

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Proteinsko in celično inženirstvo
Course title:	Protein and Cell Engineering

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Nanoznanosti in nanotehnologije, 3. stopnja	/	1	1
Nanosciences and Nanotechnologies, 3 rd cycle	/	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: NANO3-825

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	30			30	210	10

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Jože Pungerčar

Jeziki / Predavanja / Lectures: slovenščina, angleščina / Slovenian, English
Languages: Vaje / Tutorial: slovenščina, angleščina / Slovenian, English

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

Zaključena druga stopnja bolonjskega študija ali diploma univerzitetnega študijskega programa.

Potrebna so tudi osnovna znanja s področij biokemije, molekularne in celične biologije, molekularne genetike in proteinske/encimske strukture.

Prerequisites:

Completed Bologna second level study program or an equivalent pre-Bologna university study program.

Basic knowledge of biochemistry, molecular and cell biology, molecular genetics and protein/enzyme structure is also requested.

Vsebina:

- Proteinsko inženirstvo: zgodovinski pregled, osnovni pojmi, racionalni dizajn in usmerjena evolucija.
- Mutageneza: različni pristopi in najpogostejše tehnike.
- Neomejeni potencial celičnega inženirstva.
- Uporaba različnih proteinskih označevalcev.

Content (Syllabus outline):

- Protein engineering: historical view, basic concepts and terms, rational design and directed evolution.
- Mutagenesis: various approaches and common techniques.
- Unlimited potential of cell engineering.
- Use of various protein tags and markers.

- Načrtovanje usmerjenih mutacij na izbrani proteinski molekuli.
- Uvedba mutacij(e) na nukleotidnem nivoju.
- Pridobitev mutiranega rekombinantnega proteina in njegova osnovna karakterizacija.
- Priprava izbranega označenega proteina v sesalskih celicah.
- Analiza dobljenih rezultatov.
- Priprava zaključne seminarske naloge.

- Design of site-directed mutations on a selected protein molecule.
- Introduction of mutation(s) at the nucleotide level.
- Production of a mutant recombinant protein and its basic characterization.
- Preparation of a selected labeled protein in mammalian cells.
- Analysis of the obtained results.
- Preparation of a final seminar work.

Temeljni literatura in viri / Readings:

- Ausubel, F.M. *et al.* /Eds./ (2007): Current Protocols in Molecular Biology. John Wiley and Sons, Inc., New York, USA; Continuously updated.
- Robertson, D.E. and Noel, J.P. /Eds./ (2004): Protein Engineering. In: Methods in Enzymology, Vol. 388, Elsevier Academic Press, Amsterdam, The Netherlands.
- Wittrup, K.D. and Verdine G.L. /Eds./ (2012): Protein Engineering for Therapeutics, Parts A & B. In: Methods in Enzymology, Vols. 502 & 503, Elsevier Academic Press, Amsterdam, The Netherlands.
- Al-Rubeai, M. and Fussenegger, M. /Eds./ (2007): Cell Engineering, Vol. 5 (Systems Biology), Springer Verlag, New York, USA.
- Saltzman, W.M. (2015): Biomedical Engineering - Bridging Medicine and Technology, 2nd edn., Cambridge University Press, New York, USA.
- Current research and review articles from the field.

Cilji in kompetence:

Študent poglobi svoje znanje s področja razumevanja odnosov med strukturo in funkcijo proteinov. Nauči se samostojno načrtovati ustrezne eksperimente in uporabljati različne pristope proteinskega inženirstva. Prav tako se nauči uporabljati različne celične sisteme za študij in razumevanje biološkega delovanja izbranih proteinov ter molekularnih celičnih mehanizmov.

Splošne kompetence:

- Obvladanje raziskovalnih metod, analitičnih postopkov in molekularnobioloških procesov.
- Razvoj kritične in samokritične presoje.
- Sposobnost uporabe pridobljenega znanja v praksi.
- Samostojno raziskovalno delo.
- Kooperativnost ter delo v skupini in kompetitivnem mednarodnem raziskovalnem okolju.

Predmetnospecifične kompetence:

- Predmet pripravlja študente na konkretno delo s proteini/encimi v raziskovalnem

Objectives and competences:

A student is expected to acquire in-depth knowledge and understanding of structure-function relationships in proteins. He/she learns how to independently design appropriate experiments and to use different approaches in protein engineering. The student also learns how to exploit various cell systems for studying and understanding the biological roles of proteins of interest and molecular cell mechanisms.

General Competences:

- The student will master research methods, analytical procedures and molecular biology processes.
- Development of a critical and self-critical judgment.
- Transfer of the acquired knowledge to practical use.
- Individual research work.
- Cooperativity and team work in a competitive international research environment.

molekularnobiološkem laboratoriju.

- Daje tudi dobra izhodišča za delo v ustreznem polindustrijskem laboratoriju.

Course Specific Competences:

- This course prepares students for practical work on proteins/enzymes in a molecular biology research laboratory.
- The course provides a good background for work in an appropriate semi-industrial laboratory.

Predvideni študijski rezultati:

Znanje in razumevanje:

- Poglobljeno razumevanje osnovnih pristopov proteinskega inženirstva.
- Razumevanje in vrednotenje različnih možnosti celičnega inženirstva in njihove smiselne uporabe.

Intended learning outcomes:

Knowledge and Understanding:

- In-depth understanding of basic approaches to protein engineering.
- Understanding and evaluation of different possibilities of cell engineering and their rational use.

Metode poučevanja in učenja:

- Predavanja (opcijsko)
- Seminarji, tutorstvo in seminarska naloga
- Laboratorijsko ali *in silico* individualno in timsko delo, usmerjeno v študentovo raziskovalno problematiko

Learning and teaching methods:

- Lectures (optional)
- Seminar work and tutorial
- Individual and team work in the laboratory or *in silico* that is student research-oriented

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Seminarska naloga	50 %	Seminar work
Ustni zagovor seminarske naloge	50 %	Oral defence of the seminar work

Reference nosilca / Lecturer's references:

- Latinović, Z., Leonardi, A., Šribar, J., Sajevec, T., Žužek, M.C., Frangež, R., Halassy, B., Trampuš-Bakija, A., Pungercar, J. and Križaj, I. (2016): Venomics of *Vipera berus berus* to explain differences in pathology elicited by *Vipera ammodytes ammodytes* envenomation: Therapeutic implications. *J. Proteomics* 146, 34–47.
- Leonardi, A., Sajevec, T., Latinović, Z., Pungercar, J., Lang Balija, M., Trampuš Bakija, A., Vidmar, R., Halassy, B. and Križaj, I. (2015): Structural and biochemical characterisation of VaF1, a P-IIIa fibrinogenolytic metalloproteinase from *Vipera ammodytes ammodytes* venom. *Biochimie* 109, 78–87.
- Brglez, V., Pucer, A., Pungercar, J., Lambeau, G. and Petan, T. (2014): Secreted phospholipases A2 are differentially expressed and epigenetically silenced in human breast cancer cells. *Biochem. Biophys. Res. Commun.* 445, 230–235.
- Jenko-Pražnikar, Z., Petan, T. and Pungercar, J. (2013): Ammodytoxins efficiently release arachidonic acid and induce apoptosis in a motoneuronal cell line in an enzymatic activity-dependent manner. *NeuroToxicology* 35, 91–100.
- Petan, T., Prijatelj Žnidaršič, P. and Pungercar, J. (2013): Protein engineering in structure-function studies of viper's venom secreted phospholipases A2. In: Figurski, D.H. (Ed.), Genetic Manipulation of DNA and Protein – Examples from Current Research. ISBN 978-953-51-0994-5. InTech Open Access, pp. 107–132.