

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	TEMELJI FIZIOLOGIJE
<b>Course Title:</b>	FUNDAMENTALS OF PHYSIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK121

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Robert Zorec / Dr. Robert Zorec, Full Professor

**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	slovenski / Slovenian
<b>Vaje / Tutorial:</b>	slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	<b>Prerequisites:</b> The course has to be assigned to the student.
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**Vsebina:**

Pri predmetu Temeljna fiziologija študent spozna 1) temelje fizioloških procesov metazojskih evkariontov s poudarkom predstavitve integrativnih mehanizmov. Pridobljeno znanje mu omogoča razumevanje temeljnih življenjskih procesov na ravni molekularnih funkcionalnih modulov v celici, na ravni delovanja posamezne celice, na ravni tkiv, organov in na sistemski ravni. 2) Spozna tudi načela in nekatere tehnologije meritev fizioloških količin, ki prispevajo k homeostazi v organizmu.

Predavanja obravnavajo teme od molekulske in celične ravni, do ravni organov in sistemov. Študenti spoznajo mehanizme homeostaze,

**Content (Syllabus outline):**

At the course Fundamental Physiology the student will learn: 1) basic principles of the physiological processes of the metazoan eukaryotic organism, with the emphasis on the integrative mechanisms. The acquired knowledge will enable students to understand the processes in live matter on the level of the molecular modules in the cell, on the level of the tissue, organs, and on the systemic level. 2) The student will also learn the principles of experimentation and measurement of physiological parameters. The lectures will cover a broad spectrum of topics from molecular and cellular level, to organs and the systemic level. Students will learn mechanisms of homeostasis, historical

zgodovinski vidik fiziologije, temelje transportnih mehanizmov na ravni celice in sistema, nato pa sistematično še mehanizme, ki prispevajo k homeostazi fizioloških količin z obravnavanjem živčnega in endokrinega sistema, mišičja, srca in obtočil, pljuč in pljučnih obtočil, ledvic in uravnavanja telesnih tekočin, acido-baznega ravnotežja, gastrointestinalnega trakta, uravnavanja telesne temperature, procesov staranja na molekularni, celični in sistemski ravni

Na vajah se študenti seznanijo z meritvami nekaterih fizioloških količin in pojavov (transmembranska napetost, akcijski potencial, krvni tlak, kontrakcija mišic, ...) hkrati spoznajo nekatere metode pri fiziološkem raziskovalnem delu. Pri vajah uporabljamo metode, ki so alternativa delu s poskusnimi živalmi (delo na rastlinskih celicah, samostojno delo z računalniško simulacijo poskusov na živalih, posnetki poskusov, preproste neinvazivne metode na človeku).

aspect of physiology, transport mechanisms, nervous and endocrine system, muscles, heart and vasculature, kidney, gastrointestinal tract, control of the body temperature, aging on the molecular, cellular and systemic level.

The practical training will be focused on measurements of selected physiological parameters and processes (e.g.: trans-membrane potential, action potential, blood pressure, muscle contraction). Students will learn selected methods in physiology research. The practical training will be performed using approaches, which are the alternative to the experimental animals, i.e. the use of plant cells, work in silico, video demonstrations, non-invasive measurements on human.

#### **Temeljna literatura in viri / Readings:**

- R. Rhoades in R. Pflanzer. Human Physiology, fourth edition, Saunders College Publishing, Harcourt College Publishers, 2003. (30%) ISBN-10: 0534462510
- Optional in Slovenian language: »Temelji fiziologije – Navodila za vaje, 2. popravljena in dopolnjena izd. 2012« authors, Marko Kreft, Helena Chowdhury in Robert Zorec. ISBN 978-961-91257-7-9

#### **Cilji in kompetence:**

Cilji predmeta so naučiti študente temeljev procesov v metazojskih evkariontskih organizmih, ki prispevajo k homeostazi. Kompetence študenta bodo poznavanje načel in nekaterih tehnologij meritev fizioloških količin, ki prispevajo k homeostazi v organizmu.

#### **Objectives and Competences:**

Students will learn the principles and selected methodologies in physiology. Competences will include principles of measurement in physiology, and understanding of homeostasis.

#### **Predvideni študijski rezultati:**

##### Znanje in razumevanje

Pri predmetu Temelji fiziologije študent spozna temelje fizioloških procesov metazojskih evkariontov. Spozna tudi načela in nekatere tehnologije meritev fizioloških količin. Pridobljeno znanje mu omogoča razumevanje temeljnih življenjskih procesov

#### **Intended Learning Outcomes:**

##### Knowledge and Comprehension

The outcome of the course will be acquired knowledge of the fundamental processes in the metazoan eukaryotic organism, which are essential in homeostasis in the level of molecular functional modules in the cell, the level of cellular processes and processes in

na ravni molekularnih funkcionalnih modulov v celici, na ravni delovanja posamezne celice, na ravni tkiv, organov in na sistemski ravni.	tissue, organ and organism.
<u>Uporaba</u> Študij predmeta Temelji fiziologije je nujna podlaga za razumevanje procesov v organizmih, ti pa so ključni za bioinženirstvo in mnoga druga strokovna področja biomedicine in biotehnologije.	<u>Application</u> The course is essential background for understanding processes in living organisms, which are critical in bioengineering, biomedicine and biotechnology.
<u>Refleksija</u> Študent pridobi vpogled v procese v bioloških organizmih in pridobi razumevanje homeostaze.	<u>Analysis</u> Student will learn principles of physiology in all living organisms and will understand homeostasis.
<u>Prenosljive spretnosti</u> Študent spozna temelje eksperimentalnega dela v fiziologiji in bioloških znanostih, spozna različne fiziološke količine, ki jih lahko merimo, analiziramo in interpretiramo rezultate.	<u>Skill-transference Ability</u> Student will learn basics of experimental work in physiology, biosciences. They will learn measurements of biological variables, analysis and interpretation of data.

#### Metode poučevanja in učenja:

Predavanja, laboratorijske vaje, seminarji, simulacije eksperimentov.

#### Learning and Teaching Methods:

Lectures, seminars, practical training.

#### Načini ocenjevanja:

Izpit (ustni in pisni) (ocena > 6)  
Seminarska naloga.  
Kolokvij iz vaj.

Delež (v %) /  
Weight (in %)

#### Assessment:

Oral and written exam  
Seminar work.  
Practical courses.

#### Reference nosilca / Lecturer's references:

- RITUPER, Boštjan, CHOWDHURY HAQUE, Helena, JORGAČEVSKI, Jernej, COORSEN, Jens R., KREFT, Marko, **ZOREC, Robert**. Cholesterol-mediated membrane surface area dynamics in neuroendocrine cells. *Biochimica et biophysica acta. Molecular and cell biology of lipids*, ISSN 1388-1981, Jul. 2013, vol. 1831, iss. 7, str. 1228-1238

- MILOŠEVIĆ, Milena, STENOVEC, Matjaž, KREFT, Marko, PETRUŠIĆ, Vladimir, STEVIĆ, Zorica, TRKOV, Saša, ANDJUS, Pavle, **ZOREC, Robert**. Immunoglobulins G from patients with sporadic amyotrophic lateral sclerosis affects cytosolic Ca<sup>2+</sup> homeostasis in cultured rat astrocytes. *Cell calcium*, ISSN 0143-4160, Jul. 2013, vol. 54, iss. 1, str. 17-25.

- POTOKAR, Maja, STENOVEC, Matjaž, JORGAČEVSKI, Jernej, HOLEN, Torgeir, KREFT, Marko, OTTERSEN, Ole Petter, **ZOREC, Robert**. Regulation of AQP4 surface expression via vesicle mobility in astrocytes. *Glia*, ISSN 0894-1491, Jun. 2013, vol. 61, iss. 6, str. 917-928, ilustr., doi: 10.1002/glia.22485.

- COSTA CALEJO, Ana-Isabel, JORGAČEVSKI, Jernej, KUCKA, Marek, KREFT, Marko, GONÇALVES, Paula P., STOJILKOVIĆ, Stanko, **ZOREC, Robert**. cAMP-mediated stabilization of fusion pores in cultured rat pituitary lactotrophs. *The Journal of neuroscience*, ISSN 0270-6474, May 2013, vol. 33, iss. 18, str. 8068-8078, ilustr., doi:10.1523/JNEUROSCI.5351-12.2013.

- FLAŠKER, Ajda, JORGAČEVSKI, Jernej, COSTA CALEJO, Ana-Isabel, KREFT, Marko, **ZOREC, Robert**.

Vesicle size determines unitary exocytic properties and their sensitivity to sphingosine. *Molecular and cellular endocrinology*, ISSN 0303-7207. [Print ed.], 2013, vol. 376, iss. 1/2, str. 136-147,

- RITUPER, Boštjan, GUČEK, Alenka, JORGAČEVSKI, Jernej, FLAŠKER, Ajda, KREFT, Marko, **ZOREC, Robert**. High-resolution membrane capacitance measurements for the study of exocytosis and endocytosis. *Nature protocols*, ISSN 1754-2189, 2013, vol. 8, no. 6, str. 1169-1183, ilustr., doi: 10.1038/nprot.2013.069.

- JORGAČEVSKI, Jernej, KREFT, Marko, VARDJAN, Nina, **ZOREC, Robert**. Fusion pore regulation in peptidergic vesicles. *Cell calcium*, ISSN 0143-4160, 2012, vol. 52, iss. 3/4, str. 270-276, doi: 10.1016/j.ceca.2012.04.008.

- JORGAČEVSKI, Jernej, POTOKAR, Maja, GRILC, Sonja, KREFT, Marko, **ZOREC, Robert**, et al. Munc 18-1 tuning of vesicle merger and fusion pore properties. *The Journal of neuroscience*, ISSN 0270-6474, 2011, vol. 31, issue 24, str. 9055-9066, doi: 10.1523/JNEUROSCI.0185-11.2011.

- VELEBIT MARKOVIĆ, Jelena, CHOWDHURY HAQUE, Helena, KREFT, Marko, **ZOREC, Robert**. Rosiglitazone balances insulin-induced exo- and endocytosis in single 3T3-L1 adipocytes. *Molecular and cellular endocrinology*, ISSN 0303-7207. [Print ed.], 2011, vol. 333, issue 1, str. 70-77, doi: 10.1016/j.mce.2010.12.014.

- JORGAČEVSKI, Jernej, FOŠNARIČ, Miha, VARDJAN, Nina, STENOVEC, Matjaž, POTOKAR, Maja, KREFT, Marko, KRALJ-IGLIČ, Veronika, IGLIČ, Aleš, **ZOREC, Robert**. Fusion pore stability of peptidergic vesicles. *Molecular membrane biology*, ISSN 0968-7688, 2010, letn. 27, št. 2/3, str. 65-80, doi: 10.3109/09687681003597104.