



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Nanobionika
Course title:	Nanobionics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	1., 2. ali 4.
PHYSICS		1. or 2.	1., 2. or 4.

Vrsta predmeta / Course type

Izbirni za vse module

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
10	5				165	6

Nosilec predmeta / Lecturer:

Karl Lohner

Jeziki /

Languages:

Predavanja /

Lectures:

Vaje / Tutorial:

Angleški s slovenskim prevodom / English with translation
in Slovenian

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

Ni posebnih zahtev.

Prerequisites:

No special prerequisites.

Vsebina:

- Biopolimeri kot gradniki v nanotehnologiji
- Stikala, pomnilnik in računanje s plavajočo vejico na osnovi DNA in drugih biomolekul
- Razpoznava na osnovi lateralno heterogenih podprtih membrane
- Neuronske mreže kot mikroelektronske naprave

Content (Syllabus outline):

- Biopolymers as building blocks in nanotechnology
- Switches, memory and floating-operation based calculation on DNA and other biomolecules
- Recognition based on laterally heterogeneous supported membranes
- Neural networks as microelectronic devices

- Inžiniring na osnovi fotopolimerov
- Magnetosomi: nanometrski magnetni materiali na osnovi železa v bakterijah
- Sinteza insulina oz. encimov na površinah
- Kostni – primer samoobnovljivega biomateriala

- Photopolymers-based engineering
- Magnetosomes: Nanoscale Magnetic Iron Minerals in Bacteria
- Insulin/Enzymes synthesis on surfaces
- Bones – an example of self-renewable biomaterials

Temeljni literatura in viri / Readings:

- 1) Martyn Amos: Theoretical and Experimental DNA Computation, Springer, 2005
- 2) C. M. Niemeyer and C. A. Mirkin: Nanobiotechnology: Concepts, Applications and Perspectives, Wiley-VCH, 2004
- 3) C.A. Mirkin, C.M. Niemeyer: Nanobiotechnology II: More Concepts and Applications, Wiley-VCH, 2004

Cilji in kompetence:

Študenti poglobijo znanje s področja aplikativne nanobiofizike na primerih prenosa v naravi izraženih in delujočih procesov v umetno okolje za namene nanotehnologije – torej izrazito miniaturiziranih tehnoloških procesov. Razumejo pomembnost povezanosti področij naravoslovja in tehnike ter način razmišljanja pri doseganju funkcionalnosti nanometrskih kompleksnih sistemov, ki posnemajo naravne biološke sisteme. Poznajo najnovejše raziskave in delo raziskovalnih skupin na tem področju v regiji.

Objectives and competences:

Students acquire advanced knowledge in the field of applicative nanobiophysics on the examples of transfer of natural processes into artificial environment to achieve goals of nanotechnology, i.e. miniaturization of technological processes. Student understand the importance of the connections between the fields from natural sciences and technology as well as the way of thinking while achieving the functionality of nanoscale complex systems that mimic natural biosystems. Students get familiar with up-to-date research work and research teams working in that field in the region.

Predvideni študijski rezultati:

Znanje in razumevanje:

Poglabljanje znanja o interakcijah med komponentami v bioloških sistemih ter o naravnih procesih, ki se jih da uporabiti v nanotehnologijah, iz česar se lahko potencialno razvijajo nove nanobiotehnologije.

Prenosljive/ključne spretnosti in drugi atributi:

- sposobnost reševanja tehnoloških in biokompatibilnostnih problemov na področju novih (nano)materialov in (nano-, nanobio-, bio-)tehnologij s fizikalnimi, tehničnimi in bioničnimi pristopi na bioloških sistemih

Intended learning outcomes:

Knowledge and understanding:

Gaining additional knowledge about interactions between nanomaterials and biosystems, which is basis for safe applied research & development work and products in this field.

Transferable/Key Skills and other attributes:

- ability of solving of technological and biocompatibility problems in the field of novel (nano)materials and (nano-, nanobio-, bio-)technologies with physical, technical and bionical approaches on biosystems.

- sposobnost oblikovanja in implementacije izvirnih znanstvenih rešitev v danih biofizikalnih, nanotehnoloških in interdisciplinarnih problemih.

- ability of defining and implementing unique scientific solution within defined biophysical, nanotechnological and interdisciplinary problems.

Metode poučevanja in učenja:

Predavanja, seminar in izdelava seminarske naloge iz področja nanobionike.

Learning and teaching methods:

Lectures, seminar and work out of seminar from the field of nanobionics.

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt)

Seminarska naloga
Ustni izpit

Delež (v %) /

Weight (in %)

Assessment:

Type (examination, oral, coursework, project):

Course work
Oral exam

Reference nosilca / Lecturer's references:

1. [In vitro and in vivo cytotoxic activity of human lactoferricin derived antitumor peptide R-DIM-P-LF11-334 on human malignant melanoma.](#) Riedl S, Rinner B, Schaidler H, Liegl-Atzwanger B, Meditz K, Preishuber-Pflügl J, Grissenberger S, **Lohner K**, Zweytick D. *Oncotarget*. 2017 May 11. doi: 10.18632/oncotarget.17823.
2. [Membrane-active Antimicrobial Peptides as Template Structures for Novel Antibiotic Agents.](#) **Lohner K**. *Curr Top Med Chem*. 2017;17(5):508-519. Review.
3. [Antimicrobial Peptides Targeting Gram-Positive Bacteria.](#) Malanovic N, **Lohner K**. *Pharmaceuticals (Basel)*. 2016 Sep 20;9(3). pii: E59. doi: 10.3390/ph9030059. Review.
4. [Meta-analysis of 2,104 trios provides support for 10 new genes for intellectual disability.](#) Lelieveld SH, Reijnders MR, Pfundt R, Yntema HG, Kamsteeg EJ, de Vries P, de Vries BB, Willemsen MH, Kleefstra T, Löhner K, Vreeburg M, Stevens SJ, van der Burgt I, Bongers EM, Stegmann AP, Rump P, Rinne T, Nelen MR, Veltman JA, Vissers LE, Brunner HG, Gilissen C. *Nat Neurosci*. 2016 Sep;19(9):1194-6. doi: 10.1038/nn.4352. Epub 2016 Aug 1.
5. [Membrane-active Antimicrobial Peptides as Template Structures for Novel Antibiotic Agents.](#) **Lohner K**. *Curr Top Med Chem*. 2016 Jul 13.
6. [Antimicrobial peptides: Cell Membrane and Microbial Surface Interactions.](#) **Lohner K**, Hilpert K. *Biochim Biophys Acta*. 2016 May;1858(5):915-7. doi: 10.1016/j.bbamem.2016.03.005. Epub 2016 Mar 8.
7. [Peptides with dual mode of action: Killing bacteria and preventing endotoxin-induced sepsis.](#) Brandenburg K, Heinbockel L, Correa W, **Lohner K**. *Biochim Biophys Acta*. 2016 May;1858(5):971-9. doi: 10.1016/j.bbamem.2016.01.011. Epub 2016 Jan 20. Review.