



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Interakcije nanomaterialov in bioloških sistemov
Course title:	Interactions between nanomaterials and biological systems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA, 3. stopnja		1. ali 2.	1., 2. ali 4.
PHYSICS, 3 rd cycle		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	Mentorstvo Mentorship	Samost. delo Individ. work	ECTS
15					165	6

Nosilec predmeta / Lecturer:

Janez Štrancar

Jeziki /

Languages:

Predavanja /

Lectures:

slovenski/Slovene

Vaje / Tutorial:

/

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

Ni posebnih zahtev.

Prerequisites:

No special prerequisites.

Vsebina:

- Zlivanje lipidnih vesiklov in biomembran
- Vpliv biokorone na interakcijo med nanodelci in membranami
- Ovijanje nanodelcev z lipidi
- Prenos lipofilnih substanc s trdnimi lipidnimi nanodelci
- Antibakterijska zaščita opreme z nanomateriali

Content (Syllabus outline):

- Liposome-Cell Membrane fusion
- Effect of biocorona on interaction between nanoparticles and membranes
- Lipid wrapping of nanoparticles
- Lipophilic substances transport with solid lipid nanoparticles
- Antibacterial protection with nanomaterials
- Guanisin complex - cell interaction

- Interakcija guanizinskih kompleksov s celicami
- Molekularni označevalci nanodelcev
- Detekcija toksinov s pomočjo biosenzorjev na membranah
- Preprečevanje razvoja biofilmov na tehnološko pomembnih površinah
- Interakcija toksinov s celičnimi membranami
- Prilagodljivost virusnih plaščnih proteinov na različna lipidna okolja
- Interakcija in dinamika v dendrimernih sistemih za transport učinkovin

- Nanoparticle Molecular Labels
- Toxin detection via membrane biosensors
- Preventing biofilm growth on technologically important surfaces
- Toxin-cell membrane interaction
- Adaptation of viral coat proteins in various lipid environments
- Interactions and dynamics in dendrimer systems for drug delivery

Temeljni literatura in viri / Readings:

1. J. Israelaschvili: Intermolecular Interactions & Surface Forces. Academic Press, London, 1992.
2. C. M. Niemeyer and C. A. Mirkin: Nanobiotechnology: Concepts, Applications and Perspectives, Wiley-VCH, 2004
3. Izbrani trenutni članki

Cilji in kompetence:

Študenti so sposobni sestavljati obstoječa znanja in najnovejše raziskave z lastnim raziskovalnim delom na področju molekularnih znanosti ter nanomaterialov s posebnim poudarkom na interakcijah nanomaterialov z biološkimi sistemi.

Objectives and competences:

Students can couple existing knowledge and the latest research with their own research work in fields of molecular sciences and nanomaterials with special focus on the interactions between nanomaterials and biological systems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Poglobljena analiza trenutnega znanja in glavnih tem na področju interakcij med nanomateriali in biološkimi sistemi
 Vrednotenje lastnih rezultatov v luči najnovejših raziskav
 Opredelitev varnosti nanomaterialov in drugih supramolekularnih sistemov.
 Sinteza dogodkov na osnovi fizikalnih interakcij z znanimi molekularnimi signalnimi potmi

Prenosljive/ključne spretnosti in drugi atributi:

Intended learning outcomes:

Knowledge and understanding:

Deep analysis of the current frontiers and expertise in the field of interactions between nanomaterials and biosystems
 Evaluation of own results with respect to the state-of-the-art
 Defining safety of nanomaterials and other supramolecular systems
 Synthesis of interaction-driven events and known signaling cascades

Transferable/Key Skills and other attributes:

Sposobnost reševanja tehnoloških in biokompatibilnostnih problemov na področju novih materialov in tehnologij s fizikalnimi pristopi na bioloških sistemih

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

Ability of solving of technological and biocompatibility problems in the field of novel materials and technologies with physical approaches on biosystems.

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

Metode poučevanja in učenja:

Predavanja, Problemsko učenje seminar in izdelava seminarske naloge oz članka iz področja interakcij nanomaterialov in bioloških sistemov.

Learning and teaching methods:

Lectures, problem based learning , seminar and work out of seminar or paper from the field of interacting nanomaterials and biological systems.

