

AKUSTIČNE MERILNE METODE V GOZDARSTVU, LESARSTVU IN GRADNJI Z LESOM

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Akustične merilne metode v gozdarstvu, lesarstvu in gradnji z lesom
Course title:	Acoustic measurement methods in the forestry, wood industry and in building with wood
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643575

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	15	0	0	80	5

Nosilec predmeta/Lecturer: Aleš Straže

Izvajalci predavanj: Aleš Straže, Jure Žigon
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični /theoretical

Jeziki/Languages: Predavanja/Lectures: Angleščina, Slovenščina
Vaje/Tutorial: Angleščina, Slovenščina

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

Prerequisites:

Splošni pogoji za vpis na doktorski študij Basic preconditions for doctoral studies

Vsebina:

Content (Syllabus outline):

Les je naravna ligno-celulozna snov, v tehničnem smislu pa anizotropni polimerni kompozit, s širokim spektrom uporabe. Variabilnost in nehomogenost zgradbe lesa, znotraj in med drevesnimi vrstami, odvisna tudi od socio-fizioloških in drugih zunanjih naravnih dejavnikov, zahteva učinkovito, hitro in neinvazivno merjenje njegovih relevantnih

Wood is a natural, lignocellulosic material, in the technical sense an anisotropic polymer composite, with a wide range of uses. The variability and inhomogeneity of wood structure within and between tree species, which also depends on sociophysiological and other external natural factors, requires effective, rapid, and noninvasive

<p>materialnih lastnosti. Potrebe po spremljanju lastnosti lesa segajo od stoječih dreves v gozdnih sestojih, kot tudi pri urbanem drevju, preko predelovalno-obdelovalnih postopkov, vse do končnih izdelkov. Neinvazivne tehnike in metode, zasnovane na osnovi merjenja vibro-mehanskega odziva materiala, predstavljajo objektivno osnovo, ter hitro in učinkovito spremljanje lastnosti materiala, kot tudi monitoringa končnih lesnih in ligno-celuloznih kompozitnih produktov.</p> <p>Namen predmeta je študentom doktorskega študija predstaviti akustične tehnike in metode, v slušnem, ultrazvočnem ter infrazvočnem področju, ki so na voljo na Oddelku za lesarstvo. Študent bo pridobil pregled ultrazvočnih tehnik, vibro-resonančnih tehnik in tehnik frekvenčnega odziva. Podrobneje se bo seznanil z akustično tomografijo in aplikacijami v gozdarstvu, za oceno kakovosti stoječih dreves in gozdno-lesnih sortimentov, v arboristiki, za evidentiranje notranjih strukturnih anomalij dreves, ter v gradnji z lesom, pri proučevanju nosilnih konstrukcijskih prerezov. Predstavljene bodo metode modalne analize pri vibro-resonančnih tehnikah za proučevanje elastomehanskih lastnosti lesa in lesnih kompozitov, za potrebe zasnove in izdelave lesenih glasbenih instrumentov ter gradnjo z lesom. Predstavljane bodo ultrazvočne analize tehnike za potrebe določanja elasto-mehanske anizotropije ter strukturnih anomalij masivnega lesa in lesnih kompozitov. Predstavljene bodo tudi tehnike spremljanja in analize akustične emisije, ki so skupaj z ultrazvočnimi tehnikami še posebej aktualne za monitoring in nadzor konstrukcijskih sklopov pri gradnji z lesom.</p> <p>Akustične merilne tehnike bodo predstavljene s strani izvajalcev predmeta, ki te metode redno uporabljajo pri svojem raziskovalnem delu. Študent bo v dogovoru z nosilcem predmeta in delovnim/predvidenim mentorjem lahko izbral nekaj relevantnih tehnik in metod, jih teoretično in praktično osvojil ter uporabil na izbranem problemu, ki bo povezan s temo predvidene doktorske disertacije.</p>	<p>measurement of relevant material properties. The need for monitoring wood properties ranges from standing trees in forest stands and trees in urban areas to processing, processing methods, and end products. Non-invasive techniques and methods based on the measurement of the vibromechanical response of the material provide an objective basis and enable rapid and effective monitoring of material properties and end products from wood and lignocellulosic composites.</p> <p>The objective of this course is to familiarize students with the acoustic techniques and methods in sound, ultrasound, and infrasound available in the Department of Wood Science and Technology. Students will receive an overview of ultrasonic techniques, vibro-resonance techniques, and frequency response techniques. They will learn about acoustic tomography and its applications in forestry for quality assessment of standing trees and forest assortments, in arboriculture for detection of internal structural anomalies of trees, and in timber construction for investigation of load-bearing structural cross sections. Methods of modal analysis using vibro-resonance techniques will be explored for the study of elastomechanical properties of wood and wood-based composites, for the needs of wooden musical instrument manufacturing and building with wood. Ultrasonic analysis techniques for determining elastomechanical anisotropy and structural anomalies of solid wood and wood-based composites will be presented. Techniques for monitoring and analysing acoustic emissions will be also presented, which in conjunction with ultrasonic techniques are particularly important for monitoring and testing assemblies in timber constructions.</p> <p>Acoustic measurement techniques will be presented by professional experts who regularly use these methods in their research work. The student will be able to select some relevant techniques and methods, master them theoretically and practically, and will be qualified to apply them to the chosen problem related to the topic of the proposed doctoral dissertation.</p>
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Temeljna literatura in viri/Readings:

Bucur, V. 2003. Nondestructive Characterization and Imaging of Wood. Springer. Berlin. 354 str.
 Bucur, V. 2006. Acoustics of wood. Springer Series in Wood Science. Springer-Verlag, Berlin. 393 str.
 Ross, R. 2015. Nondestructive Evaluation of wood. Forest Producty Laboratory, Madison, 169 str.

Dodatna literatura in viri/Additional readings:

Ross, R. 2015. Nondestructive Evaluation of wood. Forest Producty Laboratory, Madison, 169 str.

Povezava: <https://www.fs.usda.gov/research/treesearch/48688> ; <https://doi.org/10.2737/FPL-GTR-238>

Študentom bo na razpolago gradivo s predavanj in vaj v elektronski obliki. Gradivo bo objavljeno pred začetkom predavanj na spletni strani. Za izdelavo seminarskih nalog in nadgradnjo razumevanja vsebin bodo študentje uporabili tudi svetovni splet

Cilji in kompetence:

Objectives and competences:

<p>Cilj predmeta je seznaniti slušatelje z akustičnimi merilnimi metodami za analizo lesa, lesnih kompozitov in vrednotenje ter monitoring izbranih končnih produktov. Študentom bomo predstavili tako teoretične osnove, kot tudi aplikacije akustičnih merilnih metod v celotni gozdno-lesni verigi. V okviru predmeta se bodo študentje seznanili tako s prednostmi, kot tudi omejitvami posameznih metod.</p> <p><i>Kompetence:</i> Posamezne metode bodo preizkušene na realnem primeru. Te metode bodo študentje sposobni samostojno uporabiti pri nadaljnjem raziskovalnem delu.</p>	<p>The aim of the course is to familiarize students with acoustic measurement techniques for the analysis of wood, lignocellulosic composites, and for the evaluation and monitoring of selected wood-based products. Students will be taught about both, the theoretical principles and the applications of acoustic measurement techniques throughout the entire forest-wood industry value chain. During the course the students will learn both the advantages and limitations of each method.</p> <p><i>Competencies:</i> The individual methods will be tested on a real example. Students will be enabled to apply these methods independently in further research work.</p>
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Predvideni študijski rezultati:

<p><i>Znanje in razumevanje:</i> Spoznati najpomembnejše akustične merilne metode in tehnike, ki so na voljo za analizo lesa in lignoceluloznih kompozitov, ter uporabne v celotni gozdno-lesni verigi, od stoječih dreves v gozdnih sestojih, tekom predelave in obdelave lesa in lignoceluloznih kompozitov, vse do določanja kakovosti in monitoringa končnih izdelkov.</p> <p><i>Refleksija:</i> Kritično ovrednotiti primernost posamezne akustične merilne metode in tehnike za preverjanje raziskovalnih hipotez in doseganje raziskovalnih ciljev.</p> <p><i>Uporaba:</i> Uporabiti izbrane akustične merilne tehnike in metode na lastnem raziskovalnem problemu in jih preizkusiti na praktičnem primeru v gozdnem sestoju, gozdno-lesnem sortimentu, materialu ali pol-izdelku v predelavi in obdelavi, ali na končnem produktu. Naučiti se izbirati ustrezne metode pri preverjanju raziskovalnih hipotez.</p>	<p>Intended learning outcomes:</p> <p><i>Knowledge and Understanding:</i> Learn about the main acoustic measurement methods and techniques available for wood and lignocellulosic composites analysis and their application throughout the entire forest-wood industry value chain, from standing trees in the forest stand to processing of wood and lignocellulosic composites, and finally quality monitoring of end products.</p> <p><i>Reflection:</i> Critically evaluate the suitability of individual acoustic measurement methods and techniques for testing research hypotheses and achieving research objectives.</p> <p><i>Application:</i> Apply selected acoustic measurement procedures and methods to students' own research question and test them on a practical example in a forest stand, a forest-wood value chain, a material or semi-finished product in processing or on the final product, respectively. The students will learn how to select appropriate methods when testing research hypotheses.</p>
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Metode poučevanja in učenja:

<p>Seminarji (20 ur), Laboratorijske vaje (15 ur)</p>	<p>Learning and teaching methods: Seminar (20 h) Laboratory work (15 h)</p>
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Načini ocenjevanja:

	Delež/Weight	Assessment:
Pisni in ustni izpit	60,00 %	Oral and written exam
Seminar	40,00 %	Seminar

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

Aleš Straže

1. RAY, Tony, KALJUN, Jasmin, STRAŽE, Aleš. 2021. Comparison of the vibration damping of the wood species used for the body of an electric guitar on the vibration response of open-strings. *Materials*, 14, 18, s1-13. [COBISS.SI-ID 76586755]
2. STRAŽE, Aleš, NOVAK, Klemen, ČUFAR, Katarina. 2022. Quality and price of spruce logs, determined conventionally and by dendrochronological and NDE techniques. *Forests*, 13, 5, 1-15. [COBISS.SI-ID 108420867], [JCR, SNIP, WoS, Scopus]
3. STRAŽE, Aleš, FAJDIGA, Gorazd, GOSPODARIČ, Bojan. 2018. Nondestructive characterization of dry heat-treated fir (*Abies Alba Mill.*) timber in view of possible structural use. *Forests*, 9, 12, 776 [COBISS.SI-ID 2986633]
4. KRAJNC, Luka, KADUNC, Aleš, STRAŽE, Aleš. 2019. The use of ultrasound velocity and damping for the detection of internal structural defects in standing trees of European beech and Norway spruce. *Holzforschung*, 73, 9, str. 807-816 [COBISS.SI-ID 5408422]
5. RAY, Tony, KALJUN, Jasmin, ŽVEPLAN, Ervin, STRAŽE, Aleš. 2019. Selection of wood based on acoustic properties for the solid body of electric guitar. *Archives of Acoustics*. 44, 1, str. 51-58, [COBISS.SI-ID 3007113]
6. KRAPEŽ TOMEČ, Daša, STRAŽE, Aleš, HAIDER, Andreas, KARIŽ, Mirko. 2021. Hygromorphic response dynamics of 3D-printed wood-PLA composite bilayer actuators. *Polymers*, 13, 19, str. 1-16 [COBISS.SI-ID 7778662]

Žigon Jure

1. ŽIGON, Jure, STRAŽE, Aleš. 2023. Vpliv vlažnosti na mikrotvdoto smrekovine, določeno z vtiskanjem. *Les*. 72, 2, str. 5-16 [COBISS.SI-ID 147736323]
2. ŽIGON, Jure, SEDIGHI MOGHADDAM, Maziar, WÄLINDER, Magnus E.P. 2023. Wettability and surface interactions of natural and thermally modified beech wood with water and water-based coatings: the effect of surface pre-treatment type. *European journal of wood and wood products.*, vol. 81, str. 73-88, [COBISS.SI-ID 120288771]
3. ŽIGON, Jure, SARAŽIN, Jaša, ŠERNEK, Milan, KOVAČ, Janez, DAHLE, Sebastian. 2021. The effect of ageing on bonding performance of plasma treated beech wood with urea-formaldehyde adhesive. *Cellulose*. 28, str. 2461-2478. [COBISS.SI-ID 49872899]
4. ŽIGON, Jure. 2021. Interactions of a waterborne coating with plasma pre-treated densified beech wood. *European journal of wood and wood products*. 79, 6, str. 1383-1394. [COBISS.SI-ID 63573251]
5. ŽIGON, Jure, KOVAČ, Janez, PETRIČ, Marko. 2022. The influence of mechanical, physical and chemical pre-treatment processes of wood surface on the relationships of wood with a waterborne opaque coating. *Progress in organic coatings*. 162, str. 1-14 [COBISS.SI-ID 82745091]
6. ŽIGON, Jure, PETRIČ, Marko, DAHLE, Sebastian. 2019. Artificially aged spruce and beech wood surfaces reactivated using FE-DBD atmospheric plasma. *Holzforschung*, 73, 12, str. 1069-1081 [COBISS.SI-ID 3099785]

ANALITIKA ORGANSKIH IN ANORGANSKIH ONESNAŽIL V EKOSISTEMIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Analitika organskih in anorganskih onesnažil v ekosistemih
Course title:	Analysis of organic and inorganic pollutants in ecosystems
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037240
Koda učne enote na članici/UL Member course code:	3742

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	15	0	10	80	5

Nosilec predmeta/Lecturer: Marjan Veber

Izvajalci predavanj:	Marjan Veber
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.

Prerequisites:

Graduates of uniform master programmes and 2nd cycle programmes of biomedical, biotechnical, mathematical and natural sciences

Vsebina:

Koncepti analitike sledov in mikroanalize značilnosti in zahteve; praktični problemi v analitiki sledov; pomen in vpliv posameznih stopenj analiznega postopka na rezultate kemijskih analiz;

Content (Syllabus outline):

Concepts in trace analysis and micro analysis; characteristics and requirements, practical problems in trace analysis, importance of different steps of analytical procedure and their impact on results of chemical analysis, preconcentration and

<p>predkoncentriranje in izolacija analitov iz tekočih, plinastih in trdnih vzorcev.</p> <p>Pregled metod atomske absorpcijske (AAS) in emisijske spektrometrije (OES) ter elementne masne spektrometrije (ICP-MS) in njihova uporaba za določevanje anorganskih onesnažil.</p> <p>Osnove masne spektrometrije (MS).</p> <p>Principi kromatografskih separacij, plinska kromatografija (GC) tekočinska kromatografija visoke ločljivosti (HPLC), kapilarna elektroforeza (CE).</p> <p>Primeri uporabe kromatografskih metod za določanje organskih onesnažil v realnih vzorcih.</p> <p>Sklopljene metode v analitiki okoljskih vzorcev - speciacijska analitika.;</p> <p>Primeri določitve značilnih onesnažil v zraku, vodi, zemlji in bioloških vzorcih.</p>	<p>isolation of analytes from gaseous, liquid and solid samples.</p> <p>Survey of methods of atomic spectrometry (atomic absorption -AAS and emission spectrometry –OES), elemental mass spectrometry (ICP-MS) and their application for the determination of inorganic pollutants.</p> <p>Principles of mass spectrometry (MS)</p> <p>Principles of chromatographic separations - gas chromatography (GC), high pressure liquid chromatography (HPLC), capillary electrophoresis (CE). Examples of the application of chromatographic methods for the determination of organic pollutants in real samples.</p> <p>Hyphenated techniques in analysis of environmental samples- speciation analysis.</p> <p>Some examples of determination of typical pollutants in air, water soil and biological samples.</p>
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Temeljna literatura in viri/Readings:

<p>Fifield, F. W., Haines, P. J. (Ured.) 2000. Environmental Analytical Chemistry, Blackwell Science. https://plus.cobiss.net/cobiss/si/sl/bib/ul/187899</p> <p>Skoog, D. A., Holler, F. J., Crouch, S. R., 2007. Principles of Instrumental Analysis, Thomson, (Izbrana poglavja/Selected chapters). https://plus.cobiss.net/cobiss/si/sl/bib/ul/39119109</p> <p>članki v znanstveni in strokovni periodiki s področja analizne kemije, papers in scientific journals related to analytical chemistry</p>
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Cilji in kompetence:

<p>Pridobiti znanja, ki so potrebna za razumevanje analiznih metod in postopkov, ki jih uporabljamo za določevanje organskih in anorganskih onesnažil v okoljskih vzorcih.</p>	<p>Objectives and competences:</p> <p>To obtain knowledge necessary for the understanding of analytical methods and procedures which are used for the determination of organic and inorganic pollutants in environmental samples.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Poznavanje in razumevanje značilnosti in lastnosti modernih analiznih pristopov za določevanje sledov anorganskih in organskih spojin v okoljskih vzorcih bo omogočilo izbiro ustreznega analiznega pristopa pri reševanju konkretnih analiznih problemov ter kritično oceno in vrednotenje analiznih rezultatov.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>The knowledge and understanding of characteristics of modern analytical methods for the determination of traces of inorganic and organic pollutants in environmental samples will enable selection or suggestion for the proper analytical approach for the solution of practical analytical problems and critical evaluation of analytical results.</p>
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Metode poučevanja in učenja:

<p>Predavanja s seminarjem, priprava seminarske naloge na osnovi pregleda literature za izbrano tematiko. Laboratorijske vaje obravnavajo praktični primer analiznega postopka. Individualni študij s konzultacijami.</p>	<p>Learning and teaching methods:</p> <p>Lectures with seminar, seminar thesis (selected topic based on the literature survey), Laboratory exercise deals with an example of practical analytical procedure, Individual study with consultation</p>
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Načini ocenjevanja:

Načini ocenjevanja:	Delež/Weight	Assessment:
Vsebina in predstavitev seminarske naloge	30,00 %	Content and presentation of the seminar thesis
Ustni izpit	70,00 %	Oral exam

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

1. ŠEBEZ, Bine, OGOREVC, Božidar, HOČEVAR, Samo B., VEBER, Marjan. Functioning of antimony film electrode in acid media under cyclic and anodic stripping voltammetry conditions. *Analytica chimica acta*, ISSN 0003-2670. [Print ed.], 2013, vol. 785, no. 1, str. 43-49, ilustr., doi: [10.1016/j.aca.2013.04.051](https://doi.org/10.1016/j.aca.2013.04.051). [COBISS.SI-ID [36731141](#)],
2. CAMILLERI, J., KRALJ, Polonca, VEBER, Marjan, SINAGRA, E. Characterization and analyses of acid-extractable and leached trace elements in dental cements. *International endodontic journal*, ISSN 0143-2885, 2012, vol. 45, no. 8, str. 737-743, doi: [10.1111/j.1365-2591.2012.02027.x](https://doi.org/10.1111/j.1365-2591.2012.02027.x). [COBISS.SI-ID [36005893](#)]
3. ARH, Gregor, KLASINC, Leo, VEBER, Marjan, POMPE, Matevž. Calibration of mass selective detector in non-target analysis of volatile organic compounds in the air. *Journal of chromatography. A*, ISSN 0021-9673, 2011, vol. 1218, issue 11, str. 1538-1543. [COBISS.SI-ID [1448796](#)],
4. KITANOVSKI, Zoran, GRGIĆ, Irena, VEBER, Marjan. Characterization of carboxylic acids in atmospheric aerosols using hydrophilic interaction liquid chromatography tandem mass spectrometry. *Journal of chromatography. A*, ISSN 0021-9673, 2011, vol. 1218, issue 28, str. 4417-4425, doi: [10.1016/j.chroma.2011.05.020](https://doi.org/10.1016/j.chroma.2011.05.020). [COBISS.SI-ID [4657946](#)]
5. BEESTON, Michael Philip, POHAR, Andrej, ELTEREN, Johannes Teun van, PLAZL, Igor, ŠLEJKOVEC, Zdenka, VEBER, Marjan, GLASS, Hylke J. Assessment of physical leaching processes of some elements in soil upon ingestion by continuous leaching and modeling. *Environmental science & technology*, ISSN 0013-936X. [Print ed.], 2010, vol. 44, issue 16, str. 6242-6248, doi: [10.1021/es1006725](https://doi.org/10.1021/es1006725). [COBISS.SI-ID [4448538](#)],
6. ARH, Gregor, FRAS, Simona, POLAK, Tomaž, ŽLENDER, Božidar, VEBER, Marjan, POMPE, Matevž. Modification of method for the determination of organochlorine pesticides in meat samples. *Acta chimica slovenica*, ISSN 1318-0207. [Tiskana izd.], 2009, vol. 56, no. 4, str. 920-926. [COBISS.SI-ID [3736952](#)],

ANALIZA BIOLOŠKIH SIGNALOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Analiza bioloških signalov
Course title:	Biological signal analysis
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037353
Koda učne enote na članici/UL Member course code:	3856

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	10	0	0	85	5

Nosilec predmeta/Lecturer: Marko Kreft

Izvajalci predavanj: Gregor Belušič, Marko Kreft
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General prerequisites for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
Signali, ki jih posnamemo na živih organizmih nosijo informacijo o procesih na molekularski ali celični ravni, ravni organov ali sistemski ravni. Različni biološki signali so na primer posnetki govora, elektrokardiogram (EKG), elektroencefalogram (EEG), elektoretinogram (ERG), elektrofiziološki posnetki na posameznih celicah, itd. Pogosto snemamo kombinacijo signalov, npr. signal	Signal transduced from living organisms are reporting processes at the molecular, cell, organ, or systemic level of organisation. Biological signals range from recordings of speech, the electrocardiogram (ECG), the electroencephalogram (EEG), electroretinogram (ERG), electrophysiological recordings on single cells, etc. In many cases we record a combination of signals, e.g. fluorescence signal as a reporter of

<p>fluorescence kot kazalca vsebnost kalcija v celicah, sočasno s signalom toka na plazmalemi. Podobno beležimo signale na poligrafu (detektor laži) ali polisomnografu za študije spanja. Biološki signali so sestavljeni iz signala in šuma. Pri predmetu bomo obravnavali osnove obdelave signalov v programskem jeziku Octave ali Matlab. Pri predmetu bomo uporabili realne signale za praktično uporabo analize časovnih sprememb bioloških spremenljivk. Uporabili bomo filtriranje, prileganje funkcij, povprečenje. Uporabili bomo primer študija profila fluorescenčne intenzitete. Šum pogosto povzroči močno variabilne profile. Filtriranje teh signalov zmanjšuje prostorsko ločljivost. Da bi se temu izognili, bomo uporabili povprečenje vrednosti sosednjih točk. V tem praktičnem primeru bomo uporabili diskretno Fourierjevo transformacijo (DFT) računano z algoritmom (FFT).</p>	<p>calcium level in the cell, together with the signal of the plasma membrane current. Similarly, we record signals of a polygraph (lie detector) or polysomnograph for sleep studies. Biological signals are and additive combination of signal and noise. A brief introduction to signal processing in Octave or Matlab will be given. Practical application of the signal processing will be studied. We will use analysis approaches of time dependent changes of biological measurements. We will use filtering, fitting of functions, averaging. An example of study of a line profile of fluorescent intensities will be presented. The image noise often results in scattered line profiles. Filtering of the signal results in reduced spatial resolution of the processed data. To avoid reducing the spatial resolution we will apply averaging of neighbouring pixel values. In this practical example the discrete Fourier transform (DFT) will be computed with a fast Fourier transform (FFT) algorithm.</p>
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Temeljna literatura in viri/Readings:

<p>R.B. Northrop: Signals and Systems Analysis In Biomedical Engineering, 2. ed., CRC press (2009) Izbrani članki iz revije Biomedical Signal Processing and Control, Elsevier</p>
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Cilji in kompetence:

<p>Pridobivanje osnovnih znanj za zajem podatkov, analogno-digitalno pretvorbo, obdelavo, analizo in interpretacijo rezultatov.</p> <ul style="list-style-type: none"> - zajem podatkov, - vrednotenje in analiza šuma - povprečenje, filtriranje, korelacija, - meritve pojavov sprememb v signalu - realni in kompleksni del analize Fourier, FFT, Bodejev diagram

Objectives and competences:

<p>Acquiring of basic skills on data acquisition, analogue to digital conversion, processing, analysis and interpretation of results.</p> <ul style="list-style-type: none"> - Data acquisition, - Noise evaluation and analysis - Signal averaging, filtering, correlation, - Measurements of features in the signal - Real and Complex Fourier Series, Fast Fourier transform, Bode plot

Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <ul style="list-style-type: none"> - Praktična znanja za obdelavo signalov s pomočjo računalniških orodij. - razumevanje temeljev bioloških signalov - izbira ustrezne metodologije za obdelavo in analizo signalov.

Intended learning outcomes:

<p>Knowledge and understanding:</p> <ul style="list-style-type: none"> - practical knowledge to solve signal processing tasks using computer tools. - understanding basics of biological signals - choosing of appropriate methodology to process and analyse signals.

Metode poučevanja in učenja:

<p>Predavanja, konzultacije, praktične demonstracije, seminarji in individualno projektno delo.</p>

Learning and teaching methods:

<p>Lectures, consultations, practical demonstrations, seminars, individual project.</p>

Načini ocenjevanja:

<p>Predstavitve individualnega projekta in odgovori na vprašanja</p>
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Delež/Weight

<p>100,00 %</p>

Assessment:

<p>Project presentation and answers to question</p>

Ocenjevalna lestvica:

Grading system:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

Marko Kreft

FINK, Katja, VELEBIT MARKOVIĆ, Jelena, VARDJAN, Nina, ZOREC, Robert, KREFT, Marko. Noradrenaline-induced l-lactate production requires d-glucose entry and transit through the glycogen shunt in single-cultured rat astrocytes. *Journal of neuroscience research*. [Print ed.]. Apr. 2021, vol. 99, iss. 4, str. 1084-1098, ilustr. ISSN 0360-4012.

D'ADAMO, Patrizia, HORVAT, Anemari, VELEBIT MARKOVIĆ, Jelena, MALNAR, Maja, MUHIČ, Marko, FINK, Katja, POTOKAR, Maja, TRKOV, Saša, KREFT, Marko, CHOWDHURY HAQUE, Helena, STENOVEC, Matjaž, VARDJAN, Nina, ZOREC, Robert, et al. Inhibiting glycolysis rescues memory impairment in an intellectual disability Gdi1-null mouse. *Metabolism, clinical and experimental*. Mar. 2021, vol. 116, str. 1-16, ilustr. ISSN 1532-8600.

FINK, Katja, LOBE PREBIL, Mateja, VARDJAN, Nina, JENSEN, Jørgen, ZOREC, Robert, KREFT, Marko. Increase in subcellular GSK-3 clusters in insulin- and adrenaline-treated differentiated rat skeletal muscle fibres. *Image analysis & stereology : official journal of the International Society for Stereology*. [Tiskana izd.]. Mar. 2020, vol. 39, no. 1, str. 25-32, iii, ilustr. ISSN 1580-3139.

STENOVEC, Matjaž, LASIČ, Eva, PUŽAR DOMINKUŠ, Pia, TRKOV, Saša, ZOREC, Robert, LENASSI, Metka, KREFT, Marko. Slow release of HIV-1 protein nef from vesicle-like structures is inhibited by cytosolic calcium elevation in single human microglia. *Molecular neurobiology*. Jan. 2019, vol. 56, iss. 1, str. 102-118, ilustr. ISSN 0893-7648.

STENOVEC, Matjaž, TRKOV, Saša, SMOLIČ, Tina, KREFT, Marko, PARPURA, Vladimir, ZOREC, Robert. Presenilin PS1 [delta]E9 disrupts mobility of secretory organelles in rat astrocytes. *Acta physiologica*. [Online ed.]. Jun. 2018, vol. 223, iss.2, str. 1-12, ilustr. ISSN 1748-1716.

PUŽAR DOMINKUŠ, Pia, STENOVEC, Matjaž, SITAR, Simona, LASIČ, Eva, ZOREC, Robert, PLEMENITAŠ, Ana, ŽAGAR, Ema, KREFT, Marko, LENASSI, Metka. PKH26 labeling of extracellular vesicles : characterization and cellular internalization of contaminating PKH26 nanoparticles. *Biochimica et biophysica acta. Biomembranes*. [Print ed.]. Jun. 2018, vol. 1860, iss. 6, str. 1350-1361, ilustr. ISSN 0005-2736.

Gregor Belušič

WANG, Yifan, BELUŠIČ, Gregor, PEN, Ido, BEUKEBOOM, Leo W., WERTHEIM, Bregje, STAVENGA, Doekele Gerben, HUT, Roelof A. Circadian rhythm entrainment of the jewel wasp, *Nasonia vitripennis*, by antagonistic interactions of multiplespectral inputs. *Proceedings of the Royal Society. B, Biological sciences*. 2023, vol. 290, str. [1]-9, ilustr. ISSN 1471-2954.

MATSUSHITA, Atsuko, STEWART, Finlay J., ILIČ, Marko, CHEN, Pei-Ju, WAKITA, Daiki, MIYAZAKI, Naoyuki, MURATA, Kazuyoshi, KINOSHITA, Michiyo, BELUŠIČ, Gregor, ARIKAWA, Kentaro. Connectome of the lamina reveals the circuit for early color processing in the visual pathway of a butterfly. *Current biology*. [Print ed.]. May 2022, vol. 32, iss. 10, str. 2291-2299, e1-e3. ISSN 0960-9822.

KHALDY, Lana, FOSTER, James J., YILMAZ, Ayse, BELUŠIČ, Gregor, GAGNON, Yakir, TOCCO, Claudia, BYRNE, Marcus J., DACKÉ, Marie. The interplay of directional information provided by unpolarised and polarised light in the heading direction network of the diurnal dung beetle *Kheper lamarki*. *Journal of Experimental Biology*. Feb. 2022, vol. 225, iss. 3, str. 1-9, ilustr. ISSN 0022-0949.

ILIČ, Marko, CHEN, Pei-Ju, PIRIH, Primož, MEGLIČ, Andrej, PREVC, Jošt, YAGO, Masaya, BELUŠIČ, Gregor, ARIKAWA, Kentaro. Simple and complex, sexually dimorphic retinal mosaic of fritillary butterflies. *Philosophical transactions : Biological Sciences*. 2022, vol. 377, iss. 1862, [1]-8 str., 1-12 str. pril., ilustr. ISSN 0962-8436.

YILMAZ, Ayse, EL JUNDI, Basil, BELUŠIČ, Gregor, BYRNE, Marcus J., BAIRD, Emily, DACKÉ, Marie. Mechanisms of spectral orientation in a diurnal dung beetle. *Philosophical transactions : Biological Sciences*. 2022, vol. 377, iss. 1862, [1]-11 str., ilustr. ISSN 0962-8436.

PIRIH, Primož, ILIČ, Marko, MEGLIČ, Andrej, BELUŠIČ, Gregor. Opponent processing in the retinal mosaic of nymphalid butterflies. *Philosophical transactions : Biological Sciences*. 2022, vol. 377, iss. 1862, [1]-11 str., ilustr. ISSN 0962-8436.

ANALIZA STARODAVNE IN MUZEJSKE DNA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Analiza starodavne in muzejske DNA
Course title:	Analysis of ancient and museum DNA
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0640278

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	10	0	0	80	5

Nosilec predmeta/Lecturer: Anja Palandačič

Izvajalci predavanj:	Anja Palandačič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: teoretični /theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij, poznavanje osnov genetike.

Prerequisites:

General conditions for enrolment in doctoral studies, basic knowledge of genetics.

Vsebina:

Študentje se bodo spoznali s pojmom starodavne DNA, izolirane iz biološkega materiala organizmov, ki so živeli v preteklosti. Spoznali bodo zgodovino starodavne DNA in prvih raziskav na tem področju. V predmet bodo vključene teme o tem, kaj je starodavna DNA in kakšne so njene lastnosti (posebnosti zaradi njene degradacije). »Muzejska DNA« je pogovoren izraz za DNA izolirano iz organizmov hranjenih v muzejskih zbirkah, delno se

Content (Syllabus outline):

Students will be introduced to the concept of ancient DNA isolated from the biological material of organisms that lived in the past. They will learn about the history of ancient DNA and the first research in this field. The course will include topics about what ancient DNA is and what its properties are (specifics due to its degradation). "Museum DNA" is a colloquial term for DNA isolated from organisms stored in museum collections. The term partially

<p>pojmem prekriva s pojmom starodavne DNA, predmet pa bo obravnaval njune podobnosti in razlike. Predstavljeno bo delo v muzejskih zbirkah – nekoč in danes – in zakaj so muzejske zbirke izjemnega pomena pri raziskovanju pretekle biodiverzitete ter njenemu ohranjanju.</p> <p>Predmet bo obsegal razlike v analizi starodavne (muzejske) DNA in analize standardne DNA, vse od prvih korakov izolacije do bioinformatične analize. Studentom bo predstavljena široka paleta znanstvenih področij, pri katerih se starodavna DNA uporablja (od antropologije, klimatskih sprememb pa do populacijske genetike).</p> <p>Sledili bodo izjemni primeri novih spoznanj, ki jih je omogočila analiza starodavne DNA:</p> <ol style="list-style-type: none"> 1. V evoluciji človeka: analiza starodavne DNA Neandertalcev in Denisovancev, kaj smo podedovali od enih oziroma drugih, skrivnostna četrta vrsta, katere DNA je viden v genomu ostalih treh? 2. Izumrtja določenih živalskih vrst (mamuti, tasmanski tigri, dodo), kaj vse nam povedo njihovi genomi? 3. Klimatske spremembe in odgovori, ki nam jih ponuja starodavna DNA. <p>Jurassic Park: kako daleč smo od obuditve dinosavrov, mamutov, neandertalcev – tehnične omejitve in etično-moralni vidiki.</p>	<p>overlaps with the expression ancient DNA, and we will address their similarities and differences. The work in museum collections, in the past and today will be presented together with the importance of museum collections in preserving biodiversity. The course will cover the differences in the analysis of ancient (museum) DNA and the analysis of standard DNA, from the first steps of isolation to bioinformatics analysis. Students will be introduced to a wide range of scientific fields in which ancient DNA is used (from anthropology and climate change to population genetics).</p> <p>Finally, some outstanding examples of the analysis of ancient DNA, which enabled new insights in their respective fields, will be presented/ discussed:</p> <ol style="list-style-type: none"> (1) Human evolution: Analysis of the ancient DNA of Neanderthals and Denisovans, what did we inherit from one or the other, the mysterious fourth species whose DNA is visible in the genome of the other three. (2) Extinctions of certain animal species (mammoths, Tasmanian tigers, dodos), what do their genomes tell us? (3) Climate change and the answers offered to us by ancient DNA. (4) Jurassic Park: how far are we from the revival of dinosaurs, mammoths, Neanderthals - technical limitations and ethical-moral aspects.
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Temeljna literatura in viri/Readings:

Splošno o starodavni DNA (General about ancient DNA):

Revijalni članki s področja, tekoča periodika ter druga učna gradiva

Cilji in kompetence:

Cilji predmeta je seznaniti študente z lastnostmi starodavne DNA in številnimi znanstvenimi področji, kjer se uporablja. V tem kontekstu bo poudarek na študijah in konkretnih primerih, kjer je uporaba ključno doprinesla k razjasnitvi nekaterih vprašanj. Predstavljena bo tudi t.i. muzejska DNA in delo v muzejskih zbirkah, ki ga študentje običajno ne spoznajo tekom študija.

Kompetence študentov po opravljenem predmetu vključujejo znanje o starodavni in muzejski DNA ter njihova sposobnost vključiti to področje raziskav v njihove trenutne raziskave ali za uporabo v prihodnosti.

Objectives and competences:

The objectives of the course are to present the properties of ancient DNA and the many scientific fields where it is used. In this context, the focus will be on studies and concrete cases where the application has made a key contribution to clarifying research questions. The so-called museum DNA and work in museum collections will also be introduced as this subject is currently not represented in the curriculum.

Students' competences after completing the course include knowledge of ancient and museum DNA and their ability to incorporate the newly acquired knowledge into their current research or for future use.

Predvideni študijski rezultati:

Študentje bodo osvojili teoretično in praktično znanje o:

- lastnostih starodavne in muzejske DNA,
- delu v muzejskih zbirkah,

Intended learning outcomes:

Students will gain theoretical and practical knowledge of:

- properties of ancient and museum DNA,
- work in museum collections,

<p>- znanstvenih področjih, kjer se starodavna in muzejska DNA uporabljata (in sta doprinesli ključna spoznanja za njihov razvoj),</p> <p>- razlike v analizi v primerjavi s »standardno« DNA – od laboratorija do bioinformatike,</p> <p>- praktično delo, ki bo pripravilo študenta na dejansko uporabo starodavne DNA na izbranem področju.</p>	<p>- the scientific fields where ancient and museum DNA are used (and have contributed key insights to their development),</p> <p>- differences in analysis compared to "standard" DNA - from laboratory to bioinformatics,</p> <p>- practical work that will prepare the student for the actual use of ancient DNA in the chosen field.</p>
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Metode poučevanja in učenja:

Metode poučevanja bodo odvisne od števila prijavljenih študentov. Predvidena so predavanja, kjer bodo predstavljene teoretične osnove in zgoraj navedeni konkretni primeri. V primeru manjšega števila študentov, bodo te osnove in primere spoznali preko navedene literature, ki jim bodo sledile konzultacije. Glede na področje raziskovanja oziroma interes bodo študentje pripravili seminarsko nalogo (ali predavanje, ali manuskript), ki se bo poglobila v eno izmed tem. Praktično delo bo prilagojeno zmoglostim/ času študentov: omogočen bo obisk Prirodoslovnega muzeja na Dunaju in našega laboratorija, ki je specializiran za delo z muzejsko in starodavno DNA, ali pa bo praktično delo bioinformatične narave. Glede na področje raziskovanja doktorskega študenta se lahko analizo starodavne DNA tudi konkretno vključi v doktorsko raziskavo in objavi v obliki znanstvenega članka.

Learning and teaching methods:

Teaching methods will depend on the number of students enrolled. In case of lectures (more than five students enrolled), the theoretical foundations and the above-mentioned concrete examples will be presented. In case of a small number of students, they will learn these basics and examples through studying the cited literature, followed by consultations. Depending on the field of research or interest, students will prepare a seminar (either in a form of a lecture or text), within one of the topics. The practical work will be adapted to the abilities / time of the students: it will be possible to visit the Natural History Museum in Vienna and our laboratory, which specializes in working with museum and ancient DNA, or the practical work will be of bioinformatics nature. Depending on the field of research of the doctoral student, the analysis of ancient DNA can also be concretely included in the doctoral research and published in the form of a scientific article.

Načini ocenjevanja:

Delež/Weight

Assessment:

Seminarska naloga (alternativno: priprava znanstvenega članka)	60,00 %	Project preparation (alternatively outline/draft of a manuscript)
Ustni izpit	40,00 %	Oral exam

Ocenjevalna lestvica:

Grading system:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

BOGUTSKAYA N, MIKSCHI E, RIEDEL MD, SZEILER S, FRADE PR, **PALANDAČIĆ A**. A catalogue of the type specimens described by Maximilian Holly housed in the Natural History Museum of Vienna. Part. 1. Chordata: Actinopterygii and Echinodermata: Asteroidea. Die Annalen des Naturhistorischen Museums. Serie A. 2022, 124:19-92.

TSAPARIS D, KONSTANTINIDIS I, **PALANDAČIĆ A**, KALOGIANNI E, TH. STOUMBOUDI M, BARBIERI R, VARDAKAS L, KOUTSIKOS N, TSIGENOPOULOS CS. DNA barcoding provides new insights on the distribution, systematics and conservation of the freshwater genus *Pelasgus* (Cypriniformes: Cyprinidae) in Greece. *Hydrobiologia*, 2021, 848, 1163–1176. <https://doi.org/10.1007/s10750-021-04526-9>

BRAVNIČAR J, **PALANDAČIĆ A**, SUŠNIK BAJEC S, SNOJ A. Neotype designation for *Thymallus aeliani* Valenciennes, 1848 from a museum topotype specimen and its affiliation with Adriatic grayling on the basis of mitochondrial DNA. *ZooKeys*, 2020, 999: 165-178.

ENGLMAIER G, VIÑUELA RODRIGUEZ N, WAIDBACHER H, **PALANDAČIĆ A**, TESFAYE G, GESSL W and MEULENBROEK P. New data on *Garra makiensis* (Cyprinidae, Labeoinae) from the Awash River (Ethiopia) with remarks on its relation to congeners on the Arabian Peninsula. *Zookeys*, 2020, 984: 133-163.

PALANDAČIĆ A, KRUCKENHAUSER L, AHNELT H, MIKSCHI E. European minnows through time: museum collections aid genetic assessment of species introductions in freshwater fishes (Cyprinidae: Phoxinus species complex). *Heredity*, 2020, 124, 410–422.

SIDELEVA V G, NASEKA A, NOWAK M, **PALANDAČIĆ A**. The finding of holotype and redescription of *Cottus microstomus* Heckel 1837 (Cottidae). *Ichthyological Research*, 2019, 66, 249–257.

PALANDAČIĆ A, NASEKA A, RAMLER D, AHNELT H. Contrasting morphology with molecular data: an approach to revision of species complexes based on the example of European Phoxinus (Cyprinidae). *BMC Evolutionary Biology*, 2017, 17 (1), 1.

RAMLER D, **PALANDAČIĆ A**, DELMASTRO GB, WANZENBÖCK J, AHNELT H. Morphological divergence of lake and stream Phoxinus of Northern Italy and the Danube basin based on geometric morphometric analysis. *Ecology and Evolution*, 2017, 7(2): 572-584.

ANALIZE INTERAKCIJ MED MOLEKULAMI S POVRŠINSKO PLAZMONSKO REZONANCO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet: Course title:	Analize interakcij med molekulami s površinsko plazmonsko resonanco The analysis of interactions between molecules using surface plasmon resonance
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0643127

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	0	25	0	0	100	5

Nosilec predmeta/Lecturer: Matej Butala

Izvajalci predavanj:
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: individualno raziskovalni /individual research course

Jeziki/Languages:

Predavanja/Lectures:	Angleščina, Slovenščina
Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij.

Prerequisites:

General requirements for the enrolment in PhD program.

Vsebina:

Metoda, ki temelji na površinski plazmonski resonanci (ang. surface plasmon resonance, SPR) je sodobna biofizikalna analitska metoda za analizo interakcij med molekulami. Z metodo lahko analiziramo ali pride do interakcije in v realnem

Content (Syllabus outline):

The method based on the surface plasmon resonance (SPR) is a modern biophysical analytical method for the analysis of interactions between molecules. Using the method we can analyze in the real time whether an interaction among selected

<p>času okarakteriziramo kinetiko interakcij npr. med proteini, proteini in membranami, proteini in nukleinskimi kislinami, proteini in malimi molekulami (večjimi od 100 Da) in celo med proteini in virusi oziroma celimi celicami.</p> <p>V okviru <i>teoretičnega</i> dela predmeta študent spozna:</p> <ol style="list-style-type: none"> 1. Osnovne dele in princip delovanja aparata za merjenje interakcij na osnovi SPR 2. Osnovne parametre SPR analize: K_a, K_d, R_{max}, KD, Chi^2. 3. Nabor in kemijo SPR čipov za imobilizacijo makromolekul 4. Kako zasnovati poskus za analizo interakcij med molekulami 5. Načine imobilizacije molekule liganda na izbrani čip 6. Načine injiciranja analita preko liganda in sledenje interakciji v realnem času 7. Načine kako regenerirati površino čipa in zagotoviti ponovljivost rezultatov 8. Analiza podatkov – ugotoviti ali je prišlo do vezave med ligandom in analitom, analiza kinetike vezave. <p>Študent <i>praktično</i> izvede zasnovano, izvedbo in analizo eksperimenta interakcije med izbranimi molekulami.</p>	<p>(macro)molecules occurs and characterize the kinetics of interaction e.g. between proteins, proteins and membranes, proteins and nucleic acids, proteins and small molecules (bigger than 100 Da) and even among proteins and viruses or whole cells.</p> <p>Within the <i>theoretical</i> part of the course the student learns:</p> <ol style="list-style-type: none"> (i) Basic parts and principle of operation of the SPR apparatus (ii) Basic parameters of SPR analysis: K_a, K_d, R_{max}, KD, Chi^2. (iii) Set and chemistry of SPR chips used for the immobilization of molecules (iv) How to design an experiment to analyse interactions between molecules (v) Methods of immobilizing the ligand molecule on the selected SPR chip (vi) Methods of injecting the analyte over the ligand and tracking the interactions in real-time (vii) How to regenerate the chip surface and ensure repeatability of results (viii) Data analysis - to determine whether ligand-analyte binding has occurred, analysis of binding kinetics of the interacting molecules. <p>The student practically designs and carries out the experiment and analyses the data of interaction between selected molecules.</p>
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Temeljna literatura in viri/Readings:

Handbook of Surface Plasmon Resonance, Richard B. M. Schasfoort, ed., The Royal Society of Chemistry, 2017. <https://www.biodyn.ro/course/literatura/Handbook%20of%20Surface%20Plasmon%20Resonance%2017.pdf>

Cilji in kompetence:

Pridobitev znanja o zmožnosti analiz interakcij med (makro)molekulami z aparatom na osnovi SPR.

Zmožnost zasnove, izvedbe interakcij protein-protein, protein-membrana, protein-DNA, protein-RNA, protein-male učinkovine, celični lizat-protein ali virus-protein.

Študent se nauči kritične analize izmerjenih lastnosti interakcij.

Objectives and competences:

Acquisition of knowledge about the ability to analyse interactions between (macro)molecules with an apparatus based on SPR.

Ability to conceive, perform protein-protein, protein-membrane, protein-DNA, protein-RNA, low-protein, cell lysate-protein or virus-protein interactions.

The student learns how to critically analyse and characterize properties of the interactions.

Predvideni študijski rezultati:	Intended learning outcomes:
<p>Študent izvede individualno raziskovalno nalogo in na primeru spozna lastnosti aparata, ki deluje na principu površinske plazmonske resonance. Študent spozna kako zasnovati in analizirati pridobljene meritve – predvideni študijski rezultat je uspešna analiza izbrane interakcije med molekulami. Rezultati analiz študentu omogočijo zasnovo nadaljnjih poskusov, ki bi <i>in vivo</i> potrdili izsledke SPR analiz.</p>	<p>The student performs an individual research task and »hands on« experiences the properties of the SPR apparatus. The student learns how to design and analyse the obtained measurements - the expected study result is a successful analysis of the selected interaction between molecules. The results of the analyses enable the student to design further experiments that would confirm the results of SPR analyses <i>in vivo</i>.</p>

Metode poučevanja in učenja:	Learning and teaching methods:
<p>Konzultacije in pomoč pri zasnovi, izvedbi in analizi SPR eksperimenta izbrane interakcije med molekulami. V dogovoru z mentorjem kandidata je mogoča izvedba dela raziskav v sklopu kandidatove doktorske naloge študenta v infrastrukturnem centru za merjenje molekulskih interakcij.</p>	<p>Consultations and assistance in the design, implementation and analysis of the SPR experiment of the interaction between selected molecules. In agreement with the candidate's mentor, it is possible to carry out a part of the research work of the student's doctoral dissertation in the SPR infrastructure center for measuring the molecular interactions.</p>

Načini ocenjevanja:	Delež/Weight	Assessment:
<p>Ocenjuje se izvedba problemsko orientiranega individualnega raziskovalnega dela, ki ga kandidat odda v pisni obliki glede na tri sklope: zasnova eksperimenta, izvedba analize in interpretacija pridobljenih meritev.</p>	<p>100,00 %</p>	<p>The implementation of problem-oriented individual research work is evaluated, which the candidate submits in writing according to three parts: the design of the experiment, the implementation of the analysis and the interpretation of the obtained measurements.</p>

Ocenjevalna lestvica:	Grading system:
<p>5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10</p>	<p>5 - 10, a student passes the exam if he is graded from 6 to 10</p>

Reference nosilca/Lecturer's references:
<p>Matej Butala</p> <ol style="list-style-type: none"> 1. BAHUN, Miha, JUKIČ, Marko, OBLAK, Domen, KRANJC, Luka, BAJC, Gregor, BUTALA, Matej, BOZOVIČAR, Krištof, BRATKOVIČ, Tomaž, PODLIPNIK, Črtomir, POKLAR ULRIH, Nataša. Inhibition of the SARS-CoV-2 3CLpro main protease by plant polyphenols. <i>Food chemistry</i>, 2022, vol. 373, št. članka 131594, doi: 10.1016/j.foodchem.2021.131594. [COBISS.SI-ID 84899331]. 2. MRAVINEC, Martina, BAJC, Gregor, BUTALA, Matej. Surface plasmon resonance approach to study drug interactions with SARS-CoV-2 RNA-dependent RNA polymerase highlights treatment potential of suramin. <i>Journal of virological methods</i>, 2021, vol. 298, št. članka 114283, , doi: 10.1016/j.jviromet.2021.114283. [COBISS.SI-ID 76436739]. 3. KOČAR, Eva, LENARČIČ, Tea, HODNIK, Vesna, PANEVSKA, Anastasija, HUANG, Yunjie, BAJC, Gregor, KOSTANJŠEK, Rok, NAREN, Anjaparavanda P., MAČEK, Peter, ANDERLUH, Gregor, SEPČIČ, Kristina, PODOBNIK, Marjetka, BUTALA, Matej. Crystal structure of RahU, an aegerolysin

protein from the human pathogen *Pseudomonas aeruginosa*, and its interaction with membrane ceramide phosphorylethanolamine. *Scientific reports*, 2021, vol. 11, article no. 6572, doi: [10.1038/s41598-021-85956-2](https://doi.org/10.1038/s41598-021-85956-2). [COBISS.SI-ID [56737283](#)].

4. MOLAN, Katja, PODLESEK, Zdravko, HODNIK, Vesna, BUTALA, Matej, OSWALD, Eric, ŽGURBERTOK, Darja. The *Escherichia coli* colibactin resistance protein ClbS is a novel DNA binding protein that protects DNA from nucleolytic degradation. *DNA Repair*, 2019, vol. 79, str. 50-54. doi: [10.1016/j.dnarep.2019.05.003](https://doi.org/10.1016/j.dnarep.2019.05.003). [COBISS.SI-ID [5079119](#)].

5. CAVENEY, Nathanael A., PAVLIN, Anja, CABALLERO, Guillermo, BAHUN, Miha, HODNIK, Vesna, CASTRO, Liza de, FORNELOS, Nadine, BUTALA, Matej, STRYNADKA, Natalie C.J. Structural insights into bacteriophage GIL01 gp7 inhibition of host LexA repressor. *Structure*, 2019, vol. 27, str. 1094-1102.e4, doi: [10.1016/j.str.2019.03.019](https://doi.org/10.1016/j.str.2019.03.019). [COBISS.SI-ID [5060431](#)].

6. FORNELOS, Nadine, BROWNING, Douglas F., PAVLIN, Anja, PODLESEK, Zdravko, HODNIK, Vesna, SALAS, Margarita, BUTALA, Matej. Lytic gene expression in the temperate bacteriophage GIL01 is activated by a phage-encoded LexA homologue. *Nucleic acids research*, 2018, vol. 12, str. 9432-9443, doi: [10.1093/nar/gky646](https://doi.org/10.1093/nar/gky646). [COBISS.SI-ID [4764239](#)].

Kristina Sepčić

1. KOČAR, Eva, LENARČIČ, Tea, HODNIK, Vesna, PANEVSKA, Anastasija, HUANG, Yunjie, BAJC, Gregor, KOSTANJŠEK, Rok, NAREN, Anjaparavanda P., MAČEK, Peter, ANDERLUH, Gregor, SEPČIĆ, Kristina, PODOBNIK, Marjetka, BUTALA, Matej. Crystal structure of RahU, an aegerolysin protein from the human pathogen *Pseudomonas aeruginosa*, and its interaction with membrane ceramide phosphorylethanolamine. *Scientific reports*, ISSN 2045-2322, 2021, vol. 11, article no. 6572, str. 1-12, <https://www.nature.com/articles/s41598-021-85956-2.pdf>, <https://www.nature.com/articles/s41598-021-85956-2>, doi: [10.1038/s41598-021-85956-2](https://doi.org/10.1038/s41598-021-85956-2). [COBISS.SI-ID [56737283](#)].
2. MILIJAŠ JOTIĆ, Matej, PANEVSKA, Anastasija, IACOVACHE, Ioan, KOSTANJŠEK, Rok, MRAVINEC, Martina, SKOČAJ, Matej, ZUBER, Benoît, PAVŠIČ, Ana, RAZINGER, Jaka, MODIC, Špela, TRENTI, Francesco, GUELLA, Graziano, SEPČIĆ, Kristina. Dissecting out the molecular mechanism of insecticidal activity of ostreolysin A6/pleurotolysin B complexes on western corn rootworm. *Toxins : Elektronski vir*, ISSN 2072-6651, 2021, vol. 13, no. 7, str. 1-16. <https://www.mdpi.com/2072-6651/13/7/455>, doi: [10.3390/toxins13070455](https://doi.org/10.3390/toxins13070455). [COBISS.SI-ID [68691203](#)].
3. NOVAK, Maruša, KR PAN, Teja, PANEVSKA, Anastasija, SHEWELL, Lucy K., DAY, Christopher J., JENNINGS, Michael P., GUELLA, Graziano, SEPČIĆ, Kristina. Binding specificity of ostreolysin A6 towards Sf9 insect cell lipids. *Biochimica et biophysica acta, Biomembranes*, ISSN 0005-2736. [Print ed.], 1 Sep. 2020, vol. 1862, iss. 9, str. 1-10, doi: [10.1016/j.bbamem.2020.183307](https://doi.org/10.1016/j.bbamem.2020.183307). [COBISS.SI-ID [13431555](#)].
4. NOVAK, Maruša, ČEPIN, Urška, HODNIK, Vesna, NARAT, Mojca, JAMNIK, Maja, KRAŠEVEC, Nada, SEPČIĆ, Kristina, ANDERLUH, Gregor. Functional studies of aegerolysin and MACPF-like proteins in *Aspergillus niger*. *Molecular microbiology*, ISSN 0950-382X, Oct. 2019, vol. 112, iss. 4, str. 1253-1269. <https://onlinelibrary.wiley.com/doi/full/10.1111/mmi.14360>, doi: [10.1111/mmi.14360](https://doi.org/10.1111/mmi.14360). [COBISS.SI-ID [4280456](#)].ž
5. PANEVSKA, Anastasija, HODNIK, Vesna, SKOČAJ, Matej, NOVAK, Maruša, MODIC, Špela, PAVLIC, Ivana, PODRŽAJ, Sara, ZARIĆ, Miki, RESNIK, Nataša, MAČEK, Peter, VERANIČ, Peter, RAZINGER, Jaka, SEPČIĆ, Kristina. Pore-forming protein complexes from *Pleurotus* mushrooms kill western corn rootworm and Colorado potato beetle through targeting membrane ceramide phosphoethanolamine. *Scientific reports*, ISSN 2045-2322, 2019, vol. 9, str. 1-14. <https://doi.org/10.1038/s41598-019-41450-4>, doi: [10.1038/s41598-019-41450-4](https://doi.org/10.1038/s41598-019-41450-4). [COBISS.SI-ID [5013839](#)].
6. VEZOČNIK, Valerija, HODNIK, Vesna, SITAR, Simona, OKUR, Halil I., TUŠEK-ŽNIDARIČ, Magda, LÜTGEBACKS, Cornelis, SEPČIĆ, Kristina, KOGEJ, Ksenija, ROKE, Sylvie, ŽAGAR,

Ema, MAČEK, Peter. Kinetically stable triglyceride-based nanodroplets and their interactions with lipid-specific proteins. *Langmuir*, ISSN 0743-7463, 2018, vol. 34, no. 30, str. 8983-8993, doi: [10.1021/acs.langmuir.8b02180](https://doi.org/10.1021/acs.langmuir.8b02180). [COBISS.SI-ID [4754255](#)]

ANIMALNA BIOTEHNOLOGIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Animalna biotehnologija
Course title:	Animal biotechnology
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037280
Koda učne enote na članici/UL Member course code:	3782

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	20	0	0	25	185	10

Nosilec predmeta/Lecturer:	Peter Dovč
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Izvajalci predavanj:	Peter Dovč, Gregor Gorjanc, Tanja Kunej, Mojca Narat, Minja Zorc
Izvajalci seminarjev:	Peter Dovč
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical
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Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
splošni pogoji za vpis na doktorski študij	general requirement for the enrollment to the doctoral programme

Vsebina:	Content (Syllabus outline):
Predmet obsega najpomembnejša področja animalne biotehnologije, njihov razvoj in aktualne raziskovalne probleme. Vsebina predmeta je razdeljena na pet poglavij: 1. Pregled razvoja animalne biotehnologije s poudarkom na razvoju metod transgeneze in molekularnih markerjev za upravljanje z živalskimi genskimi viri. 2. Imunske tehnologije v animalni biotehnologiji. 3. Epigenetski mehanizmi, ki	The subject addresses the most important areas of animal biotechnology, their development and present research problems. The content is organized in five chapters: 1. Review of development in animal biotechnology with special accent on technology of transgenesis. 2. Immune technologies in animal biotechnology. 3. Epigenetic mechanisms regulating gene expression and development of animal models

uravnavajo izražanje genov in razvoj živalskih modelov za biomedicinske študije. 4. Analiza genomskih podatkov 5. Upravljanje velikih podatkovnih zbirk in genomski selekcija.	for biomedical research. 4. Analysis of genomic data. 5. Management of big datasets and genomic selection.
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> • Zhihua Jiang (Editor), Troy L. Ott (Editor): Reproductive Genomics in Domestic Animals ISBN: 978-0-470-96182-7 (2011) Wiley-Blackwell • Abdurakhmonov IY, editor. Bioinformatics in the Era of Post Genomics and Big Data [Internet]. InTech; 2018. Available from: http://dx.doi.org/10.5772/intechopen.71349 • Ashish S. Verma and Anchal Singh: Animal Biotechnology: Models in Discovery and Translation, Academic Press; 2nd edition (2019) ISBN-10:0128117109 • Heiner Niemann, Christine Wrenzycki: Animal Biotechnology 2, Springer Cham; 1st edition (2018). https://doi.org/10.1007/978-3-319-92348-2 	revijalni članki s področja, tekoča periodika, druga učna gradiva...
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Cilji in kompetence:

Pridobiti pregled nad najpomembnejšimi področji raziskav v animalni biotehnologiji in seznanitev z osnovnimi metodološkimi pristopi. Študentje naj bi tako dobro poznali področje, da bi lahko kompetentno presojali različne raziskovalne pristope in bili sposobni prepoznati možnosti za tehnološki preboj.	Objectives and competences: Gaining the overview in the most important areas of research in animal biotechnology and getting acquainted with the basic methodological approaches. Students should be able to judge critically different research approaches and to develop the ability to recognize possibilities for technological break through.
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Predvideni študijski rezultati:

Znanje in razumevanje: Temelječ na znanju genetike, molekularne biologije, fiziologije in statistike naj bi se študent seznanil s stanjem v animalni biotehnologiji in se usposobil za sledenje razvoja tega znanstvenega področja.	Intended learning outcomes: Knowledge and understanding: Based on their knowledge in genetics, molecular biology, physiology and statistics should students get informed about the research challenges in animal biotechnology and develop skills to follow advancements in this field of research.
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Metode poučevanja in učenja:

Predavanja (pet predavateljev, skupno 20 ur predavanj). Prirava seminarskega dela pri enem od predavateljev, konzultacije za pripravo seminarja. Samostojen študij	Learning and teaching methods: Lectures (five lecturers, cumulative 20 hours of lectures) Preparation of the seminar under the guidance of one of the lecturers, consultations during the preparation of the seminar. Individual study
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Načini ocenjevanja:

Načini ocenjevanja:	Delež/Weight	Assessment:
Pisni izpit	40,00 %	Exam
Seminar (pisni izdelek)	40,00 %	Seminar (written version)
Predstavitev in zagovor seminarja	20,00 %	Presentation and defence of the seminar

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

<p>Peter DOVČ, nosilec: 1. OGOREVC, Jernej, SIMČIČ, Mojca, ZORC, Minja, ŠKRJANC, Monika, DOVČ, Peter. TLR2 polymorphism (rs650082970) is associated with somatic cell count in goat milk. <i>PeerJ</i>. 31. jul. 2019, vol. 7, str.</p>
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- 1-9, e-7340, ilustr. ISSN 2167-8359. <https://peerj.com/articles/7340.pdf>, DOI: [10.7717/peerj.7340](https://doi.org/10.7717/peerj.7340). [COBISS.SI-ID [4274568](#)]
2. PRPAR MIHEVC, Sonja, OGOREVC, Jernej, DOVČ, Peter. Markers and antibodies for characterization of goat mammary tissue and the derived primary epithelial cell cultures. *Revista Brasileira de Zootecnia*. 2020, vol. 49, e 20180164, str. 1-9, ilustr. ISSN 1806-9290. https://www.rbz.org.br/wp-content/uploads/articles_xml/1806-9290-rbz-49-e20180164/1806-9290-rbz-49-e20180164.pdf, DOI: [10.37496/rbz4920180164](https://doi.org/10.37496/rbz4920180164). [COBISS.SI-ID [19192579](#)]
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7. JANEŠ, Mateja, ZORC, Minja, FERENČAKOVIĆ, Maja, ČURIK, Ino, DOVČ, Peter, ČUBRIĆ ČURIK, Vlatka. Genomic characterization of the three Balkan livestock guardian dogs. *Sustainability*. 2021, vol. 13, no. 4, art. 2289, str. 1-17, ilustr. ISSN 2071-1050. <https://www.mdpi.com/2071-1050/13/4/2289>, DOI: [10.3390/su13042289](https://doi.org/10.3390/su13042289). [COBISS.SI-ID [52551427](#)]
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ANTIOKSIDANTI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Antioksidanti
Course title:	Antioxidants
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037364
Koda učne enote na članici/UL Member course code:	3867

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
	15	5	0	5	100	5

Nosilec predmeta/Lecturer: Helena Abramovič

Izvajalci predavanj:	
Izvajalci seminarjev:	Helena Abramovič
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: individualno raziskovalni/individual research

Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies

Vsebina: Dodatek snovi z antioksidativno učinkovitostjo v živilski izdelek prispeva h kakovosti in varnosti hrane, saj podaljša obstojnost ter zviša biološko vrednost živila. Antioksidanti so strukturno raznolike spojine. V okviru izbirnega predmeta bomo opisali posamezne skupine antioksidantov, ki so v živilu naravno prisotni ali dodani. Opisali bomo različne reakcijske mehanizme (redukcijska sposobnost, učinkovitost lovljenja prostih radikalov, sposobnost	Content (Syllabus outline): The substances with antioxidative effectiveness added to food product contribute to its quality and safety, since it prolongs shelf-life and raises the biological value of the food. Antioxidants are structurally different compounds. In the frame of the elective subject the groups of antioxidants (naturally present in food or added) will be described. Various reaction mechanisms (reducing capacity, effectiveness in scavenging free radicals, ability to chelate metals) of
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<p>keliranja kovin) delovanja antioksidantov. Pokazali bomo, da je antioksidativna učinkovitost spojine posledica ustreznih fizikalno-kemijskih lastnosti in kemijske strukture. Seznanili se bomo z različnimi metodološkimi pristopi določitve antioksidativne učinkovitosti. Živila so po svoji sestavi heterogeni sistemi. Zato vsebina predmeta vključuje primerjavo in interpretacijo delovanja antioksidantov v različnih sistemih ter razlago, kako strukturne lastnosti in specifična porazdelitev omenjenih spojin odloča o njihovi antioksidativni učinkovitosti. Ozaveščenost potrošnikov glede škodljivih vplivov sintetičnih aditivov vzpodbuja uporabo naravnih dodatkov. Zato se bomo seznanili z novejšimi metodološkimi pristopi pridobivanja in karakterizacije izvlečkov spojin z antioksidativno učinkovitostjo iz različnih naravnih virov.</p>	<p>antioxidant's action will be described. It will be demonstrated that the antioxidative effectiveness of a compound is a consequence of corresponding physico-chemical properties and chemical structure. The students will be acquainted with various methodological approaches of antioxidative effectiveness determination. Foods are heterogeneous systems in their composition. Therefore the comparison and interpretation of the activity of antioxidants in various systems will be provided; we will show and explain how structural properties and partition of these compounds determine their antioxidative effectiveness. Consumer awareness of the harmful effects of synthetic additives promotes the use of natural additives. Therefore, the novel methodological approaches of obtaining and characterization of extracts of compounds with antioxidant efficiency from various natural resources will be provided.</p>
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Chaiyasit W., McClements D. J., Decker E. A. 2005. The relationship between the physicochemical properties of antioxidants and their ability to inhibit lipid oxidation in bulk oil and oil-in-water emulsions. *Journal of Agricultural and Food Chemistry*, 53: 4982-4988

Cilji in kompetence:

Izobraževalni cilji: Cilj predmeta je posredovati znanja povezana s problematiko antioksidantov in osvojiti ustrezno metodologijo določitve antioksidativne učinkovitosti.

Kompetence: Sistematična obravnava in razumevanje različnih dejavnikov, ki so povezani z antioksidanti je potrebna zato, da bi lahko predvideli in nadzorovali kakovost in varnost živilskega izdelka.

Objectives and competences:

Educational aims: The aim of the subject is to provide the knowledge associated with antioxidants and to get familiar with appropriate methodology of antioxidative effectiveness determination.

Competences: Systematic treatment and understanding of the various factors connected with antioxidants is necessary for anticipating and controlling the quality and safety of food products.

Predvideni študijski rezultati:

Izobraževalni cilji: Cilj predmeta je pridobiti znanje o antioksidantih in se seznaniti z ustrezno metodologijo določanja antioksidativne učinkovitosti.

Kompetence: Sistematična obravnava in razumevanje različnih dejavnikov, povezanih z antioksidanti, ki sta potrebna za predvidevanje in nadzor kakovosti ter varnosti živilskih izdelkov.

Intended learning outcomes:

Knowledge and understanding the mechanisms of antioxidant action.

Capacity to predict the quality, effectiveness, usefulness and suitability of individual antioxidants in given food matrices.

Capacity to interpret research results.

Metode poučevanja in učenja:

Seminar, vaje, konzultacije.

Learning and teaching methods:

Seminar, tutorial, consultation.

Načini ocenjevanja:

Priprava seminarske naloge	70,00 %	Preparation of seminar
Predstavitev seminarske naloge	30,00 %	Presentation of seminar

Delež/Weight

Assessment:

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Abramovič Helena

- MENCIN, Marjeta, ABRAMOVIČ, Helena, JAMNIK, Polona, MIKULIČ PETKOVŠEK, Maja, VEBERIČ, Robert, TERPINC, Petra. Abiotic stress combinations improve the phenolics profiles and activities of extractable and bound antioxidants from germinated spelt (Triticum spelta L.) seeds. *Food chemistry*. [Print ed.]. 2021, art no. 128704, vol. 344, str. 1-12, ilustr. ISSN 0308-8146. DOI: [10.1016/j.foodchem.2020.128704](https://doi.org/10.1016/j.foodchem.2020.128704). [COBISS.SI-ID 42042883]
- MARTINOVIČ, Neda, POLAK, Tomaž, POKLAR ULRIH, Nataša, ABRAMOVIČ, Helena. Mustard seed : phenolic composition and effects on lipid oxidation in oil, oil-in-water emulsion and oleogel. *Industrial crops and products*. 2020, vol. 156, str. 1-8, ilustr. ISSN 0926-6690. DOI: [10.1016/j.indcrop.2020.112851](https://doi.org/10.1016/j.indcrop.2020.112851). [COBISS.SI-ID 26302723]

3. MARTINOVIĆ, Neda, POKLAR ULRIH, Nataša, ABRAMOVIĆ, Helena. Sinapic acid and its derivatives increase oxidative stability in different model lipid systems. *European journal of lipid science and technology*. [Print ed.]. 2019, vol. 121, iss. 4, str. 1-10, 1800326, ilustr. ISSN 1438-7697. DOI: [10.1002/ejlt.201800326](https://doi.org/10.1002/ejlt.201800326). [COBISS.SI-ID [5026680](#)]
4. GENERALIĆ MEKINIĆ, Ivana, LJUBENKOV, Ivica, SMOLE MOŽINA, Sonja, ABRAMOVIĆ, Helena, ŠIMAT, Vida, KATALINIĆ, Ana, NOVAK, Tina, SKROZA, Danijela. Abiotic factors during a one-year vegetation period affect sage phenolicmetabolites, antioxidants and antimicrobials. *Industrial crops and products*. 2019, vol. 141, str. 1-7, [no.] 111741, ilustr. ISSN 0926-6690. DOI: [10.1016/j.indcrop.2019.111741](https://doi.org/10.1016/j.indcrop.2019.111741). [COBISS.SI-ID [5094008](#)]
5. ABRAMOVIĆ, Helena, GROBIN, Blaž, POKLAR ULRIH, Nataša, CIGIĆ, Blaž. Relevance and standardization of in vitro antioxidant assays : ABTS, DPPH and Folin-Ciocalteu. *Journal of Chemistry (Hindawi) (Print)*. 2018, vol. 2018, article id 4608405, str. 1-9, ilustr. ISSN 2090-9063. DOI: [10.1155/2018/4608405](https://doi.org/10.1155/2018/4608405). [COBISS.SI-ID [4966008](#)]
6. ABRAMOVIĆ, Helena, ABRAM, Veronika, ČUK, Anja, ČEH, Barbara, SMOLE MOŽINA, Sonja, VIDMAR, Mateja, PAVLOVIĆ, Martin, POKLAR ULRIH, Nataša. Antioxidative and antibacterial properties of organically grown thyme (*Thymus sp.*) and basil (*Ocimum basilicum L.*). *Turkish journal of agriculture and forestry*. [Tiskana izdaja]. 2018, vol. 42, iss. 3, str. 185-194. ISSN 1300-011X. DOI: [10.3906/tar-1711-82](https://doi.org/10.3906/tar-1711-82). [COBISS.SI-ID [4884088](#)]

ANTROZOLOGIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Antrozologija
Course title:	Anthrozoology
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037347
Koda učne enote na članici/UL Member course code:	3850

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	30	0	0	0	85	5

Nosilec predmeta/Lecturer: Manja Zupan Šemrov

Izvajalci predavanj: Manja Zupan Šemrov
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:

Predavanja/Lectures:	Angleščina, Slovenščina
Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij	Prerequisites: General conditions for enrolment in doctoral studies.
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Vsebina:

Predmet vsebuje štiri vsebinske sklope:
- Specialna in splošna etologija domačih in družnih živali: poznavanje splošne etološke terminologije; ugotavljanje pomena izražanja oblik obnašanja; razumevanje procesa od sprejemanja dražljajev do obdelave v centralnem živčnem sistemu in reakcije živali; izražanje čustev; načini učenja in nabiranja izkušenj; fiziološke osnove-obnašanja, igra kot kazalec dobrega počutja živali in drugo

Content (Syllabus outline):

Lectures contain four sections:
- The basic science of ethology of farm and companion animals: knowledge of general ethological terminology; searching explanations for behavioural expressions; understanding the process of adopting stimuli to processing in the central nervous system and the reactions of animals; expressing feelings; ways of learning and the accumulation of experience;

<p>- Živalska etika: teorije v etiki, ki se nanašajo na dolžnosti človeka do živali bodo predstavljene; razpravljanje o razmerju med znanostjo in etiko ter o gensko spremenjenih organizmih, ekološki rejji, dobrem počutju živali, mučenju živali itn.</p> <p>- Odnos človeka do živali: pregled in razprava o odnosu človeka do živali s poudarkom na zgodovinskem vidiku</p> <p>- Znanstveni pristopi k razumevanja počutja živali: seznanitev s pristopi k raziskovanju dobrega počutja živali; razprava o pomembnosti dojemanja živali kot čutnih individuumov</p>	<p>physiological bases of behavior; playing as an indicator of animal welfare and other</p> <p>- Animal Ethics: the theories of ethics, which relate to the duties of man towards animals will be presented, discussing the relationship between science and ethics of genetically modified organisms, organic farming, animal welfare, animal cruelty, etc..</p> <p>- Human-animal interaction: a review and discussion of the relation of man to animals with an emphasis on the historical aspect of</p> <p>- A scientific approach to animal welfare: familiarization with the approaches in animal welfare research; debate about the importance of animals as sentient individuals</p>
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Temeljna literatura in viri/Readings:

<p>Bekoff M. 2004. Encyclopedia of Animal Behavior. Westport, Greenwood Press: 1274 str., ISBN: 0-313-32746-7 (vol. 1), 0-313-32747-5 (vol. 2) in 0-313-33294-0 (vol 3)</p> <p>Bolhuis J.J., Giraldeau L. 2005. The Behaviour of Animals. Mechanisms, Function and Evolution. Malden, Blackwell Publishing: 515 str., ISBN: 0-631-23125-0</p> <p>Fraser A. F., Broom D. M. 2007. Domestic Animal Behaviour and Welfare, CABI; Fourth edition: 540 str., ISBN-10: 1845932870</p> <p>Jensen P. 2009. The Ethology of Domestic Animals. CABI; Second edition: 246 str., ISBN-10: 1845935365</p> <p>Scott G. 2005. Essential Animal Behaviour. Malden, Blackwell Publishing: 202 str., ISBN: 0-632-05799-8</p> <p>Yates, J., Röcklinsberg, H., Gjerris, M. 2011. "Is welfare all that matters? A discussion of what should be included in policymaking regarding animals". Animal Welfare, 20:3, 423-432.</p>

Cilji in kompetence:

<p>Poznavanje splošne etološke terminologije.</p> <p>Razumevanje dobrega počutja živali, čustev, fizioloških osnov obnašanja (npr. hormonov, nevrottransmitterjev in srčnega utripa), načinov učenja živali in nabiranja izkušenj ter njihov vpliv na obnašanje. Razumevanje vrsti značilnega obnašanja. Seznanitev z etiko na področju dobrega počutja živali. Poznavanje vplivov (npr. osebnost) na kvaliteto razmerja med človekom in živaljo.</p>	<p>Objectives and competences:</p> <p>Knowledge of general ethological terminology. Understanding of animal welfare, emotions, physiological bases of behavior (eg, hormones, neurotransmitters and heart rate), learning and experiences in animals and their impact on behavior. Understanding species specific behavior. Acquaintance with ethics in the field of animal welfare. Knowledge of the effects (eg, personality) on the quality of the animal's relationship to humans.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Razumevanje etologije in dobrega počutja živali kot interdisciplinarne znanosti.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>View ethology and animal welfare as interdisciplinary field of study.</p>
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Metode poučevanja in učenja:

<p>Predavanja, konzultacije, seminarsko delo.</p>	<p>Learning and teaching methods:</p> <p>Lectures, consultations, seminar workshops.</p>
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Načini ocenjevanja:

	Delež/Weight	Assessment:
- izdelana seminarska naloga	80,00 %	Seminar work
- ustni izpit	20,00 %	Oral Exam

Ocenjevalna lestvica:

<p>5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10</p>	<p>Grading system:</p> <p>5 - 10, a student passes the exam if he is graded from 6 to 10</p>
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Reference nosilca/Lecturer's references:

Manja Zupan Šemrov

1. ZUPAN, Manja, REHN, Therese, OLIVEIRA, Daiana de, MALOVRH, Špela, KEELING, Linda J. Individual play patterns stimulated by a familiar object are group-driven. *Scientific reports*, 2019, vol. 9, str. 1-8, [e]6092, doi: 10.1038/s41598-019-42382-9. [COBISS.SI-ID 4205192], IF (2019): RO (17/71), multidisciplinary sciences, x=3.998
2. ZULIANI, Anna, MAIR, Matthias, KRAŠEVEC, Maruša, LORA, Isabella, BRSCIC, Marta, COZZI, Giulio, LEEB, Christine, ZUPAN, Manja, WINCKLER, Christoph, BOVOLENTA, Stefano. A survey of selected animal-based measures of dairy cattle welfare in the Eastern Alps : toward context-based thresholds. *Journal of dairy science*, 2018, vol. 101, no. 2, str. 1428-1436, doi: 10.3168/jds.2017-13257. [COBISS.SI-ID 4030856], IF (2018): AD (4/61), agriculture, dairy & animal science, x=3.0822
3. PRUNIER, A., AVEROS, X., DIMITROV, Ivan, EDWARDS, Sandra A., HILLMANN, E., HOLINGER, E., ILIESKI, Vlatko, LEMING, R., TALLET, C., TURNER, S. P., ZUPAN, Manja, CAMERLINK, I. Early life predisposing factors for biting in pigs : review. *Animal : the international journal of animal biosciences*, 2020, vol. 14, no. 3, str. 570-587, doi: 10.1017/S1751731119001940. [COBISS.SI-ID 4281992], IF (2019): AD (9/63), agriculture, dairy & animal science, x=2.400
4. ZUPAN, Manja, BUSKAS, Julia, ALTIMIRAS, Jordi, KEELING, Linda J. Assessing positive emotional states in dogs using heart rate and heart rate variability. *Physiology & behavior*, 2016, vol. 155, str. 102-111, doi: 10.1016/j.physbeh.2015.11.027. [COBISS.SI-ID 3672712], IF (2016): CN (30/51), behavioural sciences, x=2.341
5. GOBBO, Elena, ZUPAN, Manja. Dogs' sociability, owners' neuroticism and attachment style to pets as predictors of dog aggression. *Animals*, 2020, vol. 10, no. 2, str. 1-15, e 315, doi: 10.3390/ani10020315. [COBISS.SI-ID 4355208], IF (2019): AD (10/64), agriculture, dairy & animal science, x=2.323
6. TERČIČ, Dušan, PANČUR, Mojca, JORDAN, Dušanka, ZUPAN, Manja. Effects of dimethyl anthranilate-based repellents on behavior, plumage condition, egg quality, and performance in laying hens. *Frontiers in veterinary science*, 2020, vol. 7, art. no. 533, str. 1-13, doi: 10.3389/fvets.2020.00533. [COBISS.SI-ID 25780483], IF (2019): ZC (19/142), veterinary sciences, x=2.245
7. ROKAVEC, Neža, ZUPAN, Manja. Psychological and physiological stress in hens with bone damage. *Frontiers in veterinary science*, ISSN 2297-1769, 2020, vol. 7, art. no. 589274, str. 1-10, doi: 10.3389/fvets.2020.589274. [COBISS.SI-ID 42687747], IF (2019): ZC (19/142), veterinary sciences, x=2.245
8. ZUPAN, Manja, REHN, Therese, OLIVEIRA, Daiana de, KEELING, Linda J. Promoting positive states : the effect of early human handling on play and exploratory behaviour in pigs. *Animal : the international journal of animal biosciences*, 2016, vol. 10, no. 1, str. 135-141. doi: 10.1017/S1751731115001743. [COBISS.SI-ID 3601032], IF (2016): AD (5/58), agriculture, dairy & animal science, x=1.921
9. MIKUS, Tomislav, RADESKI, Miroslav, CZISZTER, Ludovic Toma, DIMITROV, Ivan, JURKOVICH, Viktor, NENADOVIC, Katarina, OSTOVIC, Mario, ZUPAN, Manja, KIRCHNER, Marlene Katharina. The Danube region--on stream with animal welfare assessment in the last 35 years : a review of research on animal welfare assessment in a multi-lingual area in Europe. *Journal of agricultural & environmental ethics*, 2018, vol. 31, no. 4, str. 511-526, doi: 10.1007/s10806-018-9737-4. [COBISS.SI-ID 4080776], IF (2018): AH (16/57), agriculture, multidisciplinary, x=1.398
10. ZUPAN, Manja, ŠTUHEC, Ivan, JORDAN, Dušanka. The effect of an irregular feeding schedule on equine behavior. *Journal of applied animal welfare science*, 2020, vol. 23, no. 2, str. 156-163, doi: 10.1080/10888705.2019.1663734. [COBISS.SI-ID 4285832], IF (2019): ZC (72/142), veterinary sciences, x=1.122

APLIKATIVNE METODE PRI VARSTVU NARAVNE DEDIŠČINE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Aplikativne metode pri varstvu naravne dediščine
Course title:	Applied methods in protection of natural heritage
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037345
Koda učne enote na članici/UL Member course code:	3848

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	30	0	0	10	190	10

Nosilec predmeta/Lecturer: Mojca Nastran

Izvajalci predavanj: Thomas Andrew Nagel, Mojca Nastran
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies

Vsebina: Glede na svojo velikost je teritorij Slovenije izjemno raznolik v smislu biotske raznovrstnosti, tipov ekosistemov in geoloških formacij, kar skupaj predstavlja »naravno dediščino«. Poleg svoje inherentne vrednosti je naravna dediščina bistvenega pomena zaradi številnih družbenih in ekoloških dobrot, ki jih nudi družbi. Posledično se varstvu naravne dediščine posveča precejšnja pozornost, kar pa postaja vse težje izvedljivo zaradi rastočega vpliva	Content (Syllabus outline): For its size, the territory of Slovenia is extraordinarily diverse in terms of biodiversity, ecosystem types, and geological formations, together referred to as "natural heritage". In addition to the innate value of natural heritage, it is essential for providing a variety of social and ecological services to society. Consequently, much emphasis is placed on conserving natural heritage, yet this is becoming increasingly difficult to achieve due to the growing influence of humanity,
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<p>človeštva, predvsem v obliki podnebnih sprememb, degradacije habitatov in invazivnih vrst. Za uspešno ohranjanje je ključno razumeti, kako tako naravni (ekološki in geološki) kot tudi antropogeni procesi vplivajo na naravno dediščino in oblikovati strategije upravljanja, ki ohranjajo oziroma ponovno vzpostavljajo zelene komponente naravne dediščine v našem hitro spreminjajočem se okolju. V ta namen predmet pokriva naslednje poglavitne teme:</p> <ul style="list-style-type: none"> • Sistem varstva narave v Sloveniji in svetu: zavarovana območja ter drugi neposredni in posredni pravni ukrepi • Analize deležnikov pri varovanju naravne dediščine • Pomen vključevanja dedežnikov v ukrepe varstva narave • Interpretacija narave (možnosti, načini izbire najprimernejšega pristopa predstavitve narave ciljnim skupinam) in usmerjanje turizma • Ekologija motenj (t.j. kako procesi kot na primer sečnja, požiganje ali paša vplivajo na strukturo, sestavo in dinamiko vegetacije) • Metode kvantifikacije vzorcev in procesov v rastlinskih združbah • Metode v zgodovinski ekologiji • Znanost in praksa obnovitvene ekologije • Upoštevanje prostorske in časovne dimenzije (t.j. premiki od posamičnih rastišč k pokrajinam in od let k desetletjem) • Povezava življenjskih značilnosti zaščitene vrste s habitatnimi značilnostmi in njihovo prostorsko in časovno dinamiko • Naravne in antropogene spremembe abiotičnih značilnosti (npr. prst, voda, geološke oblike, ceste, hidrološke strukture itd.) naravne dediščine • Upravljanje z invazivnimi vrstami • Dolgoročno upravljanje naravne dediščine v kontekstu podnebnih sprememb • Analiza interesa deležnikov za naravno dediščino • Metode komuniciranja pomena naravne dediščine v javnosti 	<p>namely, from climate change, habitat degradation, and invasive species. A key to successful conservation is to understand how both natural (ecological and geological) and anthropogenic processes influence natural heritage and to design management strategies that either maintain or restore the desired components of natural heritage in our rapidly changing environment. To this end, the main themes covered in the class include:</p> <ul style="list-style-type: none"> • Nature protection system in Slovenia and worldwide: protected areas and other direct and indirect legal measures • Stakeholder analysis in natural heritage conservation • The importance of stakeholder involvement in nature conservation measures • Interpreting nature (options, ways of choosing the most appropriate approach to presenting nature to target groups) and directing tourism • Disturbance ecology (i.e. how do processes like forest harvesting, burning, or grazing influence vegetation structure, composition, and dynamics) • Methods for quantifying patterns and processes in plant communities • Methods in historical ecology • The science and practice of restoration ecology • Consideration of spatial and temporal scale (i.e. moving from individual sites to landscapes, and from years to decades) • Linking life history traits of protected species of interest with habitat characteristics and their dynamics in space and time • Natural and anthropogenic modification of abiotic features (i.e. soil, water, landforms, roads, hydrological constructions, etc) of natural heritage • Managing invasive species • Long-term management of natural heritage in the context of climate change • Analysis of stakeholder interests in natural heritage • Methods of communicating the importance of natural heritage with the public
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Temeljna literatura in viri/Readings:

Berginc, Mladen, Kremesec Jevšenak, Jelka, Vidic, Jana. Sistem varstva narave v Sloveniji. Ministrstvo za okolje in prostor, 2006.

<https://www.dlib.si/details/URN:NBN:SI:DOC-0B3SELWN>

Leung, Y. F., Spenceley, A., Hvenegaard, G., & Buckley, R. (2018). *Tourism and visitor management in protected areas: Guidelines for sustainability*. Gland: IUCN.

<https://portals.iucn.org/library/node/47918>

MARGARET A. PALMER; JOY B. ZEDLER; DONALD A. FALK. Foundations of Restoration Ecology. Washington, DC: Island Press, 2016. v. Second edition ISBN 9781610916967.

<https://plus.cobiss.net/cobiss/si/sl/bib/3850000000027318>

Izbrane monografije (znanstveni priročniki) in znanstveni članki iz znanstvenih publikacij, ki pokrivajo kandidatovo raziskovalno področje.

Selected monographs and scientific papers related to the students field of research.

Cilji in kompetence:

Cilj je zagotoviti poglobljeno znanje z znanstvenega in upravljaljskega vidika z naravno dediščino. Predmet se osredotoča na biotsko in abiotsko komponento naravne dediščine in poleg tega vsebuje tudi socialni vidik, saj so pri zavarovanju in upravljanju naravne dediščine vključeni številni deležniki oz. skupine. Predmet je tematsko naravnan tako, da se kar najbolje prilagodi tematiki študentove doktorske naloge. Predmet se osredotoča na metode za kvantifikacijo in implementacijo (vpeljavo) zaščite in obnove naravne dediščine v načrtih za upravljanje.

Objectives and competences:

The overall goal is to provide advanced knowledge on both scientific and management aspects of nature heritage. The class focuses on both biotic and abiotic components of natural heritage, and also includes a social science component due to the various stakeholder groups often involved with the protection and management of natural heritage. The class is individually tailored to the doctoral thesis of each student. All aspects of the class have a strong focus on methods to both quantify processes and implement conservation and restoration oriented management plans.

Predvideni študijski rezultati:

Znanje in razumevanje:

Študentje bodo zmožni: 1) razumeti in kvantificirati kako naravni in antropogeni procesi vplivajo na dano območje/predmet naravne dediščine, 2) oblikovati učinkovit upravljaljski načrt, ki predvideva vzdrževanje ali obnovo zaščitene naravne vrednote in 3) oceniti interes različnih skupin deležnikov v povezavi z razglasitvijo, vzdrževanjem in obnovo naravne dediščine.

Intended learning outcomes:

Knowledge and understanding:

Students will be able to 1) understand and quantify how natural and anthropogenic processes influence a given area/object of natural heritage; 2) design an effective management plan that either maintains or restores the desired features under protection; and 3) assesses the interests of various stakeholder groups in the context of establishing, maintaining, or restoring natural heritage.

Metode poučevanja in učenja:

Vsebina bo v veliki meri prilagojena kandidatovem zanimanju in temi doktorske naloge. Metode poučevanja vključujejo:

- predavanja (izbrane tematike) in pripravo na seminar
- konzultacije, terensko delo in vključitev v raziskovalne projekte
- skupinska diskusija izbranih tem

Learning and teaching methods:

The content will be in large part tailored to the individual research interests of the candidate.

Teaching methods will include:

- lectures (selected topics) and preparation of a guided seminar
- consultation, field-work, and involvement in research projects
- group discussion of selected topics

Načini ocenjevanja:**Delež/Weight****Assessment:**

Predstavitve širšega znanstvenega področja študentove doktorske teme	50,00 %	Presentation of the wider scientific field of the student's doctoral topic
sodelovanje pri diskusijah	50,00 %	Class participation

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:**Mojca Nastran**

1. HANSEN, Rieke, BUIZER, Marleen, BUIJS, Arjen, PAULEIT, Stephan, MATTIJSEN, Thomas, FORS, Hanna, VAN DER JAGT, Alexander, KABISCH, Nadja, COOK, Mandy, DELSHAMMAR, Tim, NASTRAN, Mojca, et al. Transformative or piecemeal? : Changes in green space planning and governance in eleven European cities. *European planning studies*. [Online ed.]. 2022, vol. <v tisku>, iss. <v tisku>, 24 str. ISSN 1469-5944

2. NASTRAN, Mojca, PINTAR, Marina, ŽELEZNIKAR, Špela, CVEJIC, Rozalija. Stakeholders' perceptions on the role of urban green infrastructure in providing ecosystem services for human well-being. *Land*. 2022, vol. 11, iss. 2, 14 str. (299), ilustr. ISSN 2073-445X.
3. SIMČIČ, Anica, PEČAN, Petra, NASTRAN, Mojca, KOBAL, Milan. The influence of land use on the spatial distribution and intensity of heat islands in Slovenia = Vpliv rabe tal na prostorsko razporeditev in intenzivnost toplotnih otokov v Sloveniji. *Acta Silvae et Ligni*. [Tiskana izd.]. 2021, [št.] 125, str. 13-24, ilustr. ISSN 2335-3112.
4. GOLOB, Aleš, NASTRAN, Mojca. Vplivi na obisk gozda v splošnih in gozdnih vrtcih = Forest visitation in general and forest kindergartens. *Acta Silvae et Ligni*. [Tiskana izd.]. 2021, [št.] 126, str. 1-10, ilustr. ISSN 2335-3112.
5. NASTRAN, Mojca. Visiting the forest with kindergarten children : forest suitability. *Forests*. [Online ed.]. 2020, vol. 11, iss. 6, 15 str., ilustr. ISSN 1999-4907.
6. VAN DER JAGT, Alexander, SMITH, Mike, AMBROSE-OJI, Bianca, KONIJNENDIJK, Cecil C., GIANNICO, Vincenzo, HAASE, Dagmar, LAFORTEZZA, Raffaele, NASTRAN, Mojca, PINTAR, Marina, ŽELEZNIKAR, Špela, CVEJIC, Rozalija. Co-creating urban green infrastructure connecting people and nature: A guiding framework and approach. *Journal of environmental management*. 2019, vol. 233, str. 757-767. ISSN 0301-4797.
7. NASTRAN, Mojca, KOBAL, Milan, ELER, Klemen. Urban heat islands in relation to green land use in European cities. *Urban Forestry and Urban Greening*. Jan. 2019, vol. 37, str. 33-41, ilustr. ISSN 1618-8667.
8. FISCHER, Leonie K., HONOLD, Jasmin, BOTZAT, Alexandra, BRINKMEYER, D., CVEJIC, Rozalija, DELSHAMMAR, Tim, ELANDS, Birgit, HAASE, Dagmar, KABISCH, Nadja, KARLE, S. J., LAFORTEZZA, Raffaele, NASTRAN, Mojca, NIELSEN, Anders Busse, VAN DER JAGT, Alexander, VIERIKKO, K., KOWARIK, I. Recreational ecosystem services in European cities: Sociocultural and geographical contexts matter for park use. *Ecosystem services*. 2018, vol. 31, part c, str. 455-467. ISSN 2212-0416.
9. FISCHER, Leonie K., HONOLD, Jasmin, CVEJIC, Rozalija, DELSHAMMAR, Tim, HILBERT, Sven, LAFORTEZZA, Raffaele, NASTRAN, Mojca, NIELSEN, Anders Busse, PINTAR, Marina, VAN DER JAGT, Alexander, KOWARIK, Ingo. Beyond green: Broad support for biodiversity in multicultural European cities. *Global environmental change*. 2018, vol. 49, str. 35-45. ISSN 0959-3780.
10. POPOV, Boris, POPOV, Snežana, NASTRAN, Mojca. "Does nature work? Effects of workplace greenery on employee well-being. *Primenjena psihologija*. 2023, vol. 16 (in press).

Thomas Andrew Nagel

- NAGEL, Thomas Andrew, FIRM, Dejan, ROZMAN, Andrej. Intermediate disturbances are a key driver of long-term tree demography across old-growth temperate forests. *Ecology and evolution*. 2021, vol. 11, iss. 23, str. 16862-16873.
- MIKOLÁŠ, Martin, SVITOK, Marek, BAČE, Radek, MEIGS, Garrett W., KEETON, William S., KEITH, Heather, BUECHLING, Arne, TROTSIUK, Volodymyr, KOZÁK, Daniel, BOLLMANN, Kurt, NAGEL, Thomas Andrew, et al. Natural disturbance impacts on trade-offs and co-benefits of forest biodiversity and carbon. *Proceedings of the Royal Society. B, Biological sciences*. 2021, vol. 288, article 20211631, 9 str.
- NAGEL, Thomas Andrew, FIRM, Dejan, PISEK, Rok, MIHELIC, Tomaž, HLADNIK, David, DE GROOT, Maarten, ROŽENBERGAR, Dušan. Evaluating the influence of integrative forest management on old-growth habitat structures in a temperate forest region. *Biological Conservation*. [Print ed.]. 2017, vol. 216, str. 101-107.
- NAGEL, Thomas Andrew, MIKAC, Stjepan, DOLINAR, Mojca, KLOPČIČ, Matija, KEREN, Srdjan, SVOBODA, Miroslav, DIACI, Jurij, BONČINA, Andrej, PAULIC, Vinko. The natural disturbance regime in forests of the Dinaric Mountains : a synthesis of evidence. *Forest Ecology and Management*. [Print ed.]. 2017, vol. 388, str. 29-42.
- NAGEL, Thomas Andrew, SVOBODA, Miroslav, KOBAL, Milan. Disturbance, life history traits, and dynamics in an old-growth forest landscape of southeastern Europe. *Ecological applications : a publication of the ecological society of America*. Jun. 2014, vol. 24, iss. 4, str. 663-679.

BIODIAGNOSTIKI IN BIOSENZORJI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biodiagnostiki in biosenzorji
Course title:	Biodiagnostics and biosensors
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037281
Koda učne enote na članici/UL Member course code:	3783

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	0	0	10	90	5

Nosilec predmeta/Lecturer: Janko Kos

Izvajalci predavanj: Janko Kos
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment into doctoral course.

Vsebina:	Content (Syllabus outline):
<ul style="list-style-type: none">• Biološke makromolekule v analitiki• DNA/RNA testi• Imunski testi• Biosenzorji• Avtomatizirani procesi v diagnostiki• Mikrosfere, mikromreže, mikrofluidika• Razvoj novih diagnostičnih sredstev v laboratorijskem in industrijskem merilu	<ul style="list-style-type: none">• Biological macromolecules in analytical processes• DNA/RNA assays• Immunoassays• Biosensors• Automated processes in diagnostics• Microspheres, Microarrays, Microfluidics• Development of new diagnostic assays on laboratory and industrial scale

• Kontrola in zagotavljanje kakovosti diagnostičnih sredstev	• Quality control and assurance of diagnostic assays
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Temeljna literatura in viri/Readings:

1. -Barth FG, Humphrey JAC: Sensors and sensing in Biology and Engineering. Springer, eBook ISBN 978-3-7091-6025-1Published: 06 December 2012
2- Wild D: The Immunoassay Handbook. Fourth Edition, Elsevier, Ltd., ©2013, ISBN 978-0-08-097037-0 Najnovejši pregledni članki s področja /The latest review articles from the field.

Cilji in kompetence:

<p>Predmet seznanja študente z uporabo bioloških makromolekul v različnih laboratorijskih diagnostičnih metodah in sredstvih. Študent spozna lastnosti bioloških makromolekul, njihovo sposobnost vezave ligandov in dejavnike, ki določajo njihovo specifičnost. Podani so načini njihovega pridobivanja in priprava stabilnih oblik. Seznanj se z vrstami diagnostičnih testov in biosenzorjev. Predstavljeno je njihovo delovanje, metodika priprave testov v laboratorijskem in industrijskem merilu in načini kontrole in zagotavljanja njihove kakovosti.</p>	<p>Objectives and competences:</p> <p>The students will learn about the application of biological macromolecules in laboratory diagnostic methods and devices. They will be informed on properties of biological macromolecules, their ability to bind ligands and on factors defining their specificity. The methods for their isolation and the preparation of stable forms will be presented. Students will be acquainted with types of diagnostic assays and biosensors. Their functioning, technologies for laboratory and large scale production and methods for quality control and assurance will be presented</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje: Poznavanje delovanja biodiagnostikov in biosenzorjev omogoča uporabo teh testov za samozdravljenje, v kliničnih ter industrijskih biotehnoških laboratorijih in s tem optimizacijo zdravljenja in biotehnoških postopkov.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding: Understanding of biodiagnostics and biosensors enables the application for self treatment, in clinical and industrial biotechnological laboratories optimising the treatment and biotechnological processes..</p>
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Metode poučevanja in učenja:

<p>Predavanja, seminarji, vodena diskusija, problemsko osnovano učenje, skupinsko delo.</p>	<p>Learning and teaching methods:</p> <p>Lectures, seminars, tutorial discussions, problem based learning, group learning.</p>
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Načini ocenjevanja:

	Delež/Weight	Assessment:
1. opravljena seminarska naloga	40,00 %	1. Seminar
2. ustni izpit	60,00 %	2. oral exam

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

<p>Janko Kos 1. PLAVEC, Tina Vida, MITROVIĆ, Ana, PERIŠIĆ, Milica, ŠTRUKELJ, Borut, KOS, Janko, BERLEC, Aleš. Targeting of fluorescent Lactococcus lactis to colorectal cancer cells through surface display of tumour-antigen binding proteins. <i>Microbial biotechnology</i>. [Online ed.]. 2021, str.14. ISSN 1751-7915. DOI: 10.1111/1751-7915.13907. 2. BOŽIĆ, Biljana, LONČAR, Goran, VIŽIN, Tjaša, RADOJIČIĆ, Zoran, POPOVIĆ BRKIĆ, Vera, KOS, Janko. Relationship of high circulating cystatin C to biochemical markers of bone turnover and bone mineral density in elderly males with a chronic heart failure : <i>Journal of Medical Biochemistry</i>. 2019, vol. 38, no. 1, str. 53-</p>
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- 62, ilustr. ISSN 1452-8258. <https://content.sciendo.com/view/journals/jomb/38/1/article-p53.xml>, DOI: [10.2478/jomb-2018-0011](https://doi.org/10.2478/jomb-2018-0011).
3. MITROVIĆ, Ana, PEČAR FONOVIĆ, Urša, **KOS, Janko**. Cysteine cathepsins B and X promote epithelial-mesenchymal transition of tumor cells. *European journal of cell biology*. 2017, vol. 96, iss. 6, str. 622-631, ilustr. ISSN 0171-335. <http://www.sciencedirect.com/science/article/pii/S0171933516302771>, DOI: [10.1016/j.ejcb.2017.04.003](https://doi.org/10.1016/j.ejcb.2017.04.003).
4. JAKOŠ, Tanja, PIŠLAR, Anja, PEČAR FONOVIĆ, Urša, **KOS, Janko**. Lysosomal peptidases in innate immune cells : implications for cancer immunity. *Cancer immunology and immunotherapy*. 2020, vol. 69, iss. 2, str. 275-283, ilustr. ISSN 0340-7004. <https://link.springer.com/article/10.1007/s00262-019-02447-0>, DOI: [10.1007/s00262-019-02447-0](https://doi.org/10.1007/s00262-019-02447-0).
5. **KOS, Janko**, PERIŠIĆ, Milica, PRUNK, Mateja, SABOTIČ, Jerica, DAUTOVIĆ, Esmeralda, JEWETT, Anahid. Cystatin F as a regulator of immune cell cytotoxicity. *Cancer immunology and immunotherapy*. Dec. 2018, vol. 67, iss. 12, str. 1931-1938, ilustr. ISSN 0340-7004. <https://link.springer.com/article/10.1007/s00262-018-2165-5>, DOI: [10.1007/s00262-018-2165-5](https://doi.org/10.1007/s00262-018-2165-5). [COBISS.SI-ID [31384359](https://www.cobiss.si/id/31384359)]
6. PRUNK, Mateja, **KOS, Janko**. Nanoparticle based delivery of protease inhibitors to cancer cells. *Current medicinal chemistry*. 2017, vol. 24, iss. 42, str. 4816-4837, ilustr. ISSN 0929-8673. <https://benthamscience.com/journals/current-medicinal-chemistry/article/145725/>, <http://www.eurekaselect.com/node/145725/article>, DOI: [10.2174/0929867323666160922162811](https://doi.org/10.2174/0929867323666160922162811).

BIOEKONOMIJA, INOVACIJE IN UPRAVLJANJE SISTEMOV V BIOTEHNIKI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioekonomija, inovacije in upravljanje sistemov v biotehnik
Course title:	Bioeconomy, innovation and management of systems in life sciences
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037297
Koda učne enote na članici/UL Member course code:	3799

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	0	0	10	80	5

Nosilec predmeta/Lecturer: Luka Juvančič

Izvajalci predavanj:	Luka Juvančič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General requirements for admission to doctoral programme.

Vsebina:	Content (Syllabus outline):
Biogospodarstvo – definicije, načela, kontekst • Ključni pojmi (krožnega) biogospodarstva • Gospodarski in širši družbeni kontekst • Značilnosti snovnih in procesnih tokov po virih biomase Tehnologije in inovacije v biogospodarstvu	Bioeconomy - definitions, principles, context - key concepts of (circular) bioeconomy - economic and wider social context - characteristics of material flows and processes by biomass sources Technologies and innovations in the bioeconomy

<ul style="list-style-type: none"> • Ključne in komplementarne tehnologije v kaskadni/krožni rabi biomase <p>Ekonomika biogospodarstva</p> <ul style="list-style-type: none"> • biogospodarstvo v ekonomskem sistemu – stanje in projekcije • dejavniki povpraševanja v biogospodarstvu • dejavniki ponudbe in organiziranja poslovnih procesov v biogospodarstvu • trgi, poslovni modeli in podporno okolje v biogospodarstvu • Institucije, vladanje in politična ekonomija biogospodarstva <p>Instrumenti za podporo vrednotenju in upravljanju</p> <ul style="list-style-type: none"> • omejitve in perspektive statističnega spremljanja v biogospodarstvu • vrednotenje uspešnosti: biofizikalni in monetarni pristopi <p>vrednotenje po načelih (snovne/okoljske, gospodarske in družbene) trajnosti</p>	<ul style="list-style-type: none"> - key and complementary technologies in cascading/circular use of biomass <p>Economics of bioeconomy</p> <ul style="list-style-type: none"> - bioeconomy in the economic system – current status and projections - demand factors in the bioeconomy - factors of supply and organization of business processes in the bioeconomy - markets, business models and a supportive environment in the bioeconomy - institutions, governance and political economy of the bioeconomy <p>Evaluation and management support instruments</p> <ul style="list-style-type: none"> - limitations and perspectives of statistical monitoring in the bioeconomy - performance evaluation: biophysical and monetary approaches - evaluation according to the principles of (material / environmental, economic and social) sustainability
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Temeljna literatura in viri/Readings:

<p>Viaggi, D. 2018. The Bioeconomy. Delivering Sustainable Green Growth. CAB International, Oxfordshire (UK), Boston (MS).</p> <p>Lewandowski, I. (Ed). 2018. Bioeconomy. Shaping the Transition to a Sustainable, Biobased Economy. Springer, Cham (SUI).</p> <p>Befort, N. 2023. The Bioeconomy Institutions, Innovation and Sustainability (1st Ed.). Routledge Studies of environmental economics, Routledge, Oxon (UK).</p> <p>Tišma, S., Farkaš, A., Pisarović, A., Funduk, M., Tolić, I. 2023. Economics, Ecology, and Policy for the Bioeconomy A Holistic Approach (1st Ed.). Routledge Studies of environmental economics, Routledge, Oxon (UK).</p>
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Cilji in kompetence:

<p>Gre za temeljni doktrinarni predmet študijskega področja ekonomika naravnih virov. Njegov temeljni izobraževalni cilj je sistematična in teoretično poglobljena predstavitev specifik ekonomskih sistemov in upravljaljskih vidikov v biotehniko.</p>	<p>Objectives and competences:</p> <p>It is a fundamental doctrinal course of the scientific field Economics of natural resources. Its fundamental aim is to present in a systematic and theoretically comprehensive way the specifics of economic systems and management aspects in bio-based industries.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Slušatelji se seznanijo s konceptualnim okvirom bioekonomije. Sposobni so ga prenesti v reševanje raziskovalnih in organizacijskih vprašanj, vezanih na različna področja biotehniko.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>Students are introduced to the conceptual framework of bioeconomy. They are able to translate the the principles of bioeconomy into solving of research and organizational problems related to the different areas of bio-based industries.</p>
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Metode poučevanja in učenja:

<ul style="list-style-type: none"> • Predavanja oz. konzultacije • Seminar 	<p>Learning and teaching methods:</p> <ul style="list-style-type: none"> • Lectures or consultations • Seminar
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Načini ocenjevanja:

	Delež/Weight	Assessment:
Ustni izpit	40,00 %	Oral exam
Seminar	60,00 %	Term paper

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Luka Juvančič
Šumrada, T., Lovec, M., Juvančič, L., Rac, I., Erjavec, E. Fit for the task? Integration of biodiversity policy into the post-2020 Common Agricultural Policy : illustration on the case of Slovenia. *Journal for nature conservation*. 2020, vol. 54, art. no. 125804, str. 1-11 [JCR, SNIP, WoS]
Rac, I., Juvančič, L., Erjavec, E. Stimulating collective action to preserve High Nature Value farming in post-transitional settings : a comparative analysis of three Slovenian social-ecological systems. *Nature Conservation*. 2020, vol. 39, str. 87-111, ilustr. ISSN 1314-6947. [JCR, SNIP, WoS]
Kocjančič, T., Debeljak, M., Žgajnar, J., Juvančič, L. Incorporation of emergy into multiple-criteria decision analysis for sustainable and resilient structure of dairy farms in Slovenia. *Agricultural systems*. [Print ed.]. 2018, vol. 164, str. 71-83, ilustr. ISSN 0308-521X. [JCR, SNIP, WoS]
Japelj, A., Hodges, D.G., Verlič, A., Juvančič, L. Using a latent class model to segment citizens of Ljubljana (Slovenia) according to their preferences over the recreation setting in the Golovec urban forest. *Austrian journal of forest science*. 2017, 134, sonderheft 1a, str. 41-62 [JCR, SNIP]
Kocjančič, T., Žgajnar, J., Juvančič, L. Multiple-perspective reorganisation of the dairy sector : mathematical programming approach. *Business systems research journal : international journal of the Society for Promotion of Business Information Technology (BIT)*. 2016, vol. 7, no. 2, str. 35-48, ilustr. ISSN 1847-8344. <http://www.bsrijournal.org/vol-7-no-2.html>, DOI: 10.1515/bsrj-2016-0011. [SNIP, WoS]
Japelj, A., Mavsar, R., Hodges, D.G., Kovač, M., Juvančič, L. Latent preferences of residents regarding an urban forest recreation setting in Ljubljana, Slovenia. *Forest Policy and Economics : a companion journal to Forest Ecology and Management*. [Print ed.]. 2016, vol. 71, str. 71-79 [JCR, SNIP, WoS]
Kocjančič, T., Juvančič, L., Kavčič, S., Debeljak, M. Complementarity of socio-economic and emergy evaluation of agricultural production systems : the case of Slovenian dairy sector. *Ecological economics : the journal of the International Society for Ecological Economics*. 2014, vol. 107, str. 469-481. [JCR, SNIP, WoS]

BIOFILMI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biofilmi
Course title:	Biofilms
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0568444
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	10	40	0	0	200	10

Nosilec predmeta/Lecturer: David Stopar

Izvajalci predavanj: Ines Mandić Mulec, David Stopar
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: Individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Prerequisites:

Splošni pogoji za vpis na doktorski študij.	General prerequisites for enrolment into doctoral studies
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Vsebina:

Content (Syllabus outline):

- | | |
|---|---|
| <ul style="list-style-type: none">Sestava biofilmov (biološka, kemijska).Struktura, dinamika in razvoj biofilmov.Vpliv okoljskih dejavnikov na razvoj biofilmov.Transport in medcelične komunikacije v biofilmih.Koristni in škodljivi biofilmi ter njihova perzistentnost v agroživilstvu. | <ul style="list-style-type: none">Composition of biofilms (biological, chemical).Structure, dynamics and development of biofilms.The effect of environmental factors on biofilm development.Transport and cell to cell communications in biofilms. |
|---|---|

<ul style="list-style-type: none"> Mehanska, kemijska in fizikalna kontrola rasti v biofilmih. Napredne tehnike za določanje sestave, strukture in dinamike biofilmov (npr. konfokalna laserska vrstična mikroskopija, optična pinceta, interfazna reologija, mikrofluidika). 	<ul style="list-style-type: none"> Good and bad biofilms in agro-food industry. Mechanical, chemical and physical control of biofilm growth. Advanced techniques for evaluation of a biofilm composition, structure and dynamics (i.e. confocal laser scanning microscopy, optical tweezers, interphase rheology, microfluidics).
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Temeljna literatura in viri/Readings:

aktualni znanstveni in pregledni članki, ki so javno dostopni preko spleta

Cilji in kompetence:

Cilj predmeta je, da študent uporablja različne eksperimentalne pristope za gojenje in karakterizacijo rasti biofilmov. Uporablja različne mehanske in fizikalno-kemijske pristope za kontrolo rasti mikroorganizmov v biofilmih, spozna in razume vpliv biotskih/abiotskih dejavnikov okolja na razvoj biofilmov. Nauči se uporabe naprednih tehnik za določanje sestave, strukture in dinamike biofilmov.

Objectives and competences:

Upon successful completion of the individual research training the student will learn how to use different techniques for the growth and characterization of biofilms. Will be familiar with various biotic and abiotic factors that influence biofilm development. The student will understand how to use different mechanical and physico-chemical treatments to control microbial growth in biofilms. Uses the advanced techniques for the evaluation of a biofilm composition, structure and dynamics.

Predvideni študijski rezultati:

Študent skozi individualno raziskovalno delo v laboratoriju spozna glavne biološke in kemijske komponente biofilmov. Razume njihovo strukturno in dinamično obnašanje. Razume dinamiko nastanka in propada biofilma. Pozna spremembe v celični fiziologiji, ki omogočajo nastanek biofilma. Razume transportne pojave v biofilmu, vpliv signaliziranja in pozna glavne tehnike za proučevanje biofilmov. Pozna škodljive in koristne vplive biofilmov ter načine za preprečitev oziroma uporabo biofilmov.

Intended learning outcomes:

Through individual research work in the laboratory student learns about the main biological and chemical components of biofilms. Understands structure – dynamic relationship in biofilms. Understands steps in biofilm formation, dispersal and disintegration. Understands physiological changes that allow biofilm formation. Understands transport phenomena in biofilms and role of signalling, knows the main techniques used for studies of biofilms. Student knows how to prevent or use biofilms.

Metode poučevanja in učenja:

Študent v dogovoru z nosilcem in izvajalci določi raziskovalni projekt in opravi praktično delo v laboratoriju, ki je vezano na rast in karakterizacijo biofilmov. V okviru predmeta je možna uporaba raziskovalnih orodij, ki smo jih razvili v laboratorijih, za potrebe raziskovalnega dela doktorskega študenta. V seminarskem delu študent pripravi poročilo o svojem raziskovalnem projektu.

Learning and teaching methods:

In agreement with lecturers student determines the aims of the individual research project and performs the experiments related to growth and characterization of biofilms in the laboratory. Student may use research tools developed in our laboratories for his/her PhD project related to microbial biofilms. In a seminar student produces a report about his/her individual research project.

Načini ocenjevanja:

Ocenjuje se izvedba problemsko orientiranega individualnega raziskovalnega dela in pripravljenega seminarja.

Delež/Weight

100,00 %

Assessment:

Assesment of problem oriented individual research work and written report.

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

David Stopar

1. TERLEP, Saša, HYMPANOVA, Michaela, DOGŠA, Iztok, PAJK, Franja, STOPAR, David. Photoacoustic removal of *Enterococcus faecalis* biofilms from titanium surface with an Er:Yag laser using super short pulses. *Lasers in medical science*. 2022, vol. 37, str. 381–390. ISSN 0268-8921. DOI: [10.1007/s10103-021-03265-6](https://doi.org/10.1007/s10103-021-03265-6). [COBISS.SI-ID [50278659](#)]
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7. PANDUR, Žiga, DOGŠA, Iztok, DULAR, Matevž, STOPAR, David. Liposome destruction by hydrodynamic cavitation in comparison to chemical, physical and mechanical treatments. *Ultrasonics Sonochemistry*. Mar. 2020, vol. 61, str. 1-11, ilustr. ISSN 1350-4177. <https://www.sciencedirect.com/science/article/pii/S1350417719309228?via%3Dihub>, DOI: [10.1016/j.ultsonch.2019.104826](https://doi.org/10.1016/j.ultsonch.2019.104826). [COBISS.SI-ID [5144696](#)]
8. ŠARC, Andrej, KOSEL, Janez, STOPAR, David, ODER, Martina, DULAR, Matevž. Removal of bacteria *Legionella pneumophila*, *Escherichia coli*, and *Bacillus subtilis* by (super)cavitation. *Ultrasonics Sonochemistry*. Apr. 2018, vol. 42, str. 228-236, ilustr. ISSN 1350-4177. https://ac.els-cdn.com/S1350417717305072/1-s2.0-S1350417717305072-main.pdf?_tid=8731f192-db3f-11e7-96e6-0000aacb35d&acdnat=1512645336_7ae6f9b0762e2f47704d5873693ed3c0, DOI: [10.1016/j.ultsonch.2017.11.004](https://doi.org/10.1016/j.ultsonch.2017.11.004). [COBISS.SI-ID [15787803](#)]
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Ines Mandić Mulec

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2. PODNAR, Eli, EREGA, Andi, DANEVIČIČ, Tjaša, KOVAČEC, Eva, LORIES, Bram, STEENACKERS, Hans, MANDIĆ-MULEC, Ines. Nutrient availability and biofilm polysaccharide shape the bacillaene-dependent antagonism of *Bacillus subtilis* against *Salmonella Typhimurium*. *Microbiology spectrum*. [Spletna

izd.]. Nov./Dec. 2022, vol. 10, iss. 6, str. 1-14, ilustr. ISSN 2165-0497.

<https://journals.asm.org/doi/10.1128/spectrum.01836-22>, DOI: 10.1128/spectrum.01836-22. [COBISS.SI-ID 128780803]

3. LIU, Yan, HUANG, Rong, CHEN, Yuqi, MIAO, Youzhi, ŠTEFANIČ, Polonca, MANDIĆ-MULEC, Ines, ZHANG, Ruifu, SHEN, Qirong, XU, Zhihui. Involvement of flagellin in kin recognition between *Bacillus velezensis* strains. *mSystems*. Nov./Dec. 2022, vol. 7, iss. 6, str. 1-14, ilustr. ISSN 2379-5077.

<https://journals.asm.org/doi/10.1128/msystems.00778-22>, DOI: 10.1128/msystems.00778-22. [COBISS.SI-ID 127127043]

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6. ŠPACAPAN, Mihael, DANEVČIČ, Tjaša, ŠTEFANIČ, Polonca, PORTER, Michael, STANLEY-WALL, Nicola R., MANDIĆ-MULEC, Ines. The ComX quorum sensing peptide of *Bacillus subtilis* affects biofilm formation negatively and sporulation positively. *Microorganisms*. 2020, vol. 8, iss. 8, str. 1-20, ilustr. ISSN 2076-2607. <https://www.mdpi.com/2076-2607/8/8/1131>, DOI: 10.3390/microorganisms8081131.

[COBISS.SI-ID 24045827]

Sonja Smole Možina

1. RAMIĆ, Dina, BUCAR, Franz, KUNEJ, Urban, DOGŠA, Iztok, KLANČNIK, Anja, SMOLE MOŽINA, Sonja. Antibiofilm potential of *Lavandula* preparations against *Campylobacter jejuni*. *Applied and environmental microbiology*. Oct. 2021, vol. 87, iss. 19, str. 1-18, ilustr. ISSN 1098-5336. DOI: 10.1128/AEM.01099-21. [COBISS.SI-ID 72216835]

2. GRADIŠAR CENTA, Urška, STERNIŠA, Meta, VIŠIĆ, Bojana, FEDERL, Žiga, SMOLE MOŽINA, Sonja, REMŠKAR, Maja. Novel nanostructured and antimicrobial PVDF–HFP/PVP/MoO₃PVDF–HFP/PVP/MoO₃ composite. *Surface innovations*. Oct. 2021, vol 9, iss. 5, str. 256-266, ilustr. ISSN 2050-6252. <https://www.icevirtuallibrary.com/doi/pdf/10.1680/jsuin.20.00073>, DOI: 10.1680/jsuin.20.00073. [COBISS.SI-ID 45504003]

3. ŠIMUNOVIĆ, Katarina, SAHIN, Orhan, KOVAČ, Jasna, SHEN, Zhangqi, KLANČNIK, Anja, ZHANG, Qijing, SMOLE MOŽINA, Sonja. (-)-[alpha]-Pinene reduces quorum sensing and *Campylobacter jejuni* colonization in broiler chickens. *PloS one*. 2020, vol. 15, iss. 4, str. 1-16, e0230423, ilustr. ISSN 1932-6203. DOI: 10.1371/journal.pone.0230423. [COBISS.SI-ID 5180280]

4. STACHUROVÁ, Tereza, MALACHOVÁ, Kateřina, SEMERÁD, Jaroslav, STERNIŠA, Meta, RYBKOVÁ, Zuzana, SMOLE MOŽINA, Sonja. Tetracycline induces the formation of biofilm of bacteria from different phases of wastewater treatment. *Processes*. [Online ed.]. 2020, vol. 8, iss. 8, str. 1-20, ilustr. ISSN 2227-9717. <https://www.mdpi.com/2227-9717/8/8/989>, DOI: 10.3390/pr8080989. [COBISS.SI-ID 25693955]

5. STERNIŠA, Meta, KLANČNIK, Anja, SMOLE MOŽINA, Sonja. Spoilage *Pseudomonas* biofilm with *Escherichia coli* protection in fish meat at 5 °C. *Journal of the science of food and agriculture*. [Print ed.]. 2019, vol. 99, iss. 10, str. 4635-4641, ilustr. ISSN 0022-5142. DOI: 10.1002/jsfa.9703. [COBISS.SI-ID 5040248]

6. KLANČNIK, Anja, ŠIMUNOVIĆ, Katarina, STERNIŠA, Meta, RAMIĆ, Dina, SMOLE MOŽINA, Sonja, BUCAR, Franz. Anti-adhesion activity of phytochemicals to prevent *Campylobacter jejuni* biofilm formation on abiotic surfaces. *Phytochemistry reviews*. 2021, vol. 20, str. 55-84, ilustr. ISSN 1568-7767. DOI: 10.1007/s11101-020-09669-6. [COBISS.SI-ID 5176952]

BIOFIZIKA MEMBRAN IN BIOLOŠKIH NANOSTRUKTUR

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biofizika membran in bioloških nanostruktur
Course title:	Biophysics of membranes and biological nanostructures
Članica nosilka/UL Member:	UL FE

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037319
Koda učne enote na članici/UL Member course code:	3821

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	25	5	0	10	190	10

Nosilec predmeta/Lecturer:	Veronika Kralj Igljč
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Izvajalci predavanj:	Aleš Igljč, Veronika Kralj Igljč
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical
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Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies

Vsebina: <i>Termodinamski opis sistemov z velikim številom delcev:</i> fazna vsota, entropija, prosta energija, kemijski potencial, elektrokemijski potencial, osmotski tlak. <i>Sestava bioloških membran:</i> lipidne molekule, proteini, glikoproteini, membranski skelet, oblika lipidov in proteinov, električne lastnosti lipidov in proteinov <i>Samoorganizacija lipidov in proteinov:</i> linearni agregati membranskih sestavin, agregacija lipidnih molekul v micelle in lipidne dvojne plasti, biološko pomembne	Content (Syllabus outline): <i>Thermodynamic description of systems with a large number of particles:</i> phase sums, entropy, free energy, chemical potential, electrochemical potential, osmotic pressure. <i>Composition of biological membranes:</i> lipid molecules, proteins, glycoproteins, membrane skeletons, forms of lipids and proteins, electrical properties of lipids and proteins. <i>Self-organisation of lipids and proteins:</i> linear aggregates of membranous components, aggregation of lipid
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<p>nelamelarne lipidne faze, tvorba fleksibilnih membranskih nanodomen, lateralna fazna separacija membranskih sestavin, agregacija nanodomen, tvorba in stabilnost membranskih nanotub.</p> <p><i>Elastične lastnosti membran:</i> deformacije v ravnini membrane, upogibna energija, vpliv oblike membranskih sestavin in direktnih interakcij med membranskimi sestavinami na elastične lastnosti membran, lateralna porazdelitev membranskih sestavin in elastične lastnosti membrane, elastičnih lastnosti membrane ter oblika celic in organel, vpliv citoskeleta na obliko celice.</p> <p><i>Električne lastnosti membran:</i> električna dvojna plast, Poisson-Boltzmannova teorija električne dvojne plasti, Gouy-Chapmanov model električne dvojne plasti, prosta energija električne dvojne plasti, vpliv končne velikosti molekul in porazdelitve naboja znotraj posamezne molekule na lastnosti električne dvojne plasti, vpliv velikosti in porazdelitve električnega naboja membrane na transport naelektrjenih molekul preko membrane, vezava in adhezija naelektrjenih molekul na površino membrane.</p> <p><i>Elektrostatske Interakcije med membranskimi površinami:</i> vpliv sestave raztopine na interakcije med membranami, vpliv električnih lastnosti molekul v raztopini na interakcije med membranami, adhezija membran.</p> <p><i>Transport in komunikacije med celicami in organelami:</i> mehanizmi mikro- in nano-vesikulacije, vpliv električnih lastnosti membran in raztopine na vesikulacijo membran, endocitoza, eksocitoza, fuzija vesiklov, enkapsulacija nanodelcev in DNA, vpliv detergentov in nanodelcev na vesikulacijo in obliko membrane, mehanizmi stabilnosti in tvorbe membranskih nanotub ter njihova vloga pri transportu snovi med celicami in med celičnimi organelami. Mikrovesikulacija membran in njena vloga pri razširjanju tumorjev in nastajanju krvnih strdkov. Mehanizmi nastajanje in stabilnost membranskih por.</p>	<p>molecules in mycelia and lipid double layers, biologically important non-lammelular lipid phases, formation of flexible membranous nano-domains, lateral phase separation of membranous components, aggregation of nanodomains, formation and stability of membranous nanotubes.</p> <p><i>Elastic properties of membranes:</i> deformations in levels of a membrane, flexible energy, influence of forms of membrane components and direct interactions between membranous components in elastic properties of membranes, lateral distribution of membranous components and elastic properties of membranes, elastic properties of membranes and forms of cells and organelles, influence of cytoskeleton on forms of cells.</p> <p><i>Electric properties of membranes:</i> electric double layer, Poisson-Boltzmann theory of electric double layer, Gouy-Chapman model of electric double layer, free energy of electric double layer, influence of final size of molecule and distribution of charge within individual molecules on the properties of an electrical double layer, influence of size and distribution of electrical charge of a membrane on transport of electrified molecules through a membrane, bonds and adhesion of electrified molecules on the surface of a membrane.</p> <p><i>Electrostatic interaction between membrane surfaces:</i> influence of components of solvents on the interaction between membranes, influence of electrical properties of molecules in solvents on the interaction between membranes, adhesion of membranes.</p> <p><i>Transport and communication between cells and organelles:</i> mechanisms of micro- and nano-vesiculation, influence of electrical properties of membranes and solvens on the vesiculation of membranes, endocytosis, exocytosis, fusion of vesicles, encapsulation of nano-particles and DNA, influence of detergents and nano-particles on vesiculation and forms of membrane, mechanisms of stability and formations of membrane nanotubes and their role in the transport of substances between cells and between cell organelles. Microvesiculation of membranes and its role in spreading tumours and creation of blood clots. Mechanisms of creation and stability of membrane pores.</p>
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Temeljna literatura in viri/Readings:

- 1.A. Igljč, V. Kralj-Igljč, D. Drobne: Nanostructures in Biological Systems : theory and applications. Singapore: Pan Stanford; Boca Raton: CRC Press, 2015. ISBN 978-981-4303-43-9.
<https://doi.org/10.1201/b18607>. [COBISS.SI-ID 11076436]
<https://physics.fe.uni-lj.si/publications/publications.html>
2. J. Israelachvili: Intermolecular and Surface Forces, Academic Press Ltd., London, vsakokratna nova izdaja.
<https://www.sciencedirect.com/book/9780123751829/intermolecular-and-surface-forces>
3. T.L. Hill: An Introduction to Statistical Thermodynamics, Dover Publications, New York, USA, vsakokratna nova izdaja. <https://store.doverpublications.com/0486652424.html>
4. aktualni znanstveni članki iz področja, ki jih sproti določijo izvajalci predmeta.

Cilji in kompetence:

Študenti se seznanijo z biofizikalnim opisom bioloških membran s pomočjo uveljavljenih modelov elektrostatičnih in elastičnih lastnosti membran in membranskih mikro- ter nano-struktur. Prikazani bodo izbrani najnovejši rezultati s področja biofizike membranskih nanostruktur.

Izobraževalni cilji: Temeljni izobraževalni cilj je poglobitev znanja za delo s celičnimi membranami, celicami in umetnimi lipidnimi sistemi ter pridobitev znanja na področju raziskav vpliva različnih snovi kot so maščobe, detergenti in nanodelci na stabilnost membrane, membransko vesikulacijo, medcelične komunikacije ter patološka stanja membrane in celice.

Objectives and competences:

Students are familiarised with biophysical description of biological membranes with the aid of established models of electrostatic and elastic properties of membranes and membranous micro- and macro-nanostructures. Selected most recent results in the field of biophysics of membranous nanostructures will be presented.

Educational aims: The basic educational aim is to deepen knowledge for work with cell membranes, cells and artificial lipid systems and to obtain knowledge in the field of research into the influence of various substances, such as fats, detergents and nanoparticles, on the stability of membranes, membrane vesicles, inter-cellular communication and pathological states of membranes and cells.

Predvideni študijski rezultati:

Kandidata usposobiti za izvedbo omenjenih raziskav, katerih rezultati bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti na področju študija membranskih lastnosti in membranske vesikulacije ter komunikacije med celicami v povezavi z študijem različnih bolezenskih stanj na nivoju membrane in celice, na primer razširjanje tumorjev ter nastajanje krvnih strdkov.

Intended learning outcomes:

To qualify the candidate for carrying out the mentioned research, the results of which will make an important contribution to basic and applicative science in the field of studies of membrane properties and membrane vesiculation and communication between cells, in connection with the study of various disease states on the level of membranes and cells, such as the spread of tumours and the creation of blood clots.

Metode poučevanja in učenja:

Predavanja, seminarji, konzultacije, projektno/seminarsko delo.

Learning and teaching methods:

Lectures, seminars, consultations, project/seminar work.

Načini ocenjevanja:

Seminar ali projekt.

Delež/Weight

100,00 %

Assessment:

Seminar or project.

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:**Veronika Kralj-Iglič**

1. MESAREC, Luka, GÓZDŽ, Wojciech, KRALJ-IGLIČ, Veronika, KRALJ, Samo, IGLIČ, Aleš. Coupling of nematic in-plane orientational ordering and equilibrium shapes of closed flexible nematic shells. *Scientific reports*. 2023, 13, 10663, str. 1-11.
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4. JAN, Zala, HOČEVAR, Matej, KONONENKO, Veno, MICHELINI, Sara, REPAR, Neža, CAF, Maja, KOČJANČIČ, Boštjan, DOLINAR, Drago, KRALJ, Slavko, MAKOVEC, Darko, IGLIČ, Aleš, DROBNE,

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5. JERAN, Marko, ROMOLO, Anna, SPASOVSKI, Vesna, HOČEVAR, Matej, NOVAK, Urban, ŠTUKELJ, Roman, ŠUŠTAR, Vid, KISOVEC, Matic, BEDINA ZAVEC, Apolonija, KOGEJ, Ksenija, IGLIČ, Aleš, TREBŠE, Polonca, KRALJ-IGLIČ, Veronika (avtor, korespondenčni avtor). Small cellular particles from European spruce needle homogenate. *Int. Journal of Molecular Sciences*. 2023, vol. 24, no 5, [article no.] 4349, str. 1-16.

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7. DRAB, Mitja, DANIEL, Matej, KRALJ-IGLIČ, Veronika, IGLIČ, Aleš. Solitons in the Heimburg-Jackson model of sound propagation in lipid bilayers are enabled by dispersion of a stiff membrane. *The European Physical Journal. E, Soft Matter*. Sep. 2022, iss. 9, art. no. 79, str. 1-8.

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prof. ddr. Aleš Iglíč (izvajalec):

1. MESAREC, Luka, GÓZDŽ, Wojciech, KRALJ-IGLIČ, Veronika, KRALJ, Samo, IGLIČ, Aleš. Coupling of nematic in-plane orientational ordering and equilibrium shapes of closed flexible nematic shells. *Scientific Reports*. 2023, 13, 10663, str. 1-11.

2. KUMAR SADHU, Raj, HERNANDEZ-PADILLA, Christian, ESHED EISENBACH, Yael, PENIČ, Samo, ZHANG, Lixia, VISHWASRAO, Harshad D., BEHKAM, Bahareh, KONSTANTOPOULOS, Konstantinos, SHROFF, Hari, IGLIČ, Aleš, PELES, Elijor, NAIN, Amrinder S., GOV, Nir S. Experimental and theoretical model for the origin of coiling of cellular protrusions around fibers. *Nature Communications*. 2023, vol. 14, 5612, str. 1-13.

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- 10.** JERAN, Marko, ROMOLO, Anna, SPASOVSKI, Vesna, HOČEVAR, Matej, NOVAK, Urban, ŠTUKELJ, Roman, ŠUŠTAR, Vid, KISOVEC, Matic, BEDINA ZAVEC, Apolonija, KOGEJ, Ksenija, IGLIČ, Aleš, TREBŠE, Polonca, KRALJ-IGLIČ, Veronika (avtor, korespondenčni avtor). Small cellular particles from European spruce needle homogenate. *Int. Journal of Molecular Sciences*. 2023, vol. 24, no 5, [article no.] 4349, str. 1-16.

BIOINFORMACIJSKA ORODJA IN PODATKOVNE ZBIRKE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioinformacijska orodja in podatkovne zbirke
Course title:	Bioinformatics Tools and Databases
Članica nosilka/UL Member:	UL FRI

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037262
Koda učne enote na članici/UL Member course code:	3764

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	40	0	0	0	190	10

Nosilec predmeta/Lecturer: Jernej Jakše

Izvajalci predavanj: Tomaž Curk, Cene Gostinčar, Jernej Jakše, Roman Jerala, Tanja Kunej, Uroš Petrovič, Blaž Stres

Izvajalci seminarjev:

Izvajalci vaj:

Izvajalci kliničnih vaj:

Izvajalci drugih oblik:

Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:

Predavanja/Lectures:	Angleščina, Slovenščina
Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij.	Prerequisites: General conditions for enrolment in doctoral studies.
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Vsebina:

- Bioinformacijske podatkovne zbirke: zaporedja nukleinskih kislin, proteinov, strukturne podatkovne zbirke, bibliografske podatkovne zbirke. Orodja za analizo zaporedij in struktur.

- Genomski projekti modelnih organizmov, primerjalna genomika, določevanje genov in regulatornih regij v genomih, SNP analize, genske mreže.

Content (Syllabus outline):

- Databases in bioinformatics, nucleic acid sequences, protein sequences, 3D structures, bibliographic information. Tools for analysis of sequences and structures.

- Genomic projects of model organisms, comparative genomics, identifying genes and regulatory regions of genomes, SNP analysis, gene networks.

<ul style="list-style-type: none"> - Orodja v transkriptomiki in visoko-zmogljivostni genetiki. - Bioinformacijska orodja v proteomiki in interaktomiki. - Integrativna genomika. - Aplikacije: bioinformatika v okoljski genomiki, farmakogenomiki. - Ontologije in zbirke znanj v bioinformatiki. - Bioinformacijski pristopi v kemogenomiki. - Projektno delo s specifičnimi programskimi orodji med predavanji in v okviru seminarske naloge. 	<ul style="list-style-type: none"> - Bioinformatics tools in transcriptomics and high-throughput genetics. - Integrative genomics. - Bio-informatics tools in proteomics and interactomics. - Applications: Bioinformatics in environmental genomics, pharmacogenomics. - Ontologies and knowledge databases in bioinformatics. - Bioinformatics approaches in chemogenomics. - Project work with specific software tools during the lectures and within seminar.
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> - Jonathan Pevsner (2015) Bioinformatics and Functional Genomics, 3rd Edition, ISBN 9781118581780 - David W. Mount (2004) Bioinformatics. Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, USA, 2nd edition, ISBN 0879697121. - pregledni in originalni znanstveni članki s širšega področja bioinformatike.
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Cilji in kompetence:

Seznanitev s celotnim področjem bioinformatike in trenutnimi trendi v razvoju bioinformatike. Predmet daje študentu pregled nad celotnim področjem bioinformatike in ga uvaja v raziskovalno delo na glavnih toriščih raziskav v bioinformatiki.

Objectives and competences:

Students will become familiar with the entire area of bioinformatics and current trends in the development of bioinformatics. The subject gives students an overview of the field and introduces the research work on the main spheres of research in bioinformatics.

Predvideni študijski rezultati:

Znanje in razumevanje:
Študenti bodo spoznali specifična bioinformacijska orodja, njihove omejitve in potrebe po njihovem izboljšanju glede na razvoj raziskav v genetiki, genomiki, proteomiki, sistemski in strukturni biologiji ter v evlucijskih študijah. Študenti se bodo tudi seznanili z naravo podatkov v bioloških raziskavah in z najpomembnejšimi biološkimi podatkovnimi zbirkami ter njihovo uporabo.

Intended learning outcomes:

Knowledge and understanding:
Students will learn specific bioinformatics tools, their limitations and their need for improvement in relation to the development of research in genetics, genomics, proteomics, systems and structural biology and in evolutionary studies. Students will also learn about the nature of the data in biological research and the most important biological databases and their use.

Metode poučevanja in učenja:

Predavanja, projektno delom, praktične vaje z računalniki.

Learning and teaching methods:

Lectures, project workshops, practical work with computers.

Načini ocenjevanja:

Pisno preverjanje znanja

Delež/Weight

100,00 %

Assessment:

Written exam

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Jernej Jakše
1. TURUDIĆ, Ante, LIBER, Zlatko, GRDIŠA, Martina, JAKŠE, Jernej, VARGA, Filip, ŠATOVIĆ, Zlatko. Variation in chloroplast genome size : Biological phenomena and technological artifacts. Plants. 2023, vol. 12, iss. 2, art. 254, 12 str., ilustr. ISSN 2223-7747. <https://www.mdpi.com/2223-7747/12/2/254>,

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3. MILJANIĆ, Vanja, JAKŠE, Jernej, KUNEJ, Urban, RUSJAN, Denis, ŠKVARČ, Andreja, ŠTAJNER, Nataša. Virome status of preclonal candidates of grapevine varieties (*Vitis vinifera* L.) from the Slovenian wine-growing region Primorska as determined by high-throughput sequencing. *Frontiers in microbiology*. 2022, vol. 13, 11 str., ilustr. ISSN 1664-302X. <https://www.frontiersin.org/articles/10.3389/fmicb.2022.830866/full>, DOI: 10.3389/fmicb.2022.830866. [COBISS.SI-ID 98211843]
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6. PRENTOUT, Djivan, ŠTAJNER, Nataša, ČERENAK, Andreja, TRICOU, Theo, BROCHIERARMANET, Céline, JAKŠE, Jernej, KÄFER, Jos, MARAIS, Gabriel A. B. Plant genera *Cannabis* and *Humulus* share the same pair of well-differentiated sex chromosomes. *The New phytologist*, ISSN 0028-646X, 2021, vol. , iss. , str., doi: 10.1111/nph.17456. [COBISS.SI-ID 63536131]
7. GONZALEZ, Francisco, JIBIN, Johnny, WALKER III, William B., GUAN, Qingtian, MFARREJ, Sara, JAKŠE, Jernej, MONTAGNÉ, Nicolas, JACQUIN-JOLY, Emmanuelle, ALQARNI, Abdulaziz A., MOHAMMED ALI, Al-Saleh, PAIN, Arnab, ANTONY, Binu. Antennal transcriptome sequencing and identification of candidate chemoreceptor proteins from an invasive pest, the American palm weevil, *Rhynchophorus palmarum*. *Scientific reports*, ISSN 2045-2322, 2021, vol. 11, str. 1-14 (8334), ilustr. <https://www.nature.com/articles/s41598-021-87348-y>, doi: 10.1038/s41598-021-87348-y. [COBISS.SI-ID 60452099]
8. ŠTAJNER, Nataša, RADIŠEK, Sebastjan, KUMAR MISHRA, Ajay, NATH, Vishnu Sukumari, MATOUŠEK, Jaroslav, JAKŠE, Jernej. Evaluation of Disease Severity and Global Transcriptome response Induced by Citrus bark cracking viroid, Hop latent viroid, and their co-infection in hop (*Humulus lupulus* L.). *International journal of molecular sciences*, ISSN 1422-0067, 2019, vol. 20, no. 13, str. 1-21 (3154), doi: 10.3390/ijms20133154. [COBISS.SI-ID 9268089]
9. JESENIČNIK, Taja, ŠTAJNER, Nataša, RADIŠEK, Sebastjan, JAKŠE, Jernej. RNA interference core components identified and characterised in *Verticillium nonalfalfae*, a vascular wilt pathogenic plant fungus of hops. *Scientific reports*, ISSN 2045-2322, 2019, vol. 9, str. 1-12 (8651), ilustr. <https://doi.org/10.1038/s41598-019-44494-8>, doi: 10.1038/s41598-019-44494-8. [COBISS.SI-ID 9242233]
10. NATH, Vishnu Sukumari, KUMAR MISHRA, Ajay, KUMAR, Atul, MATOUŠEK, Jaroslav, JAKŠE, Jernej. Revisiting the role of transcription factors in coordinating the defense response against citrus bark cracking viroid infection in commercial hop (*Humulus Lupulus* L.). *Viruses*, ISSN 1999-4915, 2019, vol. 11, iss. 5: 419, str. 1-19. <https://doi.org/10.3390/v11050419>. [COBISS.SI-ID 9229433]

Roman Jerala:

1. RIHTAR, Erik, LEBAR, Tina, LAINŠČEK, Duško, KORES, Katarina, LEŠNIK, Samo, BREN, Urban, JERALA, Roman. Chemically inducible split protein regulators for mammalian cells. *Nature chemical biology*. 2023, vol. 19, str.64-71, ilustr. ISSN 1552-4450. <https://www.nature.com/articles/s41589-022-01136-x>, DOI: 10.1038/s41589-022-01136-x. [COBISS.SI-ID 123628035]
2. JAZBEC, Vid, JERALA, Roman, BENČINA, Mojca. Proteolytically activated CRAC effectors through designed intramolecular inhibition. *ACS synthetic biology*. 8. Jul. 2022, vol. 11, iss. 8, str. 2756–2765, ilustr.

ISSN 2161-

5063. <https://pubs.acs.org/doi/10.1021/acssynbio.2c00151>, <https://dirros.openscience.si/IzpisGradiva.php?id=15301>, DOI: 10.1021/acssynbio.2c00151. [COBISS.SI-ID 115643651]

3. AVBELJ, Monika, HAFNER BRATKOVIČ, Iva, LAINŠČEK, Duško, MANČEK KEBER, Mateja, PETERNELJ, Tina Tinkara, PANTER, Gabriela, TREON, Steven P., GOLE, Boris, POTOČNIK, Uroš, JERALA, Roman. Cleavage-mediated regulation of Myd88 signaling by inflammasome-activated caspase-1. *Frontiers in immunology*. Jan. 2022, vol. 12, str. 1-14, ilustr. ISSN 1664-

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0067. <https://www.mdpi.com/1422-0067/23/11/6197>, DOI: 10.3390/ijms23116197. [COBISS.SIID 109968387]

5. LAINŠČEK, Duško, FORSTNERIČ, Vida, MIKOLIČ, Veronika, MALENŠEK, Špela, PEČAN, Peter, BENČINA, Mojca, SEVER, Matjaž, PODGORNIK, Helena, JERALA, Roman. Coiled-coil heterodimerbased

recruitment of an exonuclease to CRISPR/Cas for enhanced gene editing. *Nature communications*. 23 Jun. 2022, vol. 13, str. 1-12, ilustr. ISSN 2041-1723. <https://www.nature.com/articles/s41467-022-31386-1.pdf>, DOI: 10.1038/s41467-022-31386-1. [COBISS.SI-ID 114151683]

6. PRAZNIK, Arne, FINK, Tina, FRANKO, Nik, LONZARIČ, Jan, BENČINA, Mojca, JERALA, Nina, PLAPER, Tjaša, ROŠKAR, Samo, JERALA, Roman. Regulation of protein secretion through chemical regulation of endoplasmic reticulum retention signal cleavage. *Nature communications*. 14 Mar. 2022, vol. 13, str. 1-14, ilustr. ISSN 2041-1723. <https://www.nature.com/articles/s41467-022-28971-9.pdf>, DOI: 10.1038/s41467-022-28971-9. [COBISS.SI-ID 101106947]

Tanja Kunej:

1. MIKEC, Špela, KOLENC, Živa, PETERLIN, Borut, HORVAT, Simon, POGOREVC, Neža, KUNEJ, Tanja. Syndromic male subfertility : a network view of genome-phenome associations. *Andrology*. 2022, vol. 10, no. 4, str. 720-732, ilustr. ISSN 2047-2927. <https://onlinelibrary.wiley.com/doi/abs/10.1111/andr.13167>, DOI: 10.1111/andr.13167. [COBISS.SI-ID 99436291]

2. PRAŠNIKAR, Erika, KUNEJ, Tanja, GORENJAK, Mario, POTOČNIK, Uroš, KOVAČIČ, Borut, KNEZ, Jure. Transcriptomics of receptive endometrium in women with sonographic features of adenomyosis. *Reproductive biology and endocrinology*. 2022, vol. 20, art. 2, str. 1-16, ilustr. ISSN 1477-7827. <https://rbej.biomedcentral.com/articles/10.1186/s12958-021-00871-5>, DOI: 10.1186/s12958-021-00871-5. [COBISS.SIID 91852035]

3. ŠKRLJ, Blaž, ERŽEN, Nika, LAVRAČ, Nada, KUNEJ, Tanja, KONC, Janez. CaNDiS: a web server for investigation of causal relationships between diseases, drugs, and drug targets. *Bioinformatics*, ISSN 1367-4803, 2021, vol. 36, no. 6, str. 885-887. doi: 10.1093/bioinformatics/btaa762. [COBISS.SI-ID 27212035]

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Cene Gostinčar:

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5. GOSTINČAR, Cene, TURK, Martina, ZAJC, Janja, GUNDE-CIMERMAN, Nina. Fifty *Aureobasidium pullulans* genomes reveal a recombining polyextremotolerant generalist. *Environmental microbiology*. [Print ed.]. 2019, vol. 21, iss. 10, str. 3638-3652. ISSN 1462-2912. <https://doi.org/10.1111/1462-2920.14693>, DOI: 10.1111/1462-2920.14693. [COBISS.SI-ID 5158991], [JCR, SNIP, WoS do 24. 9. 2021:

št. citatov (TC): 7, čistih citatov (CI): 4, čistih citatov na avtorja (CIAu): 1,00, Scopus do 26. 10. 2021: št. citatov (TC): 8, čistih citatov (CI): 6, čistih citatov na avtorja (CIAu): 1,50]

- GOSTINČAR, Cene, SUN, Xiaohuan, ZAJC, Janja, FANG, Chao, YONG, Hou, LUO, Yonglun, GUNDE-CIMERMAN, Nina, SONG, Zewei. Population genomics of an obligately halophilic basidiomycete *Wallemia ichthyophaga*. *Frontiers in microbiology*. 2019, vol. 10, str. 1-12, ilustr. ISSN 1664-302X. DOI: 10.3389/fmicb.2019.02019. [COBISS.SI-ID 5158479], [JCR, SNIP, WoS do 19. 10. 2021: št. citatov (TC): 1, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0,00, Scopus do 20. 10. 2021: št. citatov (TC): 1, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0,00]

Tomaz Curk:

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Blaž Stres:

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- MUROVEC, Boštjan, DEUTSCH, Leon, STRES, Blaž. Computational framework for high-quality production and large-scale evolutionary analysis of metagenome assembled genomes. *Molecular biology and evolution*, ISSN 0737-4038, 2020, doi: 10.1093/molbev/msz237
- ŠKET, Robert, DEBEVEC, Tadej, KUBLIK, Susanne, SCHLOTTER, Michael, SCHOELLER, Anne, MUROVEC, Boštjan, VOGEL-MIKUŠ, Katarina, MAKUC, Damjan, PEČNIK, Klemen, PLAVEC, Janez, MEKJAVIČ, Igor B., EIKEN, Ola, PREVORŠEK, Zala, STRES, Blaž. Intestinal metagenomes and metabolomes in healthy young males : inactivity and hypoxia generated negative physiological

symptoms precede microbial dysbiosis. *Frontiers in physiology*, ISSN 1664-042X, 2018, doi: 10.3389/fphys.2018.00198.

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5. KOLBL REPINC, Sabina, BIZJAN, Benjamin, BUDHIRAJA, Vaibhav, DULAR, Matevž, GOSTIŠA, Jurij, BRAJER HUMAR, Barbara, KAURIN, Anela, KRŽAN, Andrej, LEVSTEK, Meta, MORALES ARTEAGA, Juan Francisco, PETKOVŠEK, Martin, RAK, Gašper, STRES, Blaž, ŠIROK, Brane, ŽAGAR, Ema, ZUPANC, Mojca. Integral analysis of hydrodynamic cavitation effects on waste activated sludge characteristics, potentially toxic metals, microorganisms and identification of microplastics. *Science of the total environment*. Feb. 2022, vol. 806, pt. 4, str. 1-14, ilustr. ISSN 0048-9697. <https://www.sciencedirect.com/science/article/pii/S0048969721064925>, DOI: 10.1016/j.scitotenv.2021.151414. [COBISS.SI-ID 83741955]
6. NICOLA, Lidia, INSAM, Heribert, PERTOT, Ilaria, STRES, Blaž. Reanalysis of microbiomes in soils affected by apple replant disease (ARD) : old foes and novel suspects lead to the proposal of extended model of disease development. *Applied soil ecology*. avg. 2018, vol. 129, str. 24-33, ilustr. ISSN 0929-1393. <https://www.sciencedirect.com/science/article/pii/S0929139317312556>, DOI: 10.1016/j.apsoil.2018.04.010.

BIOINFORMACIJSKI ALGORITMI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioinformacijski algoritmi
Course title:	Bioinformatics Algorithms
Članica nosilka/UL Member:	UL FRI

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037263
Koda učne enote na članici/UL Member course code:	3765

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	0	20	0	0	95	5

Nosilec predmeta/Lecturer: Tomaž Curk

Izvajalci predavanj:	
Izvajalci seminarjev:	Tomaž Curk
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: individualno raziskovalni/individual research course

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Osnovna znanja programiranja, verjetnosti in statistike.

Prerequisites:

Basics of computer programming in any language, basic knowledge of probability and statistics.

Vsebina:

- Algoritmi za analizo zaporedij, iskanje podzaporedij, iskanje motivov.
- Določanje zaporedja genomov, algoritmi na grafih.
- Primerjava zaporedij, dinamično programiranje.
- Algoritmi za filogenetsko analizo.
- Skriti markovski modeli, analiza strukture genoma.
- Analiza genskih izrazov, razvrščanje v skupine, klasifikacija, analiza obogatenosti genskih skupin.

Content (Syllabus outline):

- Sequence analysis, search for subsequences, motif search.
- Genome assembly, graph algorithms.
- Comparison of biological sequences, dynamic programming.
- Phylogeny algorithms.
- Hidden Markov Models and gene prediction.

- Rekonstrukcija in analiza genskih mrež. - Vizualizacija podatkov.	- Gene expression analysis, clustering and supervised data mining, enrichment analysis. - Gene network reconstruction and analysis. - Data vizualization.
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Temeljna literatura in viri/Readings:

- Durbin R, Eddy SR, Krogh A, Mitchison G (1998) Biological sequence analysis: probabilistic models of proteins and nucleic acids, Cambridge University Press. - Jones NC, Pevzner PA (2004) An introduction to bioinformatics algorithms, The MIT Press. - Pavel A. Pevzner, Phillip Compeau (2018) Bioinformatics Algorithms: An Active Learning Approach , Active Learning Publishers. Ostalo: revijalni članki s področja, tekoča periodika in druga učna gradiva.

Cilji in kompetence:

Študentje se bodo pri predmetu naučili implementirati vrsto algoritmov, ki jih lahko uporabimo na področju bioinformatike in sistemske biologije. Znali bodo razbrati, na kater tip biološki vprašanj lahko odgovorimo z razvojem in uporabo računskih pristopov.	Objectives and competences: Students completing the course should be able to implement a variety of bioinformatics and systems biology algorithms, and learn which type of biological questions can be answered by means of computational approaches.
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Predvideni študijski rezultati:

Študentje se bodo seznanili z glavnimi razredi algoritmov, ki so uporabljajo na področju bioinformatike in lahko z njimi analiziramo zaporedja, grafe in podatke o meritvah iz molekularne biologije. Na praktičnih primerih analize velike množice podatkov bodo spoznali probleme pri razvoju teh algoritmov, ki so vezani na hitrost izvajanja in uporabo spomina. Izpopolnili bodo svoje predznanje programiranja in v praksi uporabili predznanja s področja verjetnosti in statistike.	Intended learning outcomes: Students will become familiar with main classes of computational approaches and algorithms in bioinformatics. The algorithms that they will design in a class are those from sequence and graph analysis and analysis of data coming from experimental measurements in molecular biology. In practical cases of analysis of large data sets they will need to cope with problems of computational efficiency and limited data storage (computer memory). They will advance their knowledge of programming, and use their previously developed skills in probability and statistics in practical problems from systems biology.
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Metode poučevanja in učenja:

Praktične vaje, domače naloge, seminar, konzultacije. Reševanje problemov na učnih spletnih straneh http://rosalind.info in http://stepic.org .	Learning and teaching methods: Workshops, homeworks, consultations, seminar. Solving problems on learning portals such as http://rosalind.info and http://stepic.org .
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Načini ocenjevanja:

	Delež/Weight	Assessment:
Domače naloge	20,00 %	Homeworks
seminar	80,00 %	seminar

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

Tomaž Curk: 1. GOMIŠČEK, Rok, CURK, Tomaž. Relation chaining in binary positive-only recommender systems. Expert systems with applications, ISSN 0957-4174. 2020, vol. 150, str. 1-8, doi: 10.1016/j.eswa.2020.113296. [COBISS.SI-ID 1538542531]
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2. JAKOMIN, Martin, BOSNIĆ, Zoran, CURK, Tomaž. Simultaneous incremental matrix factorization for streaming recommender systems. *Expert systems with applications*, ISSN 0957-4174. [Print ed.], Dec. 2020, vol. 160, str. 1-10, doi: 10.1016/j.eswa.2020.113685. [COBISS.SI-ID 23113219]
3. VODOPIVEC, Maja, LAH, Ljerka, NARAT, Mojca, CURK, Tomaž. Metabolomic profiling of CHO fed-batch growth phases at 10, 100, and 1,000 L. *Biotechnology and bioengineering*, ISSN 0006-3592, 2019, vol. 116, no. 10, str. 2720-2729, doi: 10.1002/bit.27087. [COBISS.SI-ID 4260232]
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5. JAKOMIN, Martin, CURK, Tomaž, BOSNIĆ, Zoran. Generating inter-dependent data streams for recommender systems. *Simulation modelling practice and theory*. 2018, vol. 88, str. 1-16 [COBISS.SI-ID 1537860803]
6. CASTELLO, Alfredo, FRESE, Christian K., FISCHER, Bernd, JÄRVELIN, Aino I., HOROS, Rastislav, ALLEAUME, Anne-Marie, FOEHR, Sophia, CURK, Tomaž, KRIJGSVELD, Jeroen, HENTZE, Matthias W. Identification of RNA-binding domains of RNA-binding proteins in cultured cells on a system-wide scale with RBDmap. *Nature protocols*, ISSN 1754-2189, Dec. 2017, vol. 12, no. 12, str. 2447-2464, [COBISS.SI-ID 1537666243]

BIOKOMPATIBILNI MATERIALI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biokompatibilni materiali
Course title:	Biocompatible materials
Članica nosilka/UL Member:	UL ZF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037267
Koda učne enote na članici/UL Member course code:	3769

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	5	0	0	95	5

Nosilec predmeta/Lecturer:

Izvajalci predavanj:
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type:

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških. Splošni pogoji za vpis na doktorski študij.

Prerequisites:

Graduates of unified master's degree programs and 2nd degree programs of biomedical and biotechnical sciences.
General conditions for enrollment in doctoral studies.

Vsebina:

1 Sodobni trendi na področju biomaterialov (implanti . podlaga za vzgojo celičnih kultur, kompatibilnost biomaterialov, tehnike za moduliranje biokompatibilnosti)

Content (Syllabus outline):

1 Modern trends in biomaterials (implants as a basis for bringing cell cultures compatibility of biomaterials, techniques to modulate the biocompatibility)

<p>2 Mejne površine med biokompatibilnimi materiali in biosistemi</p> <p>3 Pregled najpogostejših biokompatibilnih materialov in novih tehnologij v ortopedski kirurgiji</p> <p>4 Pregled fizikalno kemijskih pojavov na površinah brezementnih endoprotez kolka (omočljivost, hrapavost in odziv celic)</p> <p>5 Pregled procesov osteointegracije deponiranih multifunkcijskih nanostrukturiranih plasti na površini kovinskih biokompatibilnih materialov z namenom izboljšati osteointegracijo vsadka s kostjo.</p>	<p>2 Interfaces between biocompatible materials and bio systems</p> <p>3 Review of new technologies in orthopedic surgeries</p> <p>4 Review of physicochemical phenomena the surface of uncemented hip endoprostheses (surface wetting and roughness and cell response)</p> <p>5 Review of osteointegration proceses of multifunction coatings on nanostructured surface of metallic materials with the aim to improve osteointegration between implant and bone.</p>
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Temeljna literatura in viri/Readings:

<p>DOLINAR, Drago. Novosti v endoprotetiki kolčnega in kolenskega sklepa. V: PAVLOVČIČ, Vinko (ur.). <i>Novosti v ortopediji</i>. Ljubljana: Ortopedska klinika, Klinični center. 2008, str. 99-105. [COBISS.SI-ID 24231129]</p> <p>Biomaterials Science: An Introduction to Materials in Medicine, Editors: William Wagner, Shelly Sakiyama-Elbert, Guigen Zhang, Michael Yaszemski. 4th Edition - May 23, 2020. eBook ISBN: 9780128161388</p> <p>M.J. Grimm Standard Handbook of Biomedical Engineering (2004)</p> <p>Biomaterials in orthopaedics <i>Biomaterials Research</i> (2020) 24:7 https://doi.org/10.1186/s40824-020-0185-7</p> <p>W.D. Yaszemski, D.J. Trantolo, K.U. Levandrowski, V. Hasirci, D.E. Altobelli Biomaterials in Orthopedics. Marcel Dekker, New York (2004)</p> <p>Park J. B., & Bronzino J. D.(eds.) (2003) "Biomaterials Principles and Applications", CRC Press</p> <p>Beer F., Johnston E., & Dewolf J. (2001) "Mechanics of Materials" 3rd Edition McGraw- Hill</p> <p>Budinski K. G., & Budinski M. K.(2001) Edition, "Engineering Materials Properties and Selection" 7th Edition, Prentice Hall.</p> <p>Revijalni članki s področja ortopedske kirurgije, tekoča periodika s področja biokompatibilnih materialov ki se uporabljajo v ortopediji in v dentalni medicini ter druga učna gradiva</p>
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Cilji in kompetence:

<p>Osnovni cilj predmeta je podati študentom teoretična in praktična znanja s področja tehnik za študij biokompatibilnosti in moduliranje biokompatibilnosti.</p> <p>Študent pridobi osnovno znanje za razumevanje na področju bio inženirskih materialov in tkiv za aplikacije v ortopedski kirurgiji in dentalni medicini.</p>	<p>Objectives and competences:</p> <p>The main objective of the course is to give students theoretical and practical knowledge in the field of biocompatibility and its modulation</p> <p>Student get the basic knowledge and understanding in the field of bio engineering materials and tissues for the applications in orthopredic surgery and rechabilitation.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Znanje in razumevanje na področju inženirskih materialov in tkiv.</p> <p>Metode sledenja kirurških rezultatov na osnovi raziskav predčasno odpovedanih endoprotez kolka in kolena</p> <p>Iskanje novih kombinacij biomaterialov za izboljšanje dobe trajanja vsadkov</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>Knowledge and understanding in the field of engineered materials and tissues.</p> <p>Methods of tracking surgical results on the base of the investigations of prematurely failed hip and knee endoprosthesis</p> <p>Finding new biomaterials combinations with the aim to improve lifetime of implants</p>
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Metode poučevanja in učenja:

<p>Predavanja, diskusijske delavnice predstavljenih seminarjev</p>	<p>Learning and teaching methods:</p> <p>Lectures, discussion workshops of presented seminars</p>
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Demonstracija že vpeljanih biomedicinskih metod v kirurgiji Predstavitev dosedaj obstoječe literature Seznanitev z potekajočimi raziskavami Smernice za nadaljne razvijanje področja	Demonstration of already introduced biomedical methods in surgery Presentation of existing literature Familiarization with ongoing research Guidelines for further development of the field
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Načini ocenjevanja:	Delež/Weight	Assessment:
Ustni in ali pisni izpit	50,00 %	Written or oral examination
Priprava in zagovor seminarja	20,00 %	Written seminar and its presentation
Vsebinska priprava manjšega projekta	30,00 %	Preparation of the short project

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

- GRDADOLNIK, Matic, MARUŠIČ, Arne K., JENKO, Monika, SNOJ, Luka, MOZER, Alenka, DOLINAR, Drago, NOVAK, Urban. The application of vibrational spectroscopy in the analysis of ultra-high molecular weight polyethylene for knee and hip prosthetics. *International journal of natural sciences : current and future research trends*. 30 Jul. 2022, vol. 14, no. 1, str. 92-108, ilustr. ISSN 2790-7929. [COBISS.SI-ID [117633539](#)]
- MERČUN, Aljaž, KOŠAK, Robert, JENKO, Monika, KOVAČ, Janez, VODIČAR, Miha. Magnetically controlled growing rods for the treatment of eos : experience from a single center and XPS surface analysis of the rods = Magnetno vodene rastoče palice za zdravljenje zgodnjih skolioz : izkušnje enega centra in XPS analize površine palic. *Materiali in tehnologije*. [Tiskana izd.]. sep.-okt. 2022, letn. 56, št. 5, str. 595-603, ilustr. ISSN 1580-2949. , DOI: [10.17222/mit.2022.565](#). [COBISS.SI-ID [126950659](#)]
- BELIČ, Igor, KLOPČIČ, Beno, LOGAR, Andraž, JENKO, Monika, DOLINAR, Drago, GORENŠEK, Matevž, KOCJANČIČ, Boštjan. A study of the sonic resonance of the femoral part of hip endoprosthesis = Študija zvočne resonance stegneničnega dela kolčne proteze. *Materiali in tehnologije*. [Tiskana izd.]. 2021, letn. 55, št. 1, str. 15-18, ilustr. ISSN 1580-2949. <http://mit.imt.si/izvodi/mit211/belic.pdf>, DOI: [10.17222/mit.2020.108](#). [COBISS.SI-ID [50473475](#)],
- ŽARKOVIĆ GJURIN, Sonja, JENKO, Monika, DONIK, Črtomir, OBLAK, Čedomir. Characterization of new and retrieved titanium biomaterial for dental implants = Karakterizacija biomaterialov novih in uporabljenih zobnih vsadkov. *Materiali in tehnologije*. [Tiskana izd.]. jan.-feb. 2021, letn. 55, št. 1, str. 33-37, ilustr. ISSN 1580-2949. DOI: [10.17222/mit.2020.114](#). [COBISS.SI-ID [50473219](#)],
- AVSEC, Klemen, CONRADI, Marjetka, JENKO, Monika, KOCJANČIČ, Boštjan, DEBELJAK, Mojca, GORENŠEK, Matevž, DOLINAR, Drago. Effect of sterilization on the surface properties of Ti6Al7Nb alloy femoral stems = Vpliv sterilizacije na površinske lastnosti femoralnih kolčnih komponent endoprotez iz Ti6Al7Nb zlitine. *Materiali in tehnologije*. [Tiskana izd.]. jan.-feb. 2021, letn. 55, št. 1, str. 59-64, ilustr. ISSN 1580-2949. DOI: [10.17222/mit.2020.141](#). [COBISS.SI-ID [50472963](#)],
- KOSEC, Tadeja, MOČNIK, Petra, MEZEG, Uroš, LEGAT, Andraž, OVSENIK, Maja, JENKO, Monika, GRANT, John T., PRIMOŽIČ, Jasmina. Tribocorrosive study of new and in vivo exposed nickel titanium and stainless steel orthodontic archwires. *Coatings*. Mar. 2020, vol. 10, iss. 3, str. 1-11, ilustr. ISSN 2079-6412. , DOI: [10.3390/coatings10030230](#). [COBISS.SI-ID [2566759](#)],
- JENKO, Monika, GODEC, Matjaž, KOCIJAN, Aleksandra, RUDOLF, Rebeka, DOLINAR, Drago, OVSENIK, Maja, GORENŠEK, Matevž, ZAPLOTNIK, Rok, MOZETIČ, Miran. A new route to biocompatible Nitinol based on a rapid treatment with H₂/O₂H₂/O₂ gaseous plasma. *Applied Surface Science*. [Print ed.]. April 2019, vol. 473, str. 976-984. ISSN 0169-4332. DOI: [10.1016/j.apsusc.2018.12.140](#). [COBISS.SI-ID [21981974](#)]
- JUAN, J., ORAZI, V., SANDOVAL, M., BECHTHOLD, P., HERNÁNDEZ-LAGUNA, A., SAINZ-DÍAZ, C. I., GONZALES, E. A., JENKO, Monika, JASEN, P. V. DTF study of Ni segregation at B2-

NiTi(110)/rutile-TiO₂(110) interface. *Applied Surface Science*. [Print ed.]. Sept. 2019, vol. 489, str. 287-296, ilustr. ISSN 0169-4332. <https://www.sciencedirect.com/science/article/pii/S0169433219316575>. [COBISS.SI-ID 1487786].

Drago DOLINAR (6 člankov za zadnjih 5 let)

1. BELIČ, Igor, KLOPČIČ, Beno, LOGAR, Andraž, JENKO, Monika, DOLINAR, Drago, GORENŠEK, Matevž, KOCJANČIČ, Boštjan. A study of the sonic resonance of the femoral part of hip endoprosthesis = Študija zvočne resonance stegneničnega dela kolčne proteze. *Materiali in tehnologije*. [Tiskana izd.]. 2021, letn. 55, št. 1, str. 15-18, ilustr. ISSN 1580-2949. doi [10.17222/mit.2020.108](https://doi.org/10.17222/mit.2020.108). [COBISS.SI-ID [50473475](https://www.cobiss.si/id/50473475)],

2. AVSEC, Klemen, CONRADI, Marjetka, JENKO, Monika, KOCJANČIČ, Boštjan, DEBELJAK, Mojca, GORENŠEK, Matevž, DOLINAR, Drago. Effect of sterilization on the surface properties of Ti6Al7Nb alloy femoral stems = Vpliv sterilizacije na površinske lastnosti femoralnih kolčnih komponent endoprotez iz Ti6Al7Nb zlitine. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2021, vol. 55, no. 1, str. 59-64, , doi: [10.17222/mit.2020.141](https://doi.org/10.17222/mit.2020.141)

3. JENKO, Monika, GODEC, Matjaž, KOCIJAN, Aleksandra, RUDOLF, Rebeka, DOLINAR, Drago, OVSENIK, Maja, GORENŠEK, Matevž, ZAPLOTNIK, Rok, MOZETIČ, Miran. A new route to biocompatible Nitinol based on a rapid treatment with H₂/O₂/H₂/O₂ gaseous plasma. *Applied Surface Science*, ISSN 0169-4332. [Print ed.], April 2019, vol. 473, str. 976-984, doi:

4. AVSEC, Klemen, JENKO, Monika, CONRADI, Marjetka, KOCIJAN, Aleksandra, VESEL, Alenka, KOVAČ, Janez, GODEC, Matjaž, BELIČ, Igor, ŠETINA, Barbara, DONIK, Črtomir, GORENŠEK, Matevž, KOCJANČIČ, Boštjan, DOLINAR, Drago. Surface properties of retrieved cementless femoral hip endoprostheses produced from a Ti6Al7Nb alloy. *Coatings*, ISSN 2079-6412, December 2019, vol. 9, iss. 12, str. 1-15, , doi: [10.3390/coatings9120868](https://doi.org/10.3390/coatings9120868).

5. DOLINAR, Drago, GORENŠEK, Matevž, JENKO, Monika, GODEC, Matjaž, ŠETINA, Barbara, DONIK, Črtomir, KOCIJAN, Aleksandra, DEBELJAK, Mojca, KOCJANČIČ, Boštjan. Biomaterials in endoprosthetics = Biomateriali v endoprotetiki. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], jan.-feb. 2018, letn. 52, št. 1, str. 89-98, doi: [10.17222/mit.2017.196](https://doi.org/10.17222/mit.2017.196).

6. JENKO, Monika, GORENŠEK, Matevž, GODEC, Matjaž, HODNIK, Maxinne, ŠETINA, Barbara, DONIK, Črtomir, GRANT, John T., DOLINAR, Drago. Surface chemistry and microstructure of metallic biomaterials for hip and knee endoprostheses. *Applied Surface Science*, ISSN 0169-4332. [Print ed.], Avg. 2017, vol. 427, str. 584-doi: [10.1016/j.apsusc.2017.08.007](https://doi.org/10.1016/j.apsusc.2017.08.007).

BIOLOŠKE TEME ZA NEBIOLOGE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biološke teme za nebiologe
Course title:	Topics in Biology for Non-Biologists
Članica nosilka/UL Member:	UL FRI

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037264
Koda učne enote na članici/UL Member course code:	3766

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	25	0	0	0	100	5

Nosilec predmeta/Lecturer: Marina Dermastia

Izvajalci predavanj: Marina Dermastia, Tom Turk
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: individualno raziskovalni /individual research course

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina: Predmet je namenjen študentom s srednješolskim znanjem biologije. Njegova vsebina je posebej prilagojena vsakemu študentu. Poučevanje je zelo neformalno in omogoča dovolj časa za razpravo ter vprašanja, s ciljem navdušiti študente, tako da jim da nekaj osnov biologije. Študentje bodo spoznali osnovne gradnike življenja od molekul do celic, razumeli mehanizme za replikacijo, transkripcijo in translacijo DNA ter kako se celice organizirajo v	Content (Syllabus outline): The course is designed for students with high school knowledge of biology and the content is specifically tailored to the individual student. The class is very informal and allows ample time for discussion and questions. The goal is to get students excited about basic biology. Students learn about the basic building blocks of life, from molecules to cells, and understand the mechanisms and machinery of DNA replication, transcription, and translation, as well as
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<p>prostoru in času. Razumeli bodo osnovno molekularno biologijo gena in temeljne celične procese, povezane z energijo. Prikazana bo organizacija rasti rastlin in živali s poudarkom na evolucijski razvojni biologiji, ki temelji na izražanju genov in genski regulaciji.</p>	<p>the organization of cells in space and time. The organization of plant and animal growth is demonstrated, with emphasis on evolutionary developmental biology based on gene expression and gene regulation.</p>
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Temeljna literatura in viri/Readings:

<p>Spellman F. R. Biology for Nonbiologists, Government Institutes; 1 edition (2007), 292 pages, ISBN-10: 0865874212</p> <p>Dermastia M. Pogled v rastline, Nacionalni inštitut za biologijo (2010), 237 strani, ISBN 978-961-92543-4-9</p> <p>Molecular Biology of the Cell Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter Sixth Edition, editors. (2014) Garland Science: New York and Abingdon, UK. 1464 pages. ISBN: 9780815344643</p> <p>Brown T. A. Genomes 4; 4 edition(2017) 544 pages, ISBN 9780815345084.</p>

Cilji in kompetence:

<p>Predmet je namenjen študentom, ki so končali drugostopenjske magistrske programe orientirane v fiziko, kemijo, matematiko, računalništvo ipd., z izraženim interesom, da povežejo svoje znanje z biološkimi disciplinami.</p> <p>Izobraževalni cilj predmeta je, da študenti razumejo koncepte biologije. Z usvojenim znanjem se bodo bolj zavedali pomena in motivov njim manj znanega biološkega področja.</p>

Objectives and competences:

<p>The course is designed for students who've a second-level master's degree in physics, chemistry, or mathematics and are explicitly interested in linking their knowledge to biological disciplines.</p> <p>The goal of the course is to understand the main concepts of biology. The knowledge acquired will increase their awareness of the area of biology with which they're less familiar.</p>

Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Študenti se bodo s pridobljenim znanjem lahko enakopravno vključevali v znanstvene razprave s študenti z biološkim predznanjem v času študija in skupaj z njimi kasneje oblikovali interaktivno mrežo področnih sodelovanj.</p>
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Intended learning outcomes:

<p>Knowledge and understanding:</p> <p>With the knowledge acquired, students will be able to participate equally in scientific discussions with students with prior biology education and to form interactive networks of collaboration between disciplines together with them.</p>

Metode poučevanja in učenja:

<p>Vodeno samoučenje; razprave o specifičnih temah zbranih iz temeljnih študijskih virov ali dodatnih virov z aktualnimi tematikami in konzultacije pri pripravi in predstavitvi seminarske naloge iz izbranih preglednih vsebin v znanstveni literaturi.</p>

Learning and teaching methods:

<p>Guided self-learning; discussions on specific selected themes; and consultation for preparation and presentation of seminar tasks from selected review contents in the scientific literature.</p>
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Načini ocenjevanja:

<ul style="list-style-type: none"> Izdelava in predstavitev seminarja
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Delež/Weight

100,00 %

Assessment:

<ul style="list-style-type: none"> Preparation and presentation of a seminar

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

<p>Prof. dr. Marina Dermastia MEHLE, Nataša, KAVČIČ, Sanda, MERMAL, Sara, VIDMAR, Sara, POMPE NOVAK, Maruša, RIEDLE-BAUER, Monika, BRADER, Günter, KLADNIK, Aleš, DERMASTIA, Marina. Geographical</p>

and temporal diversity of 'Candidatus Phytoplasma solani' in wine-growing regions in Slovenia and Austria. *Frontiers in plant science*. Mai 2022, vol. 13, str. 1-12, ilustr. ISSN 1664-462X. <https://doi.org/10.3389/fpls.2022.889675>, DOI: 10.3389/fpls.2022.889675. [COBISS.SIID 109003011]

ALIČ, Špela, DERMASTIA, Marina, BURGER, Johan, DICKINSON, Matthew, PIETERSEN, Gerhard, PIETERSEN, Gert, DREO, Tanja. Genome-informed design of a LAMP assay for the specific detection of the strain of 'Candidatus Phytoplasma asteris' phytoplasma occurring in grapevines in South Africa. *Plant disease*. Nov. 2022, vol. 106, no. 11, str. 2927-2839, ilustr. ISSN 0191-2917. <https://doi.org/10.1094/PDIS-10-21-2312-RE>, DOI: 10.1094/PDIS-10-21-2312-RE. [COBISS.SIID 131923203]

3. KOCJAN, Domen, DOLENC KOCE, Jasna, ETL, Florian, DERMASTIA, Marina. Genome size of life forms of Araceae : a new piece in the C-value puzzle. *Plants*. 27 Jan. 2022, vol. 11, iss. 3, str. 1-24, ilustr. ISSN 2223-7747. <https://www.mdpi.com/2223-7747/11/3/334>, DOI: 10.3390/plants11030334. [COBISS.SI-ID 95749123]

4. DERMASTIA, Marina, ŠKRLJ, Blaž, STRAH, Rebeka, ANŽIČ, Barbara, TOMAŽ, Špela, KRŽNIK, Maja, SCHÖNHUBER, Christina, RIEDLE-BAUER, Monika, RAMŠAK, Živa, PETEK, Marko, KLADNIK, Aleš, LAVRAČ, Nada, GRUDEN, Kristina, ROITSCH, Thomas, BRADER, Günter, POMPE NOVAK, Maruša. Differential response of grapevine to Infection with 'Candidatus Phytoplasma solani' in early and late growing season through complex regulation of mRNA and small RNA transcriptomes. *International journal of molecular sciences*. 1 Apr. 2021, vol. 22, no. 7, str. 3531-1-3531-28. ISSN 1661-6596. <https://www.mdpi.com/1422-0067/22/7/3531>. [COBISS.SI-ID 58895619]

5. ŠKRLJ, Blaž, POMPE NOVAK, Maruša, BRADER, Günter, ANŽIČ, Barbara, RAMŠAK, Živa, GRUDEN, Kristina, KRALJ, Jan, KLADNIK, Aleš, LAVRAČ, Nada, ROITSCH, Thomas, DERMASTIA, Marina. New cross-talks between pathways involved in grapevine infection with 'Candidatus Phytoplasma solani' revealed by temporal network modelling. *Plants*. Apr. 2021, vol. 10, iss. 4, str. 646-1- 646-18, ilustr. ISSN 2223-7747. <https://www.mdpi.com/2223-7747/10/4/646>, DOI: 10.3390/plants10040646. [COBISS.SI-ID 58899971]

6. ALSAHELI, Zeinab, CONTALDO, Nicoletta, MEHLE, Nataša, DERMASTIA, Marina, ELBEAINO, Toufic, BERTACCINI, Assunta. First detection of "Candidatus Phytoplasma asteris" - and "Candidatus Phytoplasma solani" -related strains in fig trees. *Journal of phytopathology*. [Print ed.]. 2020, vol. 168, iss. 1, str. 63-71, ilustr. ISSN 0931-1785. DOI: 10.1111/jph.12868. [COBISS.SI-ID 5206607]

Prof. dr. Tom Turk

1. TURK, Tom. Umetni podvodni grebeni in umetnost možnega = Artificial reefs and the art of the possible. *Acta biologica slovenica : ABS*. [Spletna izd.]. 2021, letn. 64, št. 2, str. 34-41, ilustr. ISSN 1854-3073. http://bijh-s.zrc-sazu.si/ABS/SI/ABS/Cont/64_2/ABS_2_2021_4TurkT.pdf. [COBISS.SIID 93828867]

2. BERNE, Sabina, ČEMAŽAR, Maja, FRANGEŽ, Robert, JUNTES, Polona, KRANJC BREZAR, Simona, GRANDIČ, Marjana, SAVARIN, Monika, TURK, Tom. APS8 delays tumor growth in mice by inducing apoptosis of lung adenocarcinoma cells expressing high number of [alfa]7 nicotinic receptors. *Marine drugs*. 2018, vol. 16, no. 10, št. članka 367, 1-17. ISSN 1660-3397. <https://www.mdpi.com/1660-3397/16/10/367>. [COBISS.SI-ID 4683642]

3. MOODIE, Lindon W. K., SEPČIČ, Kristina, TURK, Tom, FRANGEŽ, Robert, SVENSON, Johan. Natural cholinesterase inhibitors from marine organisms. *Natural product reports*. [Print ed.]. 2019, vol. , iss. , 40 str., ISSN 0265-0568. DOI: 10.1039/c9np00010k. [COBISS.SI-ID 5024335]

4. BERNE, Sabina, ČEMAŽAR, Maja, FRANGEŽ, Robert, JUNTES, Polona, KRANJC BREZAR, Simona, GRANDIČ, Marjana, SAVARIN, Monika, TURK, Tom. APS8 delays tumor growth in mice by inducing apoptosis of lung adenocarcinoma cells expressing high number of [alfa]7 nicotinic receptors. *Marine drugs*. 2018, vol. 16, no. 10, št. članka 367, 1-17. ISSN 1660-3397. <https://www.mdpi.com/1660-3397/16/10/367>. [COBISS.SI-ID 4683642]

5. BERNE, Sabina, KALAUZ, Martina, LAPAT, Marko, SAVIN, Lora, JANUSSEN, Dorte, KERSKEN, Daniel, AMBROŽIČ, Jerneja, ZEMLJIČ JOKHADAR, Špela, JAKLIČ, Domen, GUNDECIMERMAN, Nina, LUNDER, Mojca, ROŠKAR, Irena, ELERŠEK, Tina, TURK, Tom, SEPČIČ, Kristina. Screening of the Antarctic marine sponges (Porifera) as a source of bioactive compounds. *Polar biology*. 2016, vol. 39, str. 947-959. ISSN 0722-4060. DOI: 10.1007/s00300-015-1835-4. [COBISS.SI-ID 3662671]

6. KOSS, David J., ROBINSON, Lianne, MIETELSKA-POROWSKA, Anna, GASIOROWSKA, Anna,

SEPČIĆ, Kristina, TURK, Tom, JASPARS, Marcel, NIEWIADOMSKA, Grazyna, SCOTT, Roderick H., PLATT, Bettina, RIEDEL, Gernot. Polymeric alkylpyridinium salts permit intracellular delivery of human Tau in rat hippocampal neurons : requirement of Tau phosphorylation for functional deficits. Cellular and molecular life sciences. 2015, vol. 72, iss. 23, str. 4613-4632. ISSN 1420-682X. DOI: 10.1007/s00018-015-1949-4. [COBISS.SI-ID 3498831]

BIOLOŠKO IZOBRAŽEVANJE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biološko izobraževanje
Course title:	Biological education
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037272
Koda učne enote na članici/UL Member course code:	3774

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	15	0	0	80	5

Nosilec predmeta/Lecturer: Iztok Tomažič

Izvajalci predavanj: Iztok Tomažič
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General requirements for doctoral study.

Vsebina: Študenti pri predmetu spoznajo zgodovino razvoja in raziskovanja biološkega izobraževanja. Seznanijo se s sodobnimi smernicami raziskovanja na omenjenem področju, ki posega tako v formalna kot neformalna učna okolja. S pregledom in analizo znanstvene literature področja spoznajo pomen razvijanja naravoslovnih kompetenc ter sodobne metode in oblike pedagoškega dela. Na praktičnih primerih spoznajo pomen in vlogo	Content (Syllabus outline): The students will become familiar with the history of biology education and research in this area. They will learn about current research trends in the area, which extends both to formal and informal learning environments. By reviewing and analysing scientific literature, they become aware of the significance of developing natural science competencies and contemporary teaching methods and types. On the basis of practical examples, they learn about the
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<p>izkustvenega učenja in raziskovalnega pouka ter razvoj kritičnega mišljenja z vključevanjem obravnave družbeno-znanstvenih tem v biološko izobraževanje. Na podlagi priprave, izvedbe, analize in evalvacije dveh nastopov, enega v formalni učni ustanovi in enega v obliki predstavitve širši javnosti (neformalno učno okolje), študenti spoznajo pomen promocije znanosti za razvoj naravoslovne pismenosti.</p>	<p>significance and role of experience-based learning and learning through inquiry. They also learn about the importance of development of critical thinking by including socio-scientific issues in biology education. By preparing, delivering, analysing and evaluating two instructional units, one for a formal learning environment and the other as part of a presentation to the wider public (informal learning environment) the students learn about the significance of promoting science for development of scientific literacy.</p>
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> National Research Council. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press, 2012. Prosti dostop: https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts SCIENCE, evolution, and creationism [Elektronski vir] / National Academy of Sciences, Institute of Medicine. - El. knjiga. - Washington, D.C. : National Academies Press, cop. 2008. - xv, 70 str. : ill. (chiefly col.) ; 26 cm. Prosti dostop: https://nap.nationalacademies.org/catalog/11876/science-evolution-and-creationism <p>Revijalni članki s področja (revije Journal of Biological education, The American Biology Teacher, International Journal of Science Education in druge),</p>

Cilji in kompetence:

<p>Predmet je prvotno namenjen doktorskim študentom, ki raziskujejo na področju naravoslovnega izobraževanja. Predmet vključuje vsebine, ki omogočajo študentom širše razumevanje vloge in pomena biološkega izobraževanja, smernice na področju biološkega izobraževanja ter aplikacijo oziroma prenos teh spoznanj v pedagoško prakso.</p>	<h3>Objectives and competences:</h3> <p>The subject is primarily intended for doctoral students researching natural science education. It includes content that enables students a wider understanding of the role and significance of biology education and applying findings in actual teaching.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje: Študenti pridobijo znanje za izvajanje pedagoškega dela ter pedagoškega raziskovanja na področju biološkega izobraževanja v formalnih (osnovne, srednje šole in gimnazije ter fakultete) in neformalnih učnih okoljih (živalski in botanični vrtovi, krajinski parki, muzeji, centri šolskih in obšolskih dejavnosti) ter pridobijo znanje za promocijo znanosti širši javnosti.</p>	<h3>Intended learning outcomes:</h3> <p>Knowledge and understanding: The students acquire the knowledge to carry out pedagogical work and research in formal (primary and secondary schools, grammar schools and faculties) and informal learning environments (zoos, botanical gardens, landscape parks, museums, centres for school-related and extracurricular activities), and acquire the knowledge to promote science to the wider public.</p>
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Metode poučevanja in učenja:

<p>Teoretična znanja v obliki predavanj; projektno delo: (1) seminarji kot priprava, analiza in evalvacija projektne dela, (2) vaje v obliki dveh nastopov, enega v formalnem in enega v neformalnem učnem okolju. Konzultacije med pripravo projektne dela. Samostojno delo študenta z uporabo spletne učilnice.</p>	<h3>Learning and teaching methods:</h3> <p>Theoretical knowledge in the form of lectures; project work: (1) seminars as preparation, analysis and evaluation of project work, (2) tutorials in the form of two presentations, one in a formal and the other in an informal learning setting. Consultation during the preparation of project work. Independent work of students using the online classroom.</p>
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Načini ocenjevanja:

Načini ocenjevanja:	Delež/Weight	Assessment:
Ustni izpit	50,00 %	Oral exam

Projektno delo	50,00 %	Project work
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Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

1. MIHELIC ORAŽEM, Vesna, MAJIC SKRBINŠEK, Aleksandra, ŠORGO, Andrej, TOMAŽIČ, Iztok. Factors affecting Zoo visitors' conservation beliefs and knowledge of large carnivores in 2009 and a dozen years later. *Sustainability*. 2022, vol. 14, iss. 2, str. 1-17. DOI: [10.3390/su14020890](https://doi.org/10.3390/su14020890).
2. RANDLER, Christoph, ADAN, Ana, ANTOFIE, Maria-Mihaela, ARRONA-PALACIOS, Arturo, CANDIDO, Manecas, BOEVE-DE PAUW, Jelle, CHANDRAKAR, Priti, DEMIRHAN, Eda, DETSIS, Vassilis, DI MILIA, Lee, TOMAŽIČ, Iztok, et al. Animal Welfare Attitudes: effects of gender and diet in university samples from 22 countries. *Animals*. 2021, vol. 11, iss. 7, str. 1-14. DOI: [10.3390/ani11071893](https://doi.org/10.3390/ani11071893).
3. MIHELIC ORAŽEM, Vesna, SMOLEJ, Tadeja, TOMAŽIČ, Iztok. Students' attitudes to and knowledge of brown bears (*Ursus arctos* L.) : can more knowledge reduce fear and assist in conservation efforts?. *Animals*. 2021, vol. 11, iss. 7, str. 1-18. DOI: [10.3390/ani11071958](https://doi.org/10.3390/ani11071958). [COBISS.SI-ID [69078531](https://www.cobiss.si/id/69078531)].
4. RANDLER, Christoph, WAGNER, Annkathrin, RÖGELE, Alena, HUMMEL, Eberhard, TOMAŽIČ, Iztok. Attitudes toward and knowledge about wolves in SW German secondary school pupils from within and outside an area occupied by wolves (*Canis lupus*). *Animals*. 2020, vol. 10, iss. 4, str. 1-10. DOI: [10.3390/ani10040607](https://doi.org/10.3390/ani10040607).
5. TOMAŽIČ, Iztok, RANDLER, Christoph. Slovenian adaptation of the Morningness- Eveningness- Stability Scales improved (MESSi). *Biological rhythm research*. 2020, vol. 51, iss. 3, str. 453-459. DOI: [10.1080/09291016.2018.1535539](https://doi.org/10.1080/09291016.2018.1535539).
6. TOMAŽIČ, Iztok, HUMMEL, Eberhard, SCHRENK, Marcus, RUPNIK, Tina, RANDLER, Christoph. Cognitive and affective outcomes of teaching about poisonous and venomous animals. *Journal of biological education*. 2020, vol. 54, no. 1, str. 63-76. DOI: [10.1080/00219266.2018.1546757](https://doi.org/10.1080/00219266.2018.1546757).

BIOMEHANIKA IN BIOFIZIKA V ZDRAVSTVENIH ZNANOSTIH

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biomehanika in biofizika v zdravstvenih znanostih
Course title:	Biomechanics and biophysics in health sciences
Članica nosilka/UL	UL ZF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037268
Koda učne enote na članici/UL Member course code:	3770

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	30	20	0	0	180	10

Nosilec predmeta/Lecturer:	Veronika Kralj Igljč
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Izvajalci predavanj:	Klemen Bohinc, Aleš Igljč, Veronika Kralj Igljč, Peter Veranič
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type:	teoretični/theoretical
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Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
<ul style="list-style-type: none">Medcelična komunikacija v bioinženirstvuBiomehanika in biofizika endoprotezInterakcije različnih kemikalij z biološkimi sistemi (zwitterionske lipidne plasti, eksplicitni model vode, večvalentni ioni in korelacije, ionsko specifični pojavi, kondenzacija DNK na lipidne plasti, sila med naelektrenimi površinami)	<ul style="list-style-type: none">Intracellular communication in bioengineeringBiomechanics of endoprosthesesInteractions of different chemicals with biological systems (zwitterionic lipid layer, explicit water model, multivalent ions and correlations, ion specific effects, DNA condensation, force between charged surfaces)

Temeljna literatura in viri/Readings:

1. J. N. Israelachvili: Intermolecular and Surface Forces, Elsevier, Amsterdam, 2011
 2. IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, DROBNE, Damjana. *Nanostructures in biological systems : theory and applications*. Singapore: Pan Stanford; Boca Raton: CRC Press, 2013 [i. e. 2015]. ISBN 978-981-4303-43-9. <https://doi.org/10.1201/b18607>. [COBISS.SI-ID [11076436](#)]
 3. KRALJ-IGLIČ, Veronika, DOLINAR, Drago, IVANOVSKI, Matic, LIST, Ivo, DANIEL, Matej. Role of biomechanical parameters in hip osteoarthritis and avascular necrosis of femoral head. In: NAIK, Ganesh R (ed.). *Applied biological engineering : principles and practice*. Rijeka: InTech, 2012. Str. 347-364, ilustr. ISBN 978-953-51-0412-4. [COBISS.SI-ID [29766617](#)]
 4. KRALJ-IGLIČ, Veronika. Validation of mechanical hypothesis of hip arthritis development by HIPSTRESS method. In: CHEN, Qian (ed.). *Osteoarthritis : progress in basic research and treatment*. Rijeka: Intech, 2015. Str. 131-156, ilustr., graf. prikazi. ISBN 978-953-51-2136-7. <http://www.intechopen.com/books/osteoarthritis-progress-in-basic-research-and-treatment/validation-of-mechanical-hypothesis-of-hip-arthritis-development-by-hipstress-method>, DOI: [10.5772/59976](#). [COBISS.SI-ID [4876651](#)]
- Znanstveni članki na tem področju / state of the art papers.

Cilji in kompetence:

Osnovni cilj predmeta je podati študentom teoretična in praktična znanja s področja interakcije nanostrukturiranih površin s celično membrano in vloge biomehanike in biofizike pri funkciji endoprotez.

Objectives and competences:

The main objective of the course is to give students theoretical and practical knowledge in techniques for the study of biocompatibility and its modulation, interactions of nanostructured surfaces with the cell membrane and the role of biomechanics and biophysics in the function of endoprostheses.

Predvideni študijski rezultati:

- poznavanje biofizikalnih procesov in njihovih matematičnih modelov stika inženjerskih materialov in tkiv
- uporaba matematičnih modelov pri načrtovanju zdravljenja z endoprotezamin in pri rehabilitaciji

Intended learning outcomes:

- knowledge on biophysical processes and their mathematical models of junction of engineered materials and tissues
- use of mathematical models of the interface between engineered materials and tissues in planning of treatment and rehabilitation

Metode poučevanja in učenja:

- Predavanja
- Individualno delo na projektih
- Predstavitve in interpretacije rezultatov projektov ostalim študentom v skupini v seminarski obliki
- Diskusija o objavljenih člankih iz izbranih tem (kritično vrednotenje znanstvene literature, predstavitev »case studies«)

Learning and teaching methods:

- lectures
- Individual project work
- Presentation and interpretation of results of project work to the other students in open discussion
- Journal club – discussion of published research articles on selected topics (critical evaluation of scientific literature, presentation of the "case studies")

Načini ocenjevanja:

Delež/Weight

Assessment:

Preverjanje znanja poteka v obliki projektne naloge na realnih primerih iz raziskovalne prakse, v kateri študentje pripravijo rešitve za izbrani predlog raziskovalnega projekta. Projektne naloge oddajo v pisni obliki in jih zagovarjajo v ustni obliki, v diskusiji z nosilcem predmeta in sodelujočimi profesorji ter ostalimi študenti.	50,00 %	During the course students prepare individual projects of real cases from research practice, where students prepare solutions for determined research project proposal. They prepare final project work and defend it in the classroom in discussion with professors and other students.
Študent pripravi tudi seminar iz tematike doktorata v povezavi z eno od vsebin predmeta. Pri tem sodelujeta mentor in	50,00 %	Student prepares a doctoral seminar on the topic related to one of the course. In this cooperate mentor and lecturer or/and

nosilec predmeta oz. drugi izvajalci predmeta. Zagovor opravlja študent pred mentorjem in nosilcem in/ali drugim izvajalcem ali v obliki sodelovanja na simpoziju.		other professors. Student defend the seminar in front of mentor and lecturer and/or other professors or in the form of participation in a symposium.
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Ocenjevalna lestvica: 5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

Veronika Kralj Igljč

- MANTILE, Francesca, KISOVEC, Matic, ADAMO, Giorgia, ROMANCINO, Daniele P., HOČEVAR, Matej, BOŽIČ, Darja, BEDINA ZAVEC, Apolonija, PODOBNIK, Marjetka, STOPPELLI, Maria Patrizia, KISSLINGER, Annamaria, BONGIOVANNI, Antonella, KRALJ-IGLIČ, Veronika, LIGUORI, Giovanna L. A novel localization in human large extracellular vesicles for the EGF-CFC founder member CRIPTO and its biological and therapeutic implications. *Cancers*. 29 Jul. 2022, vol. 14, iss. 15, str. 1-18. ISSN 2072-6694. <https://www.mdpi.com/2072-6694/14/15/3700>, DOI: [10.3390/cancers14153700](https://doi.org/10.3390/cancers14153700). [COBISS.SI-ID [120720643](https://www.cobiss.si/record/120720643)]
- URŠIČ, Bojana, KOCJANČIČ, Boštjan, ROMOLO, Anna, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, ZUPANC, Oskar. Assessment of coxarthrosis risk with dimensionless biomechanical parameters. *Acta of bioengineering and biomechanics*. 2021, vol. 23, no. 1, str. 25-34, graf. prikazi. ISSN 1509-409X. <http://www.actabio.pwr.wroc.pl/Vol23No1/3.pdf>, DOI: [10.37190/ABB-01738-2020-03](https://doi.org/10.37190/ABB-01738-2020-03). [COBISS.SI-ID [67931651](https://www.cobiss.si/record/67931651)]
- ROMOLO, Anna, JAN, Zala, BEDINA ZAVEC, Apolonija, KISOVEC, Matic, ARRIGLER, Vesna, SPASOVSKI, Vesna, PODOBNIK, Marjetka, IGLIČ, Aleš, POCSFALVI, Gabriella, KOGEJ, Ksenija, KRALJ-IGLIČ, Veronika. Assessment of small cellular particles from four different natural sources and liposomes by interferometric light microscopy. *International journal of molecular sciences*. 2022, vol. 23, no. 24, str. 1-22, ilustr. ISSN 1422-0067. <https://www.mdpi.com/1422-0067/23/24/15801>, DOI: [10.3390/ijms232415801](https://doi.org/10.3390/ijms232415801). [COBISS.SI-ID [136801795](https://www.cobiss.si/record/136801795)],
- JAN, Zala, DRAB, Mitja, DROBNE, Damjana, BEDINA ZAVEC, Apolonija, BENČINA, Mojca, DRAŠLER, Barbara, HOČEVAR, Matej, KREK, Judita Lea, PAĐEN, Ljubiša, PAJNIC, Manca, REPAR, Neža, ŠIMUNIČ, Boštjan, ŠTUKELJ, Roman, KRALJ-IGLIČ, Veronika (avtor, korespondenčni avtor). Decrease in cellular nanovesicles concentration in blood of athletes more than 15 hours after marathon. *International journal of nanomedicine*. [Online ed.]. 2021, vol. 16, str. 443-456, ilustr. ISSN 1178-2013. <https://www.dovepress.com/decrease-in-cellular-nanovesicles-concentration-in-blood-of-athletes-m-peer-reviewed-article-IJN>, <https://doi.org/10.2147/IJN.S282200>, <https://dirros.openscience.si/IzpisGradiva.php?id=13691>, DOI: [10.2147/IJN.S282200](https://doi.org/10.2147/IJN.S282200). [COBISS.SI-ID [48113411](https://www.cobiss.si/record/48113411)]
- MOLICNIK, Andrej, JANŠA, Jošt, KOCJANČIČ, Boštjan, KRALJ-IGLIČ, Veronika, DOLINAR, Drago. Secondary hip dysplasia increases risk for early coxarthrosis after Legg-Calve-Perthes disease. A study of 255 hips. *Computer methods in biomechanics and biomedical engineering*. 2019, vol. 22, no. 14, str. 1107-1115, ilustr. ISSN 1025-5842. DOI: [10.1080/10255842.2019.1634193](https://doi.org/10.1080/10255842.2019.1634193). [COBISS.SI-ID [34465497](https://www.cobiss.si/record/34465497)]

Aleš Igljč

- DRAB, Mitja, PANDUR, Žiga, PENIČ, Samo, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika, STOPAR, David. A Monte Carlo study of giant vesicle morphologies in nonequilibrium environments. *Biophysical journal*. 2021, vol. 120, iss. 20, str. 4418-4428, ilustr. ISSN 0006-3495. [https://www.cell.com/biophysj/fulltext/S0006-3495\(21\)00739-6](https://www.cell.com/biophysj/fulltext/S0006-3495(21)00739-6), DOI: [10.1016/j.bpj.2021.09.005](https://doi.org/10.1016/j.bpj.2021.09.005). [COBISS.SI-ID [77233667](https://www.cobiss.si/record/77233667)]
- KULKARNI, Mukta Vishwanath, ŠEPITKA, Josef, JUNKAR, Ita, BENČINA, Metka, RAWAT, Niharika, MAZARE, Anca, RODE, Chandrashekhar, GOKHALE, Suresh, SCHMUKI, Patrik, DANIEL, Matej, IGLIČ, Aleš. Mechanical properties of anodic titanium dioxide nanostructures = Mehanske lastnosti nanostruktur titanovega dioksida. *Materiali in tehnologije*. [Tiskana izd.]. jan.-feb. 2021, letn. 55, št. 1, str. 19-24, ilustr. ISSN 1580-2949. <http://mit.imt.si/izvodi/mit211/kulkarni.pdf>, DOI: [10.17222/mit.2020.109](https://doi.org/10.17222/mit.2020.109). [COBISS.SI-ID [49969155](https://www.cobiss.si/record/49969155)]
- JUNKAR, Ita, KULKARNI, Mukta Vishwanath, BENČINA, Metka, KOVAČ, Janez, MRAK POLJŠAK, Katjuša, LAKOTA, Katja, SODIN-ŠEMRL, Snežna, MOZETIČ, Miran, IGLIČ, Aleš. Titanium dioxide

nanotube arrays for cardiovascular stent applications. *ACS omega*. Apr. 7 2020, vol. 5, iss. 13, str. 7280-7289, ilustr. ISSN 2470-1343. <https://pubs.acs.org/doi/pdf/10.1021/acsomega.9b04118>, DOI: [10.1021/acsomega.9b04118](https://doi.org/10.1021/acsomega.9b04118). [COBISS.SI-ID [12984916](https://doi.org/10.1021/acsomega.9b04118)],

4. BENČINA, Metka, JUNKAR, Ita, ZAPLOTNIK, Rok, VALANT, Matjaž, IGLIČ, Aleš, MOZETIČ, Miran. Plasma-Induced crystallization of TiO₂ nanotubes. *Materials*. 2019, vol. 12, no. 4, str. 626-1-626-13. ISSN 1996-1944. DOI: [10.3390/ma12040626](https://doi.org/10.3390/ma12040626). [COBISS.SI-ID [32125479](https://doi.org/10.3390/ma12040626)]

5. DANIEL, Matej, ŘEZNÍČKOVÁ, Jitka, HANDL, Milan, IGLIČ, Aleš, KRALJ-IGLIČ, Veronika. Clustering and separation of hydrophobic nanoparticles in lipid bilayer explained by membrane mechanics. *Scientific reports*. 2018, vol. 8, art. no. 10810, str. 1-7, ilustr. ISSN 2045-2322. <https://www.nature.com/articles/s41598-018-28965-y>, DOI: [10.1038/s41598-018-28965-y](https://doi.org/10.1038/s41598-018-28965-y). [COBISS.SI-ID [12404052](https://doi.org/10.1038/s41598-018-28965-y)]

Peter Veranič

1. RESNIK, Nataša, BARAGA, Diana, GLAŽAR, Polona, ZEMLJIČ JOKHADAR, Špela, DERGANČ, Jure, SEPČIČ, Kristina, VERANIČ, Peter, ERDANI-KREFT, Mateja (avtor, korespondenčni avtor). Molecular, morphological and functional properties of tunnelling nanotubes between normal and cancer urothelial cells : new insights from the in vitro model mimicking the situation after surgical removal of the urothelial tumor. *Frontiers in cell and developmental biology*. 2022, vol. 10, str. 1-20, ilustr. ISSN 2296-634X. <https://doi.org/10.3389/fcell.2022.934684>, DOI: [10.3389/fcell.2022.934684](https://doi.org/10.3389/fcell.2022.934684). [COBISS.SI-ID [135025923](https://doi.org/10.3389/fcell.2022.934684)]

2. TESOVIK, Tine, KOVAČ, Jernej, POHAR, Katka, HUDOKLIN, Samo, DOVČ, Klemen, BRATINA, Nataša, TREBUŠAK PODKRAJSEK, Katarina, DEBELJAK, Maruša, VERANIČ, Peter, BOSI, Emanuele, PIEMONTE, Lorenzo, IHAN, Alojz, BATTELINO, Tadej. Extracellular vesicles derived human-miRNAs modulate the immune system in type 1 diabetes. *Frontiers in cell and developmental biology*. Mar. 2020, vol. 8, str. 1-24, ilustr. ISSN 2296-634X. <https://www.frontiersin.org/articles/10.3389/fcell.2020.00202/full>, DOI: [10.3389/fcell.2020.00202](https://doi.org/10.3389/fcell.2020.00202). [COBISS.SI-ID [34799065](https://doi.org/10.3389/fcell.2020.00202)]

3. LOJK, Jasna, BABIČ, Lea, SUŠJAN, Petra, BREGAR, Vladimir Boštjan, PAVLIN, Mojca, HAFNER BRATKOVIČ, Iva, VERANIČ, Peter. Analysis of the direct and indirect effects of nanoparticle exposure on microglial and neuronal cells in vitro. *International journal of molecular sciences*. 2020, vol. 21, iss. 19, str. 1-15, ilustr. ISSN 1422-0067. <https://www.mdpi.com/1422-0067/21/19/7030>, DOI: [10.3390/ijms21197030](https://doi.org/10.3390/ijms21197030). [COBISS.SI-ID [30614531](https://doi.org/10.3390/ijms21197030)]

4. RESNIK, Nataša, ERMAN, Andreja, VERANIČ, Peter, ERDANI-KREFT, Mateja. Triple labelling of actin filaments, intermediate filaments and microtubules for broad application in cell biology : uncovering the cytoskeletal composition in tunneling nanotubes. *Histochemistry and cell biology*. Oct. 2019, vol. 152, iss. 4, str. 311-317, ilustr. ISSN 0948-6143. <https://link.springer.com/article/10.1007%2Fs00418-019-01806-3>, DOI: [10.1007/s00418-019-01806-3](https://doi.org/10.1007/s00418-019-01806-3). [COBISS.SI-ID [34446041](https://doi.org/10.1007/s00418-019-01806-3)]

5. RESNIK, Nataša, PREZELJ, Tim, LUCA, Giulia M. R. de, MANDERS, Erik, POLISHCHUK, Roman S., VERANIČ, Peter, ERDANI-KREFT, Mateja. Helical organization of microtubules occurs in a minority of tunneling membrane nanotubes in normal and cancer urothelial cells. *Scientific reports*. Nov. 2018, vol. 8, str. 1-8, ilustr. ISSN 2045-2322. <https://www.nature.com/articles/s41598-018-35370-y.pdf>, DOI: [10.1038/s41598-018-35370-y](https://doi.org/10.1038/s41598-018-35370-y). [COBISS.SI-ID [34052057](https://doi.org/10.1038/s41598-018-35370-y)]

Klemen Bohinc

1. BOHINC, Klemen, ŠPADINA, Mario, REŠČIČ, Jurij, SHIMOKAWA, Naofumi, SPADA, Simone. Influence of charge lipid head group structures on electric double layer properties. *Journal of chemical theory and computation*. Jan. 2022, vol. 18, iss. 1, str. 448-460, ilustr. ISSN 1549-9618. <https://pubs.acs.org/doi/10.1021/acs.jctc.1c00800>, DOI: [10.1021/acs.jctc.1c00800](https://doi.org/10.1021/acs.jctc.1c00800). [COBISS.SI-ID [92996611](https://doi.org/10.1021/acs.jctc.1c00800)]

2. DEÁK, Ágota, JANOVIK, László (avtor, korespondenčni avtor), TALLÓSY, Szabolcs Péter, GODIČ TORKAR, Karmen, ABRAM, Anže, DÉKÁNY, Imre, SEBŐK, Dániel, BOHINC, Klemen (avtor, korespondenčni avtor). Synthesis of self-cleaning and photoreactive spherical layered double oxide/polymer composite thin layers : biofouling and inactivation of bacteria. *Applied clay science*. [Print ed.]. Oct. 2022, vol. 228, str. 1-12, ilustr. ISSN 0169-1317. DOI: [10.1016/j.clay.2022.106587](https://doi.org/10.1016/j.clay.2022.106587). [COBISS.SI-ID [114288131](https://doi.org/10.1016/j.clay.2022.106587)]

3. BOHINC, Klemen, TINTOR, Erna, KOVAČEVIČ, Davor, VIDRIH, Rajko, ZORE, Anamarija, ABRAM, Anže, KOJIČ, Željka, OBRADOVIČ, Marija, VESELINOVIČ, Valentina, DOLIČ, Olivera. Bacterial adhesion on glass-ionomer cements and micro/nano hybrid composite dental surfaces. *Coatings*. 2021, vol. 11, iss. 2, str. 1-19, ilustr. ISSN 2079-6412. <https://www.mdpi.com/2079-6412/11/2/235>, DOI: [10.3390/coatings11020235](https://doi.org/10.3390/coatings11020235). [COBISS.SI-ID [52503043](https://doi.org/10.3390/coatings11020235)]

4. GUO, Jingyu, ITO, Hiroaki, HIGUCHI, Yuji, BOHINC, Klemen, SHIMOKAWA, Naofumi, TAKAGI, Masahiro. Three-phase coexistence in binary charged lipid membranes in a hypotonic solution. *Langmuir*.

2021, vol. 37, iss. 32, str. 9683-9693, ilustr. ISSN 0743-7463.

<https://pubs.acs.org/doi/abs/10.1021/acs.langmuir.1c00967>, DOI: [10.1021/acs.langmuir.1c00967](https://doi.org/10.1021/acs.langmuir.1c00967).

[COBISS.SI-ID [71652611](#)]

5. ABRAM, Anže, ZORE, Anamarija, LIPOVŽ, Urban, KOŠAK, Anita, ZORC, Maja, BOLTEŽAR, Žane, BOHINC, Klemen. Bacterial adhesion on prosthetic and orthotic material surfaces. *Coatings*. 2021, vol. 11, no. 12, str. 1-13. ISSN 2079-6412. <https://www.mdpi.com/2079-6412/11/12/1469>, DOI:

[10.3390/coatings11121469](https://doi.org/10.3390/coatings11121469). [COBISS.SI-ID [87028227](#)]

BIOMETEOROLOŠKO MODELIRANJE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biometeorološko modeliranje
Course title:	Biometeorological modeling
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037241
Koda učne enote na članici/UL Member course code:	3743

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	10	0	15	80	5

Nosilec predmeta/Lecturer: Lučka Kajfež Bogataj

Izvajalci predavanj: Zalika Črepinšek, Lučka Kajfež Bogataj
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:

Predavanja/Lectures:	Angleščina, Slovenščina
Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij	Prerequisites: General conditions for enrolment in doctoral studies.
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Vsebina:

Interakcije rastlina-ekosistem-atmosfera
Opredelevanje pomembnih aspektov s področij mikrometeorologije, fizike tal, ekologije in biogeokemije uporabljenih v biometeorologiji. Viri podatkov, merjenja in instrumenti v biometeoroloških študijah.

Izmenjava mase in energije v terestričnih ekosistemih. Modeliranje turbulentnih gibanj in

Content (Syllabus outline):

Plant-Ecosystem-Atmosphere Interactions
relevant aspects of micrometeorology, soil physics, physiological ecology, ecosystem ecology and biogeochemistry. Instrumentation and measurements, associated with the study of plant biometeorology.

Water and energy exchange of ecosystems.
Modeling biophysical processes (e.g. turbulence and diffusion, momentum and photon transfer through

<p>difuzije v rastlinski odeji, prenosa gibalne količine in sevanja. Matematični modeli za opis fotosinteze, dihanja, stomatalne regulacije.</p> <p>Modeli vodnega cikla. Kvantificiranje intercepcije in odtoka padavin. Metode za računanje evapotranspiracije (aerodinamične in statistične). Modeli za trajanje omočenosti lista.</p> <p>Modeli razvoja in rasti poljščin. Potrebne parametrizacije rastlinske odeje. Preprosti staistični modeli v agrometeorologiji. Dinamični modeli in pogonske spremeljivke v njih. Generični modeli.</p> <p>Fenološko modeliranje. Statistični modeli v agrofenologiji. Verifikacija modelov in njihova občutljivost. Učinki podnebnih sprememb na fenološke cikle rastlin in živali.</p> <p>Nehotene spremembe atmosferskega dela okolja – vloga človeka. Onesnaženje zraka, klimatske spremembe, ozonska luknja, odnos globalni-lokalni okoljski problemi. Slabšanje razmer v okolju skupaj z deforestacijo in dezertifikacijo.</p> <p>Biometeorološki modeli in urbano okolje, Spremembe masnih in energijskih tokov v urbaniziranem prostoru. Klima zaprtih prostorov in povezava s počutjem ter zdravjem človeka. Vpliv klime na prostorsko planiranje in arhitekturo mest.</p>	<p>vegetation, evaporation, photosynthesis, plant and soil respiration, and stomatal mechanics)</p> <p>Water cycle models. Quantifying Interception of precipitation, outflows on stems and trunks. Methods for evapotranspiration calculation – aero dynamical, radiation, empirical. Modelling leaf wetness duration.</p> <p>Crop models. Parameterization of plant canopy in models. Simple statistical and dynamical agro meteorological models. Meteorological driving variables and parameters.</p> <p>Terrestrial phenological modeling. Statistical, causal and dynamical models. Verification, calibration, sensitivity of models. The effects of climate change on plant life cycle events.</p> <p>The inadvertent modification of the atmosphere by living systems, especially human (studies of pollution, climate change impacts, changes to atmospheric amenity, and the processes of deterioration of landscape including deforestation and desertification)</p> <p>Biometeorological models of the built environment The intentional modifications of natural energy and matter flows within urban areas, and indoor climate constructions. Modeling indoor climate, urban design, and architecture.</p>
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Temeljna literatura in viri/Readings:

1. Monteith J.L. 2014. Principles of Environmental Physics: Plants, Animals, and the Atmosphere. Academic Press, <https://plus.cobiss.net/cobiss/si/sl/bib/ul/2550000001108467>
2. Ebi K.L., Burton I., McGregor G.R. (uredniki) Biometeorology for Adaptation to Climate Variability and Change. Springer, ISBN 978-1-4020-8920-6 e-ISBN 978-1-4020-8921-3. Dostopno na <https://link.springer.com/book/10.1007/978-1-4020-8921-3>
3. Special Issue "Challenges in Applied Human Biometeorology", a special issue of Atmosphere (ISSN 2073-4433); https://www.mdpi.com/journal/atmosphere/special_issues/Challenges_Biometeorology#published
4. International Journal of Biometeorology, Volume 61, supplement issue 1, September 2017 <https://link.springer.com/journal/484/volumes-and-issues/61-1/supplement>

Cilji in kompetence:

- Pridobitev poglobljenega znanja o vplivu vrena in klime na žive organizme na podlagi fizikalnega pristopa.
- Modeliranje procesov, ki vplivajo na rast in razvoj živih organizmov in kvantitativne metode za oceno vpliva podnebja na agroekosisteme.

Objectives and competences:

- Understanding of weater and climate impact on living organisms and physical factors that influence climate.
- Knowledge of approaches to model processes that influence agroecosystems and methods to quantify vegetation-climate interactions.

Predvideni študijski rezultati:

Znanje in razumevanje
 Podrobnejši vpogled v interakcije med atmosferskim delom okolja in živimi organizmi (vegetacija, fauna, človek)
 Uporaba: Uporaba fizikalnih zakonov in preprostih modelov za razumevanje biometeoroloških procesov
 Refleksija: Povezava interakcije med atmosfero, človeškim delovanjem s fizikalnimi zakoni.

Intended learning outcomes:

Knowledge and understanding:
 Deeper understanding of the interactions between atmospheric processes and living organisms (plants, animals, and humans)..
 Applicability: The use of basic physical laws and simple models to understand biometeorological processes

	Reflection: Interactions between atmosphere and organisms and their description by physical laws.
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Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja, vaje, seminar ob uporabi informacij o stanju klimatskega sistema iz različnih virov	Lectures, tutorials, seminars using information on state of the climate from different sources

Načini ocenjevanja:	Delež/Weight	Assessment:
Opravljeni seminarji iz vaj	40,00 %	Problem-solving seminars,
predstavitve seminarja, ustni izpit iz teorije.	60,00 %	Seminar presentation, theoretical examination.

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

LUČKA KAJFEŽ-BOGATAJ

- KURNIK, Blaž, LOUWAGIE, Geertrui, ERHARD, Markus, CEGLAR, Andrej, KAJFEŽ-BOGATAJ, Lučka. Analysing seasonal differences between a soil water balance model and in situ soil moisture measurements at nine locations across Europe. *Environmental modeling & assessment*, 2014, vol. 19, 1:19-34. [COBISS.SI-ID 7623801]
- TAJNIK, Tanja, KAJFEŽ-BOGATAJ, Lučka, JURAC, Egon, RIBARIČ-LASNIK, Cvetka, LIKAR, Jakob, DEBELAK, Brane. 2013. Investigation of adsorption properties of geological materials for CO₂ storage. *International journal of energy research*, ISSN 0363-907X, 2013, vol. 37, issue 8: 952-958. [COBISS.SI-ID 7007097]
- ČREPINŠEK, Zalika, ŠTAMPAR, Franci, KAJFEŽ-BOGATAJ, Lučka, SOLAR, Anita. 2012. The response of *Corylus avellana* L. phenology to rising temperature in north-eastern Slovenia. *International journal of biometeorology*, vol. 56, no. 4: 681-694. [COBISS.SI-ID 6758265]
- BERGANT, Klemen, KAJFEŽ-BOGATAJ, Lučka, TRDAN, Stanislav. 2006. Uncertainties in modelling of climate change impact in future : an example of onion thrips (*Thrips tabaci* Lindeman) in Slovenia. *Ecological modelling*, vol. 194, no. 1-3: 244-255. [COBISS.SI-ID 4481913]
- ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka, BERGANT, Klemen. Modelling of weather variability effect on fitophenology. *Ecological modelling*, vol. 194, no. 1-3: 256-265. [COBISS.SI-ID 4467065]
- BERGANT, K., TRDAN, S., ŽNIDARČIČ, D., ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka. 2005. Impact of climate change on developmental dynamics of *Thrips tabaci* (Thysanoptera: Thripidae): can it be quantified?. *Environmental entomology*, vol. 34, no. 4:755-766. [COBISS.SI-ID 4286585]

ZALIKA ČREPIŠEK

ČREPINŠEK, Zalika, ŠTAMPAR, Franci, KAJFEŽ-BOGATAJ, Lučka, SOLAR, Anita. The response of *Corylus avellana* L. phenology to rising temperature in north-eastern Slovenia. *International journal of biometeorology*, ISSN 0020-7128, 2012, vol. 56, no. 4, str. 681-694, doi: [10.1007/s00484-011-0469-7](http://dx.doi.org/10.1007/s00484-011-0469-7). [COBISS.SI-ID 6758265]

ČUFAR, Katarina, DE LUIS, Martin, SAZ, Miguel Angel, ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka. Temporal shifts in leaf phenology of beech (*Fagus sylvatica*) depend on elevation. *Trees*, ISSN 0931-1890, 2012, vol. 26, no. 4, str. 1091-1100. <http://dx.doi.org/10.1007/s00468-012-0686-7>. [COBISS.SI-ID 6988665]

CEGLAR, Andrej, ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka, POGAČAR, Tjaša. The simulation of phenological development in dynamic crop model : The Bayesian comparison of different methods.

Agricultural and forest meteorology, ISSN 0168-1923. [Print ed.], 2011, vol. 151, issue 1, str. 101-115. [COBISS.SI-ID [6502265](#)]

ČREPINŠEK, Zalika, SOLAR, Mitja, ŠTAMPAR, Franci, SOLAR, Anita. Shifts in walnut (*Juglans regia* L.) phenology due to increasing temperatures in Slovenia. *The journal of horticultural science & biotechnology*, ISSN 1462-0316, 2009, vol. 84, no. 1, str. 59-64. [COBISS.SI-ID [5814905](#)]

V zadnjem petletnem obdobju (2009-2013) ima za znanstvena in strokovna dela naslednje število citatov WoS/Scopus:

- Število citatov 588
- **Število čistih citatov 573 (izjema citiranost)**
-

<http://izumbib.izum.si/bibliografije/W20140212144614-11062.html>

BIOPROCESNA TEHNIKA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioprocena tehnika
Course title:	Bioprocess techniques
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037328
Koda učne enote na članici/UL Member course code:	3831

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	0	0	0	95	5

Nosilec predmeta/Lecturer: Iztok Golobič

Izvajalci predavanj: Iztok Golobič
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:

Predavanja/Lectures:	Angleščina, Slovenščina
Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij	Prerequisites: General conditions for enrolment in doctoral studies.
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Vsebina:

V uvodnem delu je predstavljena procesna tehnika v okviru termičnega, mehanskega, bio-, kemijskega in okoljskega segmenta procesne tehnike. Termodinamične osnove ločevalnih procesov temeljijo na predstavitvi zmesi in raztopin, parno-kapljevitega ravnotežja, Gibbsovega pravila faz, binarnih sistemov, Raultovega zakona idealnih raztopin, Henrijevega zakona ter predstavitve onovnih značilnosti ternarnih sistemov in

Content (Syllabus outline):

In the introductory chapter, process technology is presented within the framework of thermal, mechanical, biochemical, chemical and environmental segments of process engineering. Thermodynamic fundamentals of separation processes based on presentation of mixtures and solutions, vapor-liquid equilibrium, Gibbs free energy, binary systems, Rault's law of ideal solutions, Henri's law and fundamental characteristics of ternary systems and

<p>azeotropnih zmesi. V okviru Prenosa snovi bo izhodišče Fickov zakon, difuzija, konvektivni prenos snovi ter numerične metode reševanja problemov prenosa snovi. Sledijo osnovni procesi procesne tehnike: uparjanje, destilacija, rektifikacija, sorpcijski procesi, kristalizacija in sušenje z podrobnejšo obravnavo vlažnega zraka, h - x diagrama in eksergijskega diagrama vlažnega zraka, večstopenjskega sušenja, vrste sušilnikov in izbira sušilnega procesa v odvisnosti od vrste blaga v farmacevtski, prehrabeni in procesni industriji, liofilizacija. Sledijo mešanje, membranske tehnologije, mikro, ultra in nanofiltracija, reverzna osmoza in ionska izmenjava. V okviru bioreaktorjev bodo obravnavane vrste in njihova uporaba ter vodenje in nadzor procesov.</p>	<p>azeotropic mixtures. Within the framework of mass transfer, the starting points are Fick's law, diffusion, convective mass transfer and numerical methods of solving problems of mass transfer. These are followed by the basic processes of process technology: evaporation, distillation, rectification, sorbic processes, crystallization and drying with detailed consideration of moist air, h-x diagram and exergy diagram of moist air, multi-level drying, types of dryers and selection of the drying process depending on the type of goods in the pharmaceutical, food and process industries, liofilisation. Mixing, membrane technologies, micro-, ultra- and nanofiltration, reversible osmosis and ionic exchange follow. Within the framework of bioreactors the types and their application are considered, together with process management and control.</p>
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> • Seader, J.D, Henley, E.J., Roper, D.K., Separation Process Principles with Applications Using Process Simulators, 4th Edition, Wiley, 2015. [COBISS.SI-ID – 27675653] • Green D.W., Southard, M. Z., Perry's Chemical Engineers' Handbook, 9th Edition, McGraw-Hill Education; 2018. [COBISS.SI-ID – 367880] • Ullmann's Process and Process Engineering, Vol. 1, 2, 3, Wiley – VCH Verlag, Weinheim, 2004- [COBISS.SI-ID 25817861] • Basmadjian D., Mass Transfer and Separation Processes, 2nd Edition, CRC Press, 2007. [COBISS.SI-ID – 28708357] • Dincer, I., Rosen, M. A., Exergy: Energy, Environment and Sustainable Development. 2nd Edition, Elsevier, 2012. [COBISS.SI-ID 13381915] • VDI Gesellschaft, VDI Heat Atlas. 2nd Edition, Springer, 2010. [COBISS.SI-ID - 1542854879]

Cilji in kompetence:

<p>Cilj predmeta je seznaniti študenta z osnovami bioprocenjske tehnike in ga usposobiti za uporabo inženirskih orodij ob hkratnem utrjevanju inženirskega pristopa k reševanju problemov bioprocenjske tehnike. Seznanijo se z osnovnimi snovnimi operacijami, ki temeljijo na snovnih in energijskih tokovih ter fazno ravnotežnih fenomenih. Spoznajo principe in osvojijo metode za delo na področju uporabe metod, sistemov in procesov priprave, ločevanja in čiščenja nečistih snovi s ciljem dobiti čiste produkte.</p>	<p>Objectives and competences:</p> <p>The course aims to acquaint students with the fundamentals of bioprocess technology and qualify them for application of engineering tools, while revising the engineering approach in order to solve problems from bioprocess technology. Students are familiarised with basic matter operations, based on mass and energy flows and phase equilibrium phenomena. They are familiarised with principles and methods for working in the field of application of methods, systems and processes of preparation, separation and purification of impure substances in order to obtain pure products. The subject develops the ability to apply engineering, technical, mathematical and scientific tools for solving engineering problems in nature.</p>
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Predvideni študijski rezultati:

<p>Predmet razvija sposobnost uporabe inženirskih, tehničnih, matematičnih in znanstvenih orodij za reševanje inženirskih problemov v naravi. Osvojene kompetence predstavljajo gradnik usposobljenosti biti vodja in biti vodilni člen razvojno raziskovalne dejavnosti v kreativnem, komunikativnem timskem</p>	<p>Intended learning outcomes:</p> <p>The acquired competences qualify the participants to be leaders and leading members of the development-research sector in creative, communicative team work in the field of biotechnology. The competences specific to the subject qualify the participants to identify the problems and engineering approach to</p>
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delu na področju biotehnike. Predmetno specifične kompetence gradijo usposobljenost slušatelja za prepoznavanja problemov in inženirskega pristopa k reševanju problemov ob hkratnem upoštevanju inženirskega kodeksa ter profesionalne, etične in okoljske odgovornosti.	solve problems while considering engineering codes and professional, ethical and environmental responsibility.
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Metode poučevanja in učenja: Predavanja, seminarji, konzultacije.	Learning and teaching methods: Lectures, seminars, consultations.
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Načini ocenjevanja: Seminar in ustni zagovor seminarja.	Delež/Weight 100,00 %	Assessment: Seminar and oral presentation of seminar.
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Ocenjevalna lestvica: 5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	Grading system: 5 - 10, a student passes the exam if he is graded from 6 to 10
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Reference nosilca/Lecturer's references:

Iztok Golobič

1. KORACIN, Nejc, ZUPANČIČ, Matevž, VREČER, Franc, HUDOVORNIK, Grega, GOLOBIČ, Iztok. Characterization of the spray droplets and spray pattern by means of innovative optical microscopy measurement method with the high-speed camera. *International journal of pharmaceutics*. 2022, vol. 629, str. 1-8.
2. ŽALEC, Domen, HANAK, Dawid P., MOŽE, Matic, GOLOBIČ, Iztok. Process development and performance assessment of flexible calcium looping biomass gasification for production of renewable gas with adjustable composition. *International journal of energy research*. 2022, vol. 46, str. 6197-6215.
3. JEREB, Samo, ZUPANČIČ, Matevž, MOŽE, Matic, GOLOBIČ, Iztok. Predicting the drop size passing through a superhydrophobic orifice. *Physics of fluids*. 2022, vol. 34, iss. 11, str. 1-8.
4. MOŽE, Matic, HADŽIĆ, Armin, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Boiling heat transfer enhancement on titanium through nucleation-promoting morphology and tailored wettability. *International journal of heat and mass transfer*. 2022, vol. 195, str. 1-17.
5. VIDOVIČ, Sara, BIZJAK, Alan, SITAR, Anže, HORVAT, Matej, JANKOVIĆ, Biljana, GOLOBIČ, Iztok. Development of a semi-empirical model for droplet size determination of a three-channel spray nozzle for pellet coating based on the optical method concept. *Processes*. 2022, vol. 10, str. 1-19.
6. SERIANZ, Luka, RMAN, Nina, GOLOBIČ, Iztok, BRENČIČ, Mihael. Groundwater heat transfer and thermal outflow plume modelling in the Alps. *Renewable energy*. 2022, vol. 182, str. 751-763.
7. MOŽE, Matic, SENEGAČNIK, Matej, GREGORČIČ, Peter, HOČEVAR, Matej, ZUPANČIČ, Matevž, GOLOBIČ, Iztok. Laser-engineered microcavity surfaces with a nanoscale superhydrophobic coating for extreme boiling performance. *ACS applied materials & interfaces*. 2020, vol. 12, str. 24419-24431.

BIOPROCESNO INŽENIRSTVO BIOLOŠKIH MAKROMOLEKUL, VIRUSOV IN CELIC

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioproceno inženirstvo bioloških makromolekul, virusov in celic
Course title:	Bioprocess engineering of biologic macromolecules, viruses and cells
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037282
Koda učne enote na članici/UL Member course code:	3784

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20		0	0	95	5

Nosilec predmeta/Lecturer: Aleš Podgornik

Izvajalci predavanj:	Igor Plazl, Aleš Podgornik, Polona Žnidaršič Plazl
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Vpis na doktorski študij; zaključen drugostopenjski ali star univerzitetni študij biotehnologije, kemijskega inženirstva, biokemije, kemije, farmacije, mikrobiologije, živilske tehnologije in sorodnih programov

Prerequisites:

Enrollment to the doctoral study; completed **Bologna** 2nd Cycle **Study** Program or university study in biotechnology, chemical engineering, biochemistry, chemistry, pharmacy, microbiology, food technology or related studies

Vsebina:

Predstavljeni bodo sodobni inženirski trendi in izolacije bioloških makromolekul (kot so encimi, monoklonska protitelesa, plazmidna DNA), virusov (bakteriofagov in humanih virusov) in celic (matične

Content (Syllabus outline):

Modern engineering trends and isolation of biological macromolecules (such as enzymes, monoclonal antibodies, plasmid DNA), viruses (bacteriophages and human viruses) and cells (stem cells) will be

<p>celice), ki so in bodo pomembni na področju varnosti, prehrane in zdravja.</p> <p>Glavni poudarek predmeta bo na različnih tehnikah izolacije obravnavanih bioproductov na osnovi obarjanja, ekstrakcije z dvofaznimi vodnimi sistemi, kromatografij, vključno s sodobnimi trendi kontinuirnih procesov ter njihova uporaba v biokonverziji, s poudarkom na mikroreaktorjih.</p> <p>Študentje bodo seznanjeni z osnovami načrtovanja eksperimentov s poudarkom na QbD (Quality by Design), regulatornimi aspekti pridobivanja farmacevtskih učinkovin in s tem povezano specifično analitiko npr. PAT (Process Analytical Technology). Predstavljeni bodo tudi konkretni primeri procesov.</p> <p>Za specifična področja so lahko vključeni drugi predavatelji.</p>	<p>presented, which are important in the field of safety, nutrition and health.</p> <p>The main focus of the course will be on various isolation techniques of the considered bioproducts based on precipitation, extraction with two-phase aqueous systems, chromatography, including modern trends in continuous processes and their use in bioconversion, with an emphasis on microreactors.</p> <p>Students will be familiar with the basics of experimental design with an emphasis on QbD (Quality by Design), regulatory aspects and related specific analytics e.g. PAT (Process Analytical Technology). Specific examples of processes will also be presented.</p> <p>Other lecturers may be involved for specific areas.</p>
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Temeljna literatura in viri/Readings:

<p>Izbrana poglavja iz Hessel, V., Renken, A., Schouten, J.C., Yoshida, J.-I. (2009) editors, Micro Process Engineering: A Comprehensive Handbook, Vol. 1-3, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany</p> <p>Izbrana poglavja iz Buchholz K., Kasche V., Bornscheuer U.T. (2012) Biocatalysts and Enzyme Technology, 2nd Edition</p> <p>Izbrana poglavja iz Carta G., Jungbauer A. Protein Chromatography: Process Development and Scale-Up, Wiley-VCH, Weinheim, 2010 (priporočena literatura)</p> <p>Izbrana poglavja iz Subramanian G. (Eds.). Biopharmaceutical production technology. Weinheim: Wiley-VCH, 2012 (priporočena literatura)</p> <p>Znanstveni članki iz tekoče znanstvene periodike.</p>

Cilji in kompetence:

<ul style="list-style-type: none"> • Razumevanje teoretičnih principov tehnologij uporabljenih pri pridobivanju in izolacijah bioloških makromolekul, virusov in celic • Razumevanje načrtovanja eksperimentov pri zaključnih procesih • Razumevanje koncepta kontinuirnih procesov in mikroreaktorjev • Razumevanje načrtovanja in vodenja biokatalitskih procesov • Razumevanje regulatornih konceptov 	<h3>Objectives and competences:</h3> <ul style="list-style-type: none"> • Understanding theoretical principles of techniques used for production of biologic molecules, viruses and cells • Understanding concepts of experimental design for downstream processing • Microreactors and continuous processes • Understanding design and performance of biocatalytic processes • Understanding of regulatory concepts
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Predvideni študijski rezultati:

<ul style="list-style-type: none"> • Sposobnost vključevanja pridobljenega znanja v projektu • Izkazano doseganje izobraževalnih ciljev 	<h3>Intended learning outcomes:</h3> <ul style="list-style-type: none"> • Implementation of acquired knowledge in projects • Demonstrated achievement of educational goals
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Metode poučevanja in učenja:

<ul style="list-style-type: none"> • predavanja • seminarji (v obliki rednih seminarjskih predstavitev z diskusijami) 	<h3>Learning and teaching methods:</h3> <ul style="list-style-type: none"> • lectures • seminars (regular presentations with discussions)
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Načini ocenjevanja:	Delež/Weight	Assessment:
Preverjanje znanja poteka v obliki projektne naloge na realnih primerih iz raziskovalne prakse, pri kateri študentje pripravijo rešitve za izbrani predlog raziskovalnega projekta. Projektne naloge oddajo v pisni obliki in jih predstavijo v ustni obliki, čemur sledi diskusija. Izbrani primer je blizu tematike doktorskega raziskovanja kandidata.		During the course students prepare individual projects of relevant case from research practice, they present it in form of written seminar and they also present it, what is followed by discussion. Selected topic is close to doctoral research work of the candidate.

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Aleš Podgornik

LISAC, Ana, BIRSA, Elfi, PODGORNIK, Aleš. E. coli biofilm formation and its susceptibility towards T4 bacteriophages studied in a continuously operating mixing – tubular bioreactor system. *Microbial biotechnology*. [Online ed.]. Sep. 2022, vol. 15, iss. 9, str. 2450-2463, ilustr. ISSN 1751-7915. DOI: [10.1111/1751-7915.14079](https://doi.org/10.1111/1751-7915.14079). [COBISS.SI-ID [110219011](#)]

AMBROŽIČ, Rok, ARZENŠEK, Dejan, PODGORNIK, Aleš. Designing scalable ultrafiltration/diafiltration process of monoclonal antibodies via mathematical modeling by coupling mass balances and Poisson-Boltzmann equation. *Biotechnology and bioengineering*. Feb. 2021, vol. 118, iss. 2, str. 633-646, ilustr. ISSN 0006-3592. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/bit.27598>, DOI: [10.1002/bit.27598](https://doi.org/10.1002/bit.27598). [COBISS.SI-ID [32532739](#)]

STANTIČ, Metka, GUNČAR, Gregor, KUZMAN, Drago, MRAVLJAK, Rok, CVIJIĆ, Tamara, PODGORNIK, Aleš. Application of lectin immobilized on polyHIPE monoliths for bioprocess monitoring of glycosylated proteins. *Journal of chromatography. B, Analytical technologies in the biomedical and life sciences*. 1 Jun. 2021, vol. 1174, str. 1-10, ilustr. ISSN 1570-0232.

<https://www.sciencedirect.com/science/article/abs/pii/S1570023221002117>, DOI: [10.1016/j.jchromb.2021.122731](https://doi.org/10.1016/j.jchromb.2021.122731). [COBISS.SI-ID [62952451](#)]

KOPAČ, Tilen, LISAC, Ana, MRAVLJAK, Rok, RUČIGAJ, Aleš, KRAJNC, Matjaž, PODGORNIK, Aleš. Bacteriophage delivery systems based on composite polyHIPE/nanocellulose hydrogel particles. *Polymers*. Aug. 2021, vol. 13, iss. 16, str. 1-12, ilustr. ISSN 2073-4360. <https://www.mdpi.com/2073-4360/13/16/2648/htm>, DOI: [10.3390/polym13162648](https://doi.org/10.3390/polym13162648). [COBISS.SI-ID [73830403](#)]

ŠIVEC, Katja, PODGORNIK, Aleš. Determination of bacteriophage growth parameters under cultivating conditions. *Applied microbiology and biotechnology*. Oct. 2020, vol. 104, iss. 20, str. 8949-8960, ilustr. ISSN 0175-7598. <https://link.springer.com/article/10.1007/s00253-020-10866-8>, DOI: [10.1007/s00253-020-10866-8](https://doi.org/10.1007/s00253-020-10866-8). [COBISS.SI-ID [27241475](#)]

TRNOVEC, Helena, DOLES, Tibor, HRIBAR, Gorazd, FURLAN, Nebojša, PODGORNIK, Aleš. Characterization of membrane adsorbers used for impurity removal during the continuous purification of monoclonal antibodies. *Journal of chromatography. A*. 4 Jan. 2020, vol. 1609, str. 1-13, ilustr. ISSN 0021-9673. <https://www.sciencedirect.com/science/article/pii/S0021967319309021>, DOI: [10.1016/j.chroma.2019.460518](https://doi.org/10.1016/j.chroma.2019.460518). [COBISS.SI-ID [1538503619](#)]

Igor Plazl

ARINAZZO BERGAMO DIAS MARTINS, Pedro, PLAZL, Igor, STRMČNIK, Dušan, GENORIO, Boštjan. Prospect of microfluidic devices for on-site electrochemical production of hydrogen peroxide. *Current opinion in electrochemistry*. Apr. 2023, vol. 38, str. 1-8.

G.N. Jovanovic, M.Y. Coblyn, I. Plazl. Time Scale Analysis & Characteristic Times in Microscale-Based Chemical and Biochemical Processes: Part I - Concepts and Origins, *Chemical Engineering Science*, 2021, **238**, 11650.

G.N. Jovanovic, M.Y. Coblyn, I. Plazl. Time Scale Analysis & Characteristic Times in Microscale-Based Biochemical Processes: Part II - Bioreactors with Immobilized Cells, and Process Flowsheet Analysis, *Chemical Engineering Science*, 2021, **236**, 116499.

HUBMAN, Anže, PLAZL, Igor, URBIČ, Tomaž. Inertial focusing of neutrally buoyant particles in heterogenous suspensions. *Journal of molecular liquids*. [Print ed.]. 15 Apr. 2021, vol. 328, str. 1-7.

F. Strniša, T. V. Sagar, P. Djinović, A. Pintar, I. Plazl. Ni-containing CeO₂ rods for dry reforming of methane: activity tests and a multiscale lattice Boltzmann model analysis in two model geometries. *Chem. Eng. J.*, 2021, **413**, 127498.

VICENTE, Filipa A., PLAZL, Igor, VENTURA, Sónia P. M., ŽNIDARŠIČ PLAZL, Polona. Separation and purification of biomacromolecules based on microfluidics. *Green chemistry*, ISSN 1463-9262, 21 Jul. 2020, vol. 22, iss. 14, str. 4391-4410.

Polona Žnidaršič Plazl

G. Koplányi, E. Bell, Z. Molnár, G. Katona, P.L. Neumann, F. Ender, G.T. Balogh, **P. Žnidaršič-Plazl**, L. Poppe, D. Balogh- Weiser. Novel approach for isolation and immobilization of a recombinant transaminase applying an advanced nanocomposite system. *ChemBioChem* 2023, e202200713.

<https://doi.org/10.1002/cbic.202200713>

Zeko-Pivać, M. Tišma, **P. Žnidaršič-Plