

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** MOLEKULARNA BIOTEHNOLOGIJA  
**Course Title:** MOLECULAR BIOTECHNOLOGY

| Študijski program in stopnja<br>Study Programme and Level | Študijska smer<br>Study Field | Letnik<br>Academic Year | Semester<br>Semester |
|---|-------------------------------|-------------------------|----------------------|
| MAG Biokemija, 2. stopnja                                 | /                             | 1.                      | 2.                   |
| USP Biochemistry, 2 <sup>nd</sup> Cycle                   | /                             | 1 <sup>st</sup>         | 2 <sup>nd</sup>      |

**Vrsta predmeta / Course Type:**

izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:**

BI2I18

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

**Nosilec predmeta /  
Lecturer:**

prof. dr. Marko Dolinar /  
Dr. Marko Dolinar, Full 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:**

Predavanja:

1. Uvod. Biotehnologija in molekularna biotehnologija.
2. Molekularna biotehnologija in okolje: mikrobní biosenzorji, bioremediacija/fitoremediacija.
3. Molekularna biotehnologija in hrana: določanje GS sestavin in določanje sestave živil z analizo DNA.
4. Molekularna biotehnologija za pripravo terapevtikov: interferoni, rastni hormon, dejavnik tumorske nekroze, inzulin, interleukini,...

**Content (Syllabus outline):**

Lectures:

1. Introduction. Biotechnology and molecular biotechnology.
2. Molecular biotechnology and environment: microbial biosensors, bioremediation/phytoremediation.
3. Molecular biotechnology and food: determining genetically modified ingredients and composition based on DNA analysis.
4. Molecular biotechnology for preparation of therapeutics: interferons, growth hormone, tumour necrosis factor, insulin, interleukins...

5. Molekularna biotehnologija za pripravo encimov (nukleaze, lipaze).
6. Molekularna biotehnologija za pripravo diagnostičnih in terapevtskih protiteles.
7. Molekularna biotehnologija za pripravo cepiv: herpes, papilomavirus, kolera; DNA-cepiva (karies), vektorska cepiva, bakterije kot dostavni sistemi za antigene.
8. Molekularna biotehnologija za sintezo tržno zanimivih produktov: male biološke molekule, antibiotiki, biopolimeri.
9. Molekularna biotehnologija in uporaba biomase: proizvodnja fruktoze, alkoholov, mikrobn pretvorba celuloze in lignina.
10. Molekularna biotehnologija: metabolično inženirstvo.
11. Molekularna biotehnologija in novi viri energije.
12. Molekularna biotehnologija in gensko spremenjene rastline in živali.
13. Družbeni vidiki sodobne biotehnologije: varnost, okoljska tveganja, ekonomski vidiki in družbena sprejemljivost.
14. Rekombinantne bakterije v agronomiji.

#### Seminarji:

Primeri razvoja novih sistemov za proizvodnjo reagentov, terapevtikov, uporaba v zdravstvu, alternativni viri energije ipd. iz tekoče znanstvene periodike.

#### Laboratorijske vaje:

1. Določanje vrstne sestave mešanega mesa
2. Določanje vsebnosti GS rastlin v živilu
3. Načini transformacije cianobakterij

5. Molecular biotechnology for enzyme production (nucleases, lipases).
6. Molecular biotechnology for preparation of diagnostic and therapeutic antibodies.
7. Molecular biotechnology for preparation of vaccines: herpes, papilomavirus, cholera; DNA vaccines (caries), vector vaccines, bacteria as antigen delivery systems.
8. Molecular biotechnology for synthesis of commercial products: small biological molecules, antibiotics, biopolymers.
9. Molecular biotechnology and biomass utilization: production of fructose, alcohols, microbial conversion of cellulose and lignin.
10. Molecular biotechnology: metabolic engineering.
11. Molecular biotechnology and new energy sources.
12. Molecular biotechnology and genetically engineered plants and animals.
13. Open public issues of modern biotechnology: safety, environmental risks, economical issues and public acceptance.
14. Recombinant bacteria in agriculture.

#### Seminars:

Examples of novel systems for production of reagents, therapeutics, medical uses, alternative energy sources etc. from current scientific literature.

#### Laboratory work:

1. Determination of species composition in mixed meat samples
2. Determination of presence of genetically modified plants in food samples
3. Techniques for transformation of cyanobacteria

### Temeljna literatura in viri / Readings:

- B.R. Glick, J.J. Pasternak in C.L. Patten: Molecular Biotechnology: Principles and applications of recombinant DNA. 4. izdaja. Washington: ASM Press, 2009 (40 %, večino preostalega učbenika uporabijo študenti pri predmetu Tehnologija DNA v 1. letniku magistrskega študija).  
- B.R. Glick, J.J. Pasternak and C.L. Patten: Molecular Biotechnology: Principles and applications of recombinant DNA. 4. izdaja. Washington: ASM Press, 2009 (40%; most of the remaining textbook is recommended for the introductory DNA Technology course in the 1<sup>st</sup> year Master's programme).

