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, 3rd 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:	**Prerequisits:**
Vsaka obveznost študenta v načinih ocenjevanja mora biti opravljena s pozitivno oceno.	Each student requirement within the assessment methods must be completed with a passing grade.

Vsebina:	**Content (Syllabus outline):**
- Zlivanje lipidnih vesiklov in biomembran	- Liposome-Cell Membrane fusion
- Vpliv biokorone na interakcijo med nanodelci in membranami	- Effect of biocorona on interaction between nanoparticles and membranes
- Ovijanje nanodelcev z lipidi	- Lipid wrapping of nanoparticles
- Prenos lipofilnih substanc s trdnimi lipidnimi nanodelci	- Lipophilic substances transport with solid lipid nanoparticles
	- Antibacterial protection with nanomaterials

- Antibakterijska zaščita opreme z nanomateriali - 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	- Guanisin complex - cell interaction - 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:

Israelachvili, J. N. (1991). *Intermolecular and surface forces* (2nd ed., str. XXI, 450). Academic Press. https://plus.cobiss.net/cobiss/si/sl/bib/pefmb/88858

Juhi, S. (2023). *Nanobiotechnology: Principles and Applications*. Bentham Science Publishers Ltd **Celotno besedilo dostopno v EBSCOhost Ebook Academic Collection - World Wide**

SEBASTIJANOVIĆ, Aleksandar, AZZURRA CAMASSA, Laura Maria, MALMBORG, Vilhelm, KRALJ, Slavko, PAGELS, Joakim, VOGEL, Ulla, ZIENOLDDINY-NARUI, Shan, URBANČIČ, Iztok, KOKLIČ, Tilen, ŠTRANCAR, Janez. Particulate matter constituents trigger the formation of extracellularamyloid β and tau -containing plaques and neurite shortening in vitro. Nanotoxicology. 2024, vol. 18, iss. 4, str. 335-353, ilustr. ISSN 1743-5404. https://www.tandfonline.com/doi/full/10.1080/17435390.2024.2362367, DOI: 10.1080/17435390.2024.2362367. [COBISS.SI-ID 199841027]

Dodatna:

C. M. Niemeyer and C. A. Mirkin: Nanobiotechnology: Concepts, Applications and Perspectives, Wiley-VCH, 2004

Izbrani znanstveni članki / Selected scientific papers

Cilji in kompetence:	**Objectives and competences:**
Študenti so sposobni sestavljat obstoječa znanja in najnovejše raziskave z lastnim raziskovalnim delom na področju molekularnih znanosti ter nanomaterialov s posebnim poudarkom na interakcijah nanomaterialov z biološkimi sistemi.	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:	**Intended learning outcomes:**

Znanje in razumevanje:	Knowledge and understanding:
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	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
Prenesljive/ključne spretnosti in drugi atributi:	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:	**Learning and teaching methods:**
Predavanja, Problemsko učenje seminar in izdelava seminarske naloge oz članka iz področja interakcij nanomaterialov in bioloških sistemov.	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%**	Seminar paper
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.