



Univerza v Mariboru

Medicinska fakulteta

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Ime predmeta:</b>	<b>Celična fiziologija</b>							
<b>Course title:</b>	<b>Cell Physiology</b>							
<b>Študijski program in stopnja</b> <b>Study programme and cycle</b>	<b>Študijska smer</b> <b>Study option</b>			<b>Letnik</b> <b>Year of study</b>	<b>Semester</b> <b>Semester</b>			
Biomedicinska tehnologija/3. stopnja				2	3 ali 4			
Biomedical Technology/3rd Degree								
<b>Vrsta predmeta (obvezni ali izbirni) /</b> <b>Course type (compulsory or elective)</b>				Izbirni Elective				
<b>Univerzitetna koda predmeta / University course code:</b>								
<b>Predavanja</b> <b>Lectures</b>	<b>Seminar</b> <b>Seminar</b>	<b>Vaje</b> <b>Tutorial</b>			<b>Klinične vaje</b> <b>Clinical training</b>	<b>Druge oblike študija</b> <b>Other forms of study</b>	<b>Samost. delo</b> <b>Individual work</b>	<b>ECTS</b>
15	20	10					135	6
		AV	LV	RV				
<b>Nosilec predmeta / Course coordinator:</b>	Izr. prof. dr. Andraž Stožer Doc. dr. Maša Skelin Klemen							
<b>Jeziki /Languages:</b>	<b>Predavanja / Lectures:</b>		Slovenščina/Slovene					
	<b>Vaje / Tutorial:</b>		Slovenščina/Slovene					
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>	<b>Prerequisites for enrolling in the course or for performing study obligations:</b>							
<b>Vsebina (kratek pregled učnega načrta):</b>	<b>Content (syllabus outline):</b>							
Uvod v celično fiziologijo Zunaj- in znotrajcelične signalne poti Metode za študij funkcije ionskih kanalov Ionski kanalčki in transporterji v biološki membrani Homeostaza citosolnega kalcija in drugih ionov Mikrospektrofluorimetrija in dinamično slikanje anionov in kationov v posamezni celici Molekularni mehanizmi uravnavanja vezikularnega transporta snovi Pristopi za študij sekrecije hormonov in neurotransmitorjev Membranski receptorji Določanje fiziološke vloge identificiranih in kloniranih rekombinantnih beljakovin na ravni posamezne celice	Introduction to cell physiology Extra- and intracellular signalling Methods to study ion channel function Ion channels and transporters in biological membrane Homeostasis of cell calcium and other ions Mikrospectrofluorometry and functional imaging of anions and cations in a single cell Molecular mechanisms of regulation of vesicular transport Approaches to study the release of hormones and neurotransmitters Membrane receptors Determination of the physiological role of identified and cloned recombinant proteins on a single cell level							

<p>Uporaba laboratorijskih živali in njihovih tkiv ter človeških tkiv v celični fiziologiji: biološki, organizacijski in pravni okvirji.</p>	<p>Use of laboratory animals and their tissues, as well as human tissues in cell physiology: biological, organizational, and legislative aspects.</p>
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**Temeljna literatura in viri / Reading materials:**

**Temeljna literatura in viri / Readings:**

- B Alberts, AD Johnson et al. **Molecular biology of the cell**. 6th Ed, WW Norton & Company, 2014, ISBN 978-0815344322
- WF Boron, EL Boulpaep. **Medical Physiology**. 3rd Ed, Elsevier, 2016, ISBN 978-1455743773

**Dodatna literatura in viri/Additional literature and sources:**

**Visokošolski učbeniki / Textbooks**

- B Sakmann, E Neher. Single-channel recording, 2nd Ed, Springer 1995, ISBN 978-0306448706
- D Ogden. Microelectrode techniques. 2ed, The Company of Biologist Limited, Cambridge 1994, ISBN 978-0948601491
- Sperelakis N. Cell Physiology Sourcebook, 4th Ed, Academic Press 2011, ISBN 9780123877383
- Ashcroft FM. Ion channels and disease, 1st Ed. Academic press, 1999, ISBN 9780120653102
- **Izvirni in pregledni članki / Original and review papers**
- STOŽER, Andraž. Nernstov potencial in ohmski model membranskega potenciala = Nernst potential and the Ohmic model of membrane potential. Medicinski razgledi : [medicinski pregledni, strokovni in raziskovalni članki], ISSN 0025-8121. [Tiskana izd.], jun. 2014, letn. 53, št. 2, str. 193-202. [COBISS.SI-ID 512415288]
- STOŽER, Andraž, DOLENŠEK, Jurij, SKELIN, Maša, RUPNIK, Marjan. Cell physiology in tissue slices : studying beta cells in the islets of Langerhans = Celična fiziologija v tkivnih rezinah : preučevanje celic beta v Langerhansovih otočkih. Acta medico-biotechnica : AMB, ISSN 1855-5640. [Tiskana izd.], 2013, vol. 6, [no.] 1, str. 20-32, ilustr. [http://www.actamedbio.mf.uni-mb.si/03\\_10id\\_amb\\_97\\_13\\_v2.pdf](http://www.actamedbio.mf.uni-mb.si/03_10id_amb_97_13_v2.pdf). [COBISS.SI-ID 512298296]
- SKELIN, Maša. Akcijski potencial = Action potential. Medicinski razgledi : [medicinski pregledni, strokovni in raziskovalni članki], ISSN 0025-8121. [Tiskana izd.], jun. 2014, letn. 53, št. 2, str. 203-217, ilustr. [COBISS.SI-ID 512415544]
- DOLENŠEK, Jurij, POHOREC, Viljem, RUPNIK, Marjan, STOŽER, Andraž. Pancreas physiology. V: SEICEAN, Andrada (ur.). Challenges in pancreatic pathology. Rijeka: InTech. cop. 2017, str. [19]-52, ilustr. <https://cdn.intechopen.com/pdfs-wm/53020.pdf>, doi: 10.5772/65895. [COBISS.SI-ID 512723000]
- SKELIN, Maša, DOLENŠEK, Jurij, RUPNIK, Marjan, STOŽER, Andraž. The triggering pathway to insulin secretion : functional similarities and differences between the human and the mouse [beta] cells and their translational relevance. Islets, ISSN 1938-2022, 2017, vol. 9, no. 6, str. 109-139, ilustr. <http://www.tandfonline.com/doi/full/10.1080/19382014.2017.1342022>, doi: 10.1080/19382014.2017.1342022. [COBISS.SI-ID 512726328]
- DOLENŠEK, Jurij, ŠPELIČ, Denis, SKELIN, Maša, ŽALIK, Borut, GOSAK, Marko, RUPNIK, Marjan, STOŽER, Andraž. Membrane potential and calcium dynamics in beta cells from mouse pancreas tissue slices : theory, experimentation, and analysis. Sensors, ISSN 1424-8220, 2015, vol. 15, iss. 11, str. 27393-27419, ilustr. <http://www.mdpi.com/1424-8220/15/11/27393>, doi: 10.3390/s151127393. [COBISS.SI-ID 512558136]
- DOLENŠEK, Jurij, SKELIN, Maša, RUPNIK, Marjan. Calcium dependencies of regulated exocytosis in different endocrine cells. Physiological research, ISSN 0862-8408, 2011, vol. 60, iss. Suppl. 1, str. S29-S38. [http://www.biomed.cas.cz/physiolres/pdf/60%20Suppl%201/60\\_S29.pdf](http://www.biomed.cas.cz/physiolres/pdf/60%20Suppl%201/60_S29.pdf). [COBISS.SI-ID 512147512]
- Druga tekoča periodika, predvsem v revijah Molecular and cellular endocrinology, Physiological Reviews, Trends in Endocrinology and Metabolism, Endocrine Reviews, The Lancet Diabetes and

