



OPIS PREDMETA / SUBJECT SPECIFICATION

Predmet:	Izbrana poglavja iz molekularne biofizike
Subject Title:	Selected Topics in Molecular Biophysics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Doktorski študij Ekološke znanosti / Doctoral Study Ecological Sciences		Izbirni 1 ali 2 ali 3	2 ali 3 ali 4 ali 5

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
5	5				140	5

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lecture:	<input type="text" value="slovenski / Slovenian"/>
	Vaje / Tutorial:	<input type="text" value="slovenski / Slovenian"/>

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

Prerequisites:

Vsebina:

Obravnavana so izbrana poglavja iz naslednjih sklopov.

- Kemijske vezi, medatomske in medmolekularne interakcije. Struktura biotskih makromolekul (beljakovine, nukleinske kisline, polisaharidi) in supramolekularnih kompleksov (lipoproteini, biotska membrana). Kooperativna vezava ligandov na makromolekule in alosterični pojavi. Encimske reakcije. Zveza med strukturo in biotsko funkcijo makromolekularnih in supramolekularnih sistemov ter regulacija biotske aktivnosti. Voda, njena struktura in pomen za biotske sisteme. Dinamika konformacijskih sprememb makromolekul.
- Biofizika celičnega skeleta in molekularnih mehanizmov subceličnih dimenzij. Mikrotubuli, mikrofilamenti. Pogonski proteini: miozini, kinezini, dineini; krčenje mišice, mitoza, transport organelov, gibanje bičkov in migetalk.
- Biofizika celične membrane in celice. Struktura biotske celice. Osmozno ravnovesje in kislinsko-bazno ravnotežje. Metabolizem celice. Mehanske lastnosti celične membrane, oblika celice in njene transformacije. Transport skozi celično membrano. Električne osnove vzdružnosti celice in prenos električnega

Content (Syllabus outline):

Selected topics in the following chapters are discussed.

- Chemical bonds, intra- and intermolecular forces. Structure of biotic macromolecules (proteins, nucleic acids, polysaccharides) and supramolecular complexes (lipoproteins, biological membrane). Cooperative ligand binding to macromolecules and allosteric phenomena. Enzymatic reactions. Relation between structure and function of macromolecular and supramolecular systems, regulation of biotic activity. Water, its structure and meaning for biotic systems. Dynamics of conformational changes of macromolecules.
- Biophysics of cytoskeleton and molecular mechanisms of subcellular scales. Microtubules, microfilaments. Motor proteins: myosins, kinesins, dyneins; muscle contraction, mitosis, transport of organelles, cilia and flagella movement. protein motors
- Cell and cell membrane biophysics. Structure of the biotic cell. Osmotic and acid-base equilibrium. Cell metabolism. Mechanical properties of cell membrane; cell shape and its transformation. Transmembrane transports. Electrical base of the cell excitability and

impulza. Znotrajcelična in medcelična signalizacija in komunikacija.

- Pregled nekaterih eksperimentalnih metod v molekularni biofiziki: rentgenska kristalografija, absorpcijska in fluorescenčna spektroskopija, spektroskopske metode NMR in EPR.

propagation of the nerve pulse. Intra- and intercellular signalisation and communications.

- Overview of selected experimental methods in molecular biophysics: X-ray crystallography, absorption and fluorescence spectroscopy, spectroscopic methods NMR and EPR.

Temeljni literatura in viri / Textbooks:

- Dill, K. A., S. Bromberg, 2003: Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology, Garland Science, New York. – Uvodna poglavja / introductory chapters.
- Flyvbjerg, H., J. Hertz, M. H. Jensen, O. G. Mouritsen, K. Sneppen (Eds.), 1997: Physics of Biological Systems from Molecules. to Species; Springer, New York.
- Glaser, R., 2004: Biophysics, Springer, New York.
- Tuszynski, J. A., M. Kurzynski, 2000: Introduction to Molecular Biophysics, CRC Press.
- Univerzitetni učbeniki biokemije in celične biologije / university textbooks of biochemistry and cell biology.

Cilji:

Študent se podrobno seznanj s strukturo in funkcijo biotskih sistemov oziroma njihovih gradnikov na molekularni in makromolekularni ravni, na stopnji supramolekularne organiziranosti, na ravni celice in interakcije med njimi. Celoten kurz temelji na konceptih in metodah teoretične biofizike.

Objectives:

The main aim of the course is to present advanced structure and function of biotic systems with respect to different levels of organisation and complexity, from molecules to the cell and tissue. The approach is based on concepts and methods of theoretical biophysics.

Predvideni študijski rezultati:

Znanje in razumevanje:

- Študenti usvojijo podrobno znanje o strukturi biotskih sistemov in razume njihovo delovanje na osnovi fizikalnih konceptov in zakonitosti

Prenesljive/ključne spretnosti in drugi atributi:

- Študenti znajo uporabiti zahtevna matematična in fizikalna orodja in modele za kvantitativno obravnavo strukture in funkcije biotskih sistemov

Intended learning outcomes:

Knowledge and Understanding:

- Students get advanced knowledge of structure and function of selected biotic systems based on fundamental principles and concepts of physics

Transferable/Key Skills and other attributes:

- Students are able to use complex mathematical and physical tools and models for quantitative studies of structure and function of biotic systems

Metode poučevanja in učenja:

- Predavanja
- Seminar; seminarska naloga z izbranega področja iz biofizike
- Seminarske vaje

Learning and teaching methods:

- Lectures
- Seminar; coursework from selected field in biophysics
- Tutorials

Načini ocenjevanja:

- Seminarska naloga
- Pisni kolkvij
- Ustni izpit

Delež (v %) /
Weight (in %)

30 %
30 %
40 %

Assessment:

- Seminar essay
- Written partial exam
- Oral exam

Materialni pogoji za izvedbo predmeta :

- *Multimedijska predavalnica*

- *Lecture hall for multimedia presentations*

Obveznosti študentov:**Student's commitments:**

- Seminarska naloga
- Pisni kolkvij
- Ustni izpit

- Seminar essay
- Written partial exam
- Oral exam