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Način (pisni izpit, ustno izpraševanje, naloge, projekt)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
Seminarska naloga	50%	Course work
Ustni izpit	50%	Oral exam

Reference nosilca / Lecturer's references:

URBANČIČ, Iztok, GARVAS, Maja, KOKOT, Boštjan, MAJARON, Hana, UMEK, Polona, ŠKARABOT, Miha, ARSOV, Zoran, KOKLIČ, Tilen, ČEH, Miran, MUŠEVIČ, Igor, ŠTRANCAR, Janez, et al. Nanoparticles can wrap epithelial cell membranes ... *Nano letters*, 2018, vol. 18, no. 8, str. 5294-5305, doi: 10.1021/acs.nanolett.8b02291.

PODLIPEC, Rok, ŠTRANCAR, Janez. Cell-scaffold adhesion dynamics ... *ACS applied materials & interfaces*, 2015, vol. 7, no. 12, 6782-6791

URBANČIČ, Iztok, LJUBETIČ, Ajasja, ŠTRANCAR, Janez. Resolving internal motional correlations ... *The journal of physical chemistry letters*, 2014, vol. 5, no. 20, 3593-3600.

ARSOV, Zoran, URBANČIČ, Iztok, GARVAS, Maja, BIGLINO, Daniele, LJUBETIČ, Ajasja, KOKLIČ, Tilen, ŠTRANCAR, Janez. Fluorescence microspectroscopy ... *Biomedical optics express*, 2011, vol. 2, no. 8, 2083-2095

KAVALENKA, Aleh A., URBANČIČ, Iztok, KURE, Sandra, ŠTRANCAR, Janez, et al. Conformational analysis ... *Biophysical journal*, 2010, vol. 98, no. 6, 1055-1064

BELLE, Valerie, ŠTRANCAR, Janez, et al. Mapping α -helical induced folding ... *Proteins*, 2008, issue 4, vol. 73, 973-988

KAISERSBERGER VINCEK, Maja, ŠTRANCAR, Janez, KOKOL, Vanja. Antibacterial activity of chemically versus enzymatic functionalized wool with [xi]-poly-L-lysine. *Textile research journal*,

ISSN 0040-5175, Published online before print July 5, 2016, str. 1-16. <http://trj.sagepub.com/content/early/2016/07/05/0040517516657060>, doi: [10.1177/0040517516657060](https://doi.org/10.1177/0040517516657060). [COBISS.SI-ID 19666710]

JAUŠOVEC, Darja, BOŽIČ, Mojca, KOVAČ, Janez, ŠTRANCAR, Janez, KOKOL, Vanja. Synergies of phenolic-acids' surface-modified titanate nanotubes (TiNT) for enhanced photo-catalytic activities. *Journal of colloid and interface science*, ISSN 0021-9797, 2015, vol. 438, str. 277-290. <http://www.sciencedirect.com/science/article/pii/S0021979714007401#>, doi: [10.1016/j.jcis.2014.09.081](https://doi.org/10.1016/j.jcis.2014.09.081). [COBISS.SI-ID 18155542]

GARVAS, Maja, TESTEN, Anže, UMEK, Polona, GLOTER, Alexandre, KOKLIČ, Tilen, ŠTRANCAR, Janez. Protein corona prevents TiO₂ phototoxicity. *PloS one*, ISSN 1932-6203, 2015, vol. 10, no. 6, str. e0129577-1- e0129577-17. <http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0129577&representation=PDF>, doi: [10.1371/journal.pone.0129577](https://doi.org/10.1371/journal.pone.0129577). [COBISS.SI-ID 28666407]

PODLIPEC, Rok, GORGIEVA, Selestina, JURAŠIN, Darija, URBANČIČ, Iztok, KOKOL, Vanja, ŠTRANCAR, Janez. Molecular mobility of scaffolds' biopolymers influences cell growth. *ACS applied materials & interfaces*, ISSN 1944-8244. [Print ed.], 2014, vol. 6, iss. 18, str. 15980-15990, doi: [10.1021/am5037719](https://doi.org/10.1021/am5037719). [COBISS.SI-ID 18043926]