



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Nanobionika</b>
<b>Course title:</b>	<b>Nanobionics</b>

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	1., 2. ali 3.
PHYSICS		1. or 2.	1., 2. or 3.

**Vrsta predmeta / Course type**

Izbirni za modula Biofizika 1, 2, 3 in  
Fizika 1, 2, 3

**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
7	3				290	10

**Nosilec predmeta / Lecturer:**

**Karl Lohner**

**Jeziki /**

**Languages:**

**Predavanja /** slovenski/Slovenian

**Lectures:**

**Vaje / Tutorial:**

**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
- Razpoznavna na osnovi lateralno heterogenih

**Content (Syllabus outline):**

- Biopolymers as building blocks in nanotechnology
- Switches, memory and floating-operation based calculation on DNA and other biomolecules

#### podprtih membrane

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

- Recognition based on laterally heterogeneous supported membranes
- Neural networks as microelectronic devices
- Photopolimers-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:

Poglobljanje 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.

Prenesljive/ključne spretnosti in drugi atributi:

- sposobnost reševanja tehnoloških in

#### 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

biokompatibilnostnih problemov na področju novih (nano)materialov in (nano-, nanobio-, bio-) tehnologij s fizikalnimi, tehničnimi in bioničnimi pristopi na bioloških sistemih  
- sposobnost oblikovanja in implementacije izvernih znanstvenih rešitev v danih biofizikalnih, nanotehnoloških in interdisciplinarnih problemih.

biocompatibility problems in the field of novel (nano)materials and (nano-, nanobio-, bio-) technologies with physical, technical and bionical approaches on biosystems.  
- 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.** HICKEL, Andrea, DANNER, Sabine, AMENITSCH, Heinz, DEGOVICS, Gabor, RAPPOLT, Michael, LOHNER, Karl, PABST, Georg. Influence of antimicrobial peptides on the formation of nonlamellar lipid mesophases. *Biochimica et biophysica acta, Biomembranes*, ISSN 0005-2736. [Print ed.], Oct. 2008, vol. 1778, issue 10, str. 2325-2333, ilustr.  
<http://dx.doi.org/10.1016/j.bbamem.2008.05.014>, doi: 10.1016/j.bbamem.2008.05.014.  
[COBISS.SI-ID 9531220]

**2.** SANCHEZ-GOMEZ, Susana, LAMATA, Marta, LEIVA, Jose, BLONDELLE, Sylvie E., JERALA, Roman, ANDRÄ, Jörg, BRANDENBURG, Klaus, LOHNER, Karl, MORIYON, Ignacio, TEJADA DE GARAIZÁBAL, Guillermo Martinez de. Comparative analysis of selected methods for the assessment of antimicrobial and membrane-permeabilizing activity : a case study for lactoferricin derived peptides. *BMC microbiology*, ISSN 1471-2180, 11 November 2008, vol. 8, str. 1-9. <http://www.biomedcentral.com>. [COBISS.SI-ID 4081178]

**3.** JAPELJ, Boštjan, ZORKO, Mateja, MAJERLE, Andreja, PRISTOVŠEK, Primož, SANCHEZ-GOMEZ, Susana, TEJADA DE GARAIZÁBAL, Guillermo Martinez de, MORIYON, Ignacio, BLONDELLE, Sylvie E., BRANDENBURG, Klaus, ANDRÄ, Jörg, LOHNER, Karl, JERALA, Roman. The acyl group as the central element of the structural organization of antimicrobial lipopeptide. *Journal of the American Chemical Society*, ISSN 0002-7863, 2007, vol. 129, no. 5, str. 1022-1023. [COBISS.SI-ID 3635994]

**4.** ZWEYTICK, Dagmar, PABST, Georg, ABUJA, Peter M., JILEK, Alexander, BLONDELLE, Sylvie E., ANDRÄ, Jörg, JERALA, Roman, MONREAL, Daniel, TEJADA DE GARAIZÁBAL, Guillermo Martinez de, LOHNER, Karl. Influence of N-acylation of a peptide derived from human lactoferricin on membrane selectivity. *Biochimica et biophysica acta, Biomembranes*, ISSN 0005-

2736. [Print ed.], 2006, vol. 1758, no. 9, str. 1426-1435. [COBISS.SI-ID [3484698](#)]

**5.** ANDRÄ, Jörg, LOHNER, Karl, BLONDELLE, Sylvie E., JERALA, Roman, MORIYON, Ignacio, KOCH, Michel H. J., GARIDEL, Patrick, BRANDENBURG, Klaus. Enhancement of endotoxin neutralization by coupling of a C12-alkyl chain to a lactoferricin-derived peptide. *Biochemical journal*, ISSN 0264-6021, 2005, vol. 385, part 1, str. 135-143. [COBISS.SI-ID [3182106](#)]