



UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Biofizika II
Subject Title:	Biophysics II

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
FIZIKA PHYSICS		1	2

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30	50				250	10

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lecture:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
	Vaje / Tutorial:	<input type="text"/>

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

Ni posebnih zahtev.

Prerequisites:

No special prerequisites.

Vsebina:

Biofizika celice:
- celična membrana: mehanske lastnosti, transportni procesi, mehanizmi in modeli
- biofizikalni modeli celičnih procesov: kislinsko bazno ravnotežje, regulacija volumna celice in homeostaza, skrčitev mišične celice, prenos živčnega impulza
Bioelektromagnetizem:
- električne lastnosti celične membrane, modeli električnih potencialov na membrani
- biomagnetna polja v bioloških sistemih
- vpliv magnetnega polja in elektromagnetnega valovanja/sevanja na človeško telo
Komunikacija v bioloških sistemih:
- modeli bioloških oscilatorjev: metabolične oscilacije, mitotični oscilator, srčni ritem, cirkadiani ritem
- kontrolna analiza in regulacija celičnih procesov
- znotrajcelična signalizacija in medcelična komunikacija; signalne kaskade
Celice sestavljajo organizem:
- Brownovo gibanje in kemotaksa celic
- interakcije med celicami
- izbrani primeri iz medicine: modeli rasti tumorja in imunskih sistemov; krvni obtok in prenos respiratornih plinov
Interakcije celic z nano in mikrosistemi:
- interakcije celic z lipidnimi vesikli in

Content (Syllabus outline):

Cellular Biophysics:
- cell membrane: mechanical properties, transport processes, mechanisms and models
- biophysical models of cellular processes: acid-base equilibrium, cell volume regulation and homeostasis, cell muscle contraction, nerve signal transduction
Bioelectromagnetism:
- electrical properties of cell membrane, models of electric potential across the membrane
-biomagnetic fields in biological systems
- effects of magnetic field and electromagnetic waves / radiation on humans
Communications in biological systems:
- models of biological oscillators: metabolic oscillations, mitotic oscillator, cardiac rhythm, circadian rhythm
- control analysis and regulation of cellular processes
- intracellular signalisation and intercellular communication; signalling cascades
Organism is constructed by cells:
- Brownian motion and chemotaxis of cells
- cell-cell interactions
- selected cases from medicine: models of tumour growth and immune systems, blood circulation and transport of respiratory gases
Interactions between cells and nano and Microsystems:
- cell interactions with lipid vesicles and polyelectrolyte

polielektrolitskimi mikrokapsulami
- hrabreni in ciljni prenašalni sistemi ter mikrosenzorji
- adhezija celic na funkcionalne mejne plasti

microcapsules
- storage and target delivery systems, micro sensors
- cell adhesion on functional interfaces

Temeljni literatura in viri / Textbook:

1. J.A. Tuszynski : Molecullar and Cellular Biophysics (Pure and Applied Physics), Chapman & Hall / CRC Press, Boca Raton 2007
2. A. Goldbeter: Biochemical Oscillations and Cellular Rhythms, Cambridge Univ. Press, Cambridge 1996
3. A. Deutsch, J. Howard, M. Falcke, W. Zimmermann (uredniki): Function and Regulation of Cellular Systems, Birkhäuser Verlag, Basel 2004

Cilji:

Študenti poglobijo znanje s področja celične biofizike na trenutno najbolj vročih problemih. Spoznajo pomembnost in moč interdisciplinarnih znanj ter način razmišljanja pri reševanju struktur in funkcij kompleksnih bioloških sistemov na celični in tkivni ravni ter ravni organizma. Spoznajo najnovejše raziskave in delo raziskovalnih skupin na tem področju v regiji.

Objectives:

Students acquire advanced knowledge on molecular biophysics on the current hot topics. Students learn an importance and power of the interdisciplinary skills as well as the way of thinking while resolving structure and function of complex biological systems at cell and tissue level as well as at level of organism. Students get familiar with up-to-date research work and research teams working in that field in the region.

Predvideni študijski rezultati:

Znanja in razumevanja:
Poglobljanje in nadgradnja interdisciplinarnih znanj s področij molekularne in celične biofizike, celične fiziologije in fizikalne biokemije.

Prenosljive/ključne spretnosti in drugi atributi:
Reševanje oz. raziskovanje interdisciplinarnih problemov v bioloških vedah s fizikalnimi in matematičnimi orodji modeliranja. Celosten pristop k reševanju biofizikalnih problemov.

Intended learning outcomes:

Knowledge and Understanding:
Gaining additional knowledge and upgrading interdisciplinary approach in the fields of cell biophysics, cell physiology and physical biochemistry.

Transferable/Key Skills and other attributes:
Solving and exploring interdisciplinary problems in biology sciences with physical and mathematical tools of modelling. Gained global approach on solving a biophysical problem.

Metode poučevanja in učenja:

Predavanja in v seminarju samostojna obravnava izbranih problemov s seminarsko nalogo. Delo z ustreznimi računalniškimi orodji.

Learning and teaching methods:

Lectures, and in seminar, presentation and discussion selected problems in terms of coursework. Work with appropriate computer software tools.

Načini ocenjevanja:

Seminarska naloga
Ustni izpit

Delež (v %) /
Weight (in %)

50
50

Assessment:

Coursework
Oral exam