



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:

Vaje / Tutorial:

slovenski/Slovene

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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.
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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.

Načini ocenjevanja:

Delež (v %) /

Weight (in %)

Assessment:

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

Reference nosilca / Lecturer's references:

ŠTRANCAR, Janez, PODLIPEC, Rok, URBANČIČ, Iztok, ARSOV, Zoran, VREČKO, Andrej. Image-processing apparatus and image-processing method for detection of irregularities in tissue = Bildverarbeitungsvorrichtung und Bildverarbeitungsverfahren zur Erkennung von Unregelmässigkeiten in Gewebe = Appareil de traitement d'image et procédé de traitement d'image pour la détection d'irrégularités dans un tissu : European patent specification EP 3 755 994 B1, 2021-05-26. Munich: European Patent Office, 2021. 23 str., ilustr.
<https://worldwide.espacenet.com/patent/search/family/061768379/publication/EP3755994B1?q=EP3755994%20B1>. [COBISS.SI-ID 31223079]

KOKOT, Hana, KOKOT, Boštjan, SEBASTIJANOVIĆ, Aleksandar, PODLIPEC, Rok, KRIŠELJ, Ana, ČOTAR, Petra, PUŠNIK, Mojca, UMEK, Polona, PAJK, Stane, URBANČIČ, Iztok, KOKLIČ, Tilen, ŠTRANCAR, Janez, et al. Prediction of chronic inflammation for inhaled particles : the impact of material cycling and quarantining in the lung epithelium. Advanced materials. [Online ed.]. 2020, vol. 32, no. 47, str. 2003913-1-2003913-15. ISSN 1521-4095. DOI: 10.1002/adma.202003913. [COBISS.SI-ID 39713539]

KOKOT, Boštjan, KOKOT, Hana, UMEK, Polona, VAN MIDDEN, Katarina Petra, PAJK, Stane, GARVAS, Maja, EGGELING, Christian, KOKLIČ, Tilen, URBANČIČ, Iztok, ŠTRANCAR, Janez. How to control fluorescent labeling of metal oxide nanoparticles for artefact-free live cell

microscopy. Nanotechnology, ISSN 1361-6528, 2021, vol. 15, no. 8, str. 1102-1123,
doi: 10.1080/17435390.2021.1973607.