### Cilji in kompetence:

Študentje morajo poznati aplikativne vidike genskega inženirstva. Ob predhodnem poznavanju DNA-tehnologije bodo sposobni razumeti načine priprave gensko spremenjenih organizmov in umestiti njihovo uporabnost v širši kontekst ved o življenju in sodobnih tehnologij.

### Objectives and Competences:

Students have to know applicative aspects of genetic engineering. With prior knowledge of DNA technology they will be able to understand how genetically engineered organisms are prepared and to put their value into the context of life sciences and modern technologies.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

##### Znanje:

Postopki priprave rekombinantnih cepiv. Uporabnost gensko spremenjenih organizmov in produktov na različnih področjih (okoljske tehnologije, medicina, reagenti). Princip metaboličnega inženirstva in uporaba za pripravo tržno zanimivih produktov.

##### Razumevanje:

Povezovanje posameznih tehnik v postopke v molekularni biotehnologiji. Identifikacija problema – zastavitev cilja – zasnova eksperimentov – preverjanje ciljev – prenos v prakso.

#### Uporaba

Analiza živil na osnovi DNA. Povzemanje vsebine znanstvenih člankov, utrjevanje terminologije in predstavljanje zahtevnih strokovnih vsebin. Spremljanje dnevnih novic s področja biotehnologije.

#### Refleksija

Širina spektra biotehnoloških aplikacij. Biološka zdravila pridobivamo z gensko tehnologijo. Prenos temeljnih znanj v tehnologijo.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

##### Knowledge:

Procedures needed to prepare recombinant vaccines. Usefulness of genetically engineered organisms and products in different areas (environmental technologies, medicine, reagents). Principle of metabolic engineering and its use for development of commercial products.

##### Understanding:

Combining techniques into procedures in molecular biotechnology. Problem identification – goal setting – design of experiments – testing outcomes – transfer into practice.

#### Application

DNA-based food analysis. Abstracting contents of scientific articles, terminology practice and presenting advanced professional contents. Following daily news in the field of biotechnology.

#### Analysis

Broadness of biotech applications. Biopharmaceuticals are produced using gene technology. Transfer for fundamental knowledge into technology.

**Prenosljive spretnosti**

Urejanje spletnih strani v okolju Wikimedia.  
Predstavljanje strokovnih vsebin in argumentirano razpravljanje o temah s področja biotehnologije.

**Skill-transference Ability**

Editing Web pages in Wikimedia environment.  
Presenting professional contents and argued discussions on biotech topics.

**Metode poučevanja in učenja:**

Predavanja, tri laboratorijske vaje, individualno delo pri pripravi seminarja (možnost konzultacij), predstavitve seminarjev.

**Learning and Teaching Methods:**

Lectures, three laboratory experiments, individual seminar preparation (consultations possible), seminar presentation.

**Načini ocenjevanja:**

Pisni izpit.  
Seminarska naloga.  
Opravljene vaje so pogoj za pristop k izpitu.

Delež (v %) /

Weight (in %)

**Assessment:**

Written and oral examination.  
Seminar presentation.  
Access to examination only with completed laboratory practicals.

**Reference nosilca / Lecturer's references:**

- ŠKRLJ, Nives, DREVENŠEK, Gorazd, HUDOKLIN, Samo, ROMIH, Rok, ČURIN-ŠERBEC, Vladka, **DOLINAR, Marko**. Recombinant single-chain antibody with the trojan peptide penetratin positioned in the linker region enables cargo transfer across the blood-brain barrier. *Appl. biochem. biotechnol.*, 2013, vol. 169, no. 1, str. 159-169, ilustr., doi: 10.1007/s12010-012-9962-7. [COBISS.SI-ID 30399193]  
- ŠKRLJ, Nives, ERČULJ, Nina, **DOLINAR, Marko**. A versatile bacterial expression vector based on the synthetic biology plasmid pSB1. *Protein expr. purif.*, 2009, vol. 64, no. 2, str. 198-204, doi: 10.1016/j.pep.2008.10.019. [COBISS.SI-ID 30190085]  
- VASILJEVA, Olga, **DOLINAR, Marko**, ROZMAN PUNGERČAR, Jerica, TURK, Vito, TURK, Boris. Recombinant human procathepsin S is capable of autocatalytic processing at neutral pH in the presence of glycosaminoglycans. *FEBS lett.* [Print ed.], 2005, vol. 579, str. 1285-1290. [COBISS.SI-ID 18842407]