenjevanja:

Seminarska naloga
Pisni izpit
Pogoj za pristop k izpitu: opravljene laboratorijske vaje, seminarska naloga.

Delež (v %) /
Weight (in %)

Assessment:

Seminar work
Written exam
Requirements for exam admission: completed laboratory practicals, seminar work.

Reference nosilca / Lecturer's references:

KRAJNC, Anja, GABER, Aljaž, LENARČIČ, Brigita, **PAVŠIČ, Miha**. 2020. The Central Region of Testican-2 Forms a Compact Core and Promotes Cell Migration. *International Journal of Molecular Sciences*. 2020. DOI [10.3390/ijms21249413](https://doi.org/10.3390/ijms21249413). ISSN 1661-6596. [COBISS.SI-ID [42261507](#)]
GABER, Aljaž, GUNČAR, Gregor, **PAVŠIČ, Miha**. Proper Evaluation of Chemical Cross-Linking-Based Spatial Restraints Improves the Precision of Modeling Homo-Oligomeric Protein Complexes. *BMC Bioinformatics*. 2019, vol. 20 (1): 464. DOI [10.1186/s12859-019-3032-x](https://doi.org/10.1186/s12859-019-3032-x). ISSN 1471-2105. [COBISS.SI-ID [1538315971](#)]
PAVŠIČ, Miha, GUNČAR, Gregor, DJINOVIĆ-CARUGO, Kristina, LENARČIČ, Brigita. Crystal Structure and Its Bearing towards an Understanding of Key Biological Functions of EpCAM. *Nature Communications*. 2014, 5: 4764. DOI [10.1038/ncomms5764](https://doi.org/10.1038/ncomms5764). ISSN 2041-1723. [COBISS.SI-ID [1764911](#)]