Endocrinology, Diabetes, Diabetologia, Molecular Endocrinology, Endocrinology, Journal of Endocrinology, Islets, Diabetes, Obesity and Metabolism.		
<b>Cilji in kompetence:</b>	<b>Objectives and competences:</b>	
Poglavitni cilj predmeta je poglobljanje znanja o primarnih fizioloških procesih na celični ravni v normalnih in bolezenskih razmerah. Osrednji predmet preučevanja so procesi, ki potekajo na celičnih membranah in z njimi povezane signalne poti v celici in glavne tarče teh signalnih procesov, predvsem kontraktilni elementi in eksocitotoksi vezikli v električno vzdražnih in nevzdražnih celicah. Preučevanje genetskih in okoljskih patofizioloških sprememb v navedenih poteh predmetu dodaja veliko klinično relevantnost.	The major aim of the course is to gain in-depth knowledge about primary physiological processes at the single cell level in normal and diseased conditions. The main focus are the processes on the cellular membranes and the associated intracellular signalling pathways, as well as their main targets, more specifically the contractile elements and exocytotic vesicles in electrically excitable and non-excitable cells. Studying genetic and environmental changes in the above pathway adds clinical relevance to the subject.	
<b>Predvideni študijski rezultati:</b>	<b>Intended learning outcomes:</b>	
<b>Znanje in razumevanje:</b> Poglobljeno znanje o fiziologiji celične membrane in poglavitnih ionskih kanalih. Razumevanje metod, ki se uporabljajo v celični fiziologiji.	<b>Knowledge and understanding:</b> In-depth knowledge about physiology of the cell membrane and major ion channels types. Understanding the methods used in cell physiology.	
<b>Prenosljive/ključne spretnosti in drugi atributi:</b> Potencialni transfer znanja v farmacevtsko industrijo. Študent pridobi ustrezno teoretično znanje in praktične veščine, uporabne v številnih drugih laboratorijih za vede o življenju. Osvoji ustrezno nomenklaturo, pregled nad literaturo in vrsto podatkov in načine prikazovanja in interpretacije rezultatov, ki vključuje tudi statistično interpretacijo rezultatov. Kritično razmišljanje, timsko delo, kreativnost, ustno in pisno komuniciranje, reševanje problemov in samokontrola.	<b>Transferable/key competences and other abilities:</b> Potential transfer of knowledge into the pharmaceutical industry. Student gets suitable theoretical knowledge and practical skills that can be used in many other life science laboratories. She learns the relevant vocabulary, receives an overview over the literature in the field, the nature of data, their visualization, and interpretation that includes statistical interpretation. Critical thinking, teamwork, creativity, oral and written communication, problem solving and self-control.	
<b>Metode poučevanja in učenja:</b>	<b>Learning and teaching methods:</b>	
Predavanja Seminarji Vaje (demonstracija in laboratorijski nadzor) Samostojno delo	Lectures Seminars Tutorial (practicals with demonstrations and laboratory supervision) Individual work	
<b>Načini ocenjevanja:</b>	<b>Delež (v %) / Share (in %)</b>	<b>Assessment methods:</b>
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Method (written or oral exam, coursework, project):
Seminar – pregledni članek	<b>50 %</b>	Seminar – review article
Izvedene praktične vaje - projekt	<b>50 %</b>	Successfully conducted practical tutorial – project work

**Reference nosilca / Course coordinator's references:**

**Izr. prof. dr. Andraž STOŽER:**

STOŽER, Andraž, HOJS, Radovan, DOLENŠEK, Jurij. Beta cell functional adaptation and dysfunction in insulin resistance and the role of chronic kidney disease. *Nephron journals*, ISSN 2235-3186, 2019, vol. 143, no. 1, str. 33-37, ilustr. <https://www.karger.com/Article/FullText/495665>, doi: 10.1159/000495665. [COBISS.SI-ID 512876344], [JCR, SNIP, WoS do 10. 8. 2020: št. citatov (TC): 5, čistih citatov (CI): 3, čistih citatov na avtorja (CIAu): 1.00, Scopus do 10. 8. 2020: št. citatov (TC): 4, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.67] kategorija: 1A2

PERC, Matjaž, GORIŠEK MIKSIĆ, Nina, SLAVINEC, Mitja, STOŽER, Andraž. Forecasting COVID-19. *Frontiers in physics*, ISSN 2296-424X, Apr. 2020, vol. 8, art. no. 127, str. 1-5. <https://dk.um.si/IzpisGradiva.php?id=78160>, doi: 10.3389/fphy.2020.00127. [COBISS.SI-ID 25194760], [JCR, SNIP, WoS do 6. 6. 2021: št. citatov (TC): 67, čistih citatov (CI): 67, čistih citatov na avtorja (CIAu): 16.75, Scopus do 9. 6. 2021: št. citatov (TC): 81, čistih citatov (CI): 81, čistih citatov na avtorja (CIAu): 20.25] f financier: ARRS, Programi, IO-0029, SI, Infrastruktura dejavnost Univerze v Mariboru kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICM točke: 23.27, št. avtorjev: 4

STOŽER, Andraž, DOLENŠEK, Jurij, KRIŽANČIĆ BOMBEEK, Lidija, GOSAK, Marko, SKELIN, Maša. Calcium imaging. V: WALTER, Andreas (ur.), MANNHEIM, Julia G. (ur.), CARUANA, Carmel J. (ur.). *Imaging modalities for biological and preclinical research. Volume 1, Ex vivo biological imaging, (IPEM-IOP series in physics and engineering in medicine and biology)*. Bristol: IOP Publishing. 2021, str. I.1.e-1-I.1.e-13, ilustr. <https://iopscience.iop.org/book/978-0-7503-3059-6/chapter/bk978-0-7503-3059-6ch5>, doi: 10.1088/978-0-7503-3059-6ch5. [COBISS.SI-ID 65410819] kategorija: 3C (Z); tip dela še ni verificiran točke: 4, št. avtorjev: 5

**Doc. dr. Maša SKELIN KLEMEN:**

STOŽER, Andraž, DOLENŠEK, Jurij, KRIŽANČIĆ BOMBEEK, Lidija, POHOREC, Viljem, RUPNIK, Marjan, SKELIN, Maša. Confocal laser scanning microscopy of calcium dynamics in acute mouse pancreatic tissue slices. *Journal of visualized experiments*, ISSN 1940-087X, Apr. 2021, vol. 170, str. 1-26. <https://www.jove.com/t/62293/confocal-laser-scanning-microscopy-calcium-dynamics-acute-mouse>, doi: 10.3791/62293. [COBISS.SI-ID 62209795], [JCR, SNIP, WoS do 28. 5. 2021: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0]; AustrianScience Fund / Fonds zur Förderung der Wissenschaftlichen Forschung (bilateral grants I3562--B27 and I4319--B30 kategorija: 1A3 (Z); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICM točke: 11.25, št. avtorjev: 6

STOŽER, Andraž, PARADIŽ, Eva, POHOREC, Viljem, DOLENŠEK, Jurij, KRIŽANČIĆ BOMBEEK, Lidija, GOSAK, Marko, SKELIN, Maša. The role of cAMP in beta cell stimulus-secretion and intercellular coupling. *Cells*, ISSN 2073-4409, 2021, vol. 10, str. 1-26, ilustr. <https://www.mdpi.com/2073-4409/10/7/1658>, doi: 10.3390/cells10071658. [COBISS.SI-ID 70397955], [JCR, WoS do 4. 8. 2021: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, MBP; tip dela še ni verificiran točke: 12.5, št. avtorjev: 7

STOŽER, Andraž, DOLENŠEK, Jurij, KRIŽANČIĆ BOMBEEK, Lidija, GOSAK, Marko, SKELIN, Maša. Calcium imaging. V: WALTER, Andreas (ur.), MANNHEIM, Julia G. (ur.), CARUANA, Carmel J. (ur.). *Imaging modalities for biological and preclinical research. Volume 1, Ex vivo biological imaging, (IPEM-IOP series in physics and engineering in medicine and biology)*. Bristol: IOP Publishing. 2021, str. I.1.e-1-I.1.e-13, ilustr. <https://iopscience.iop.org/book/978-0-7503-3059-6/chapter/bk978-0-7503-3059-6ch5>, doi: 10.1088/978-0-7503-3059-6ch5. [COBISS.SI-ID 65410819] kategorija: 3C (Z); tip dela še ni verificiran točke: 4, št. avtorjev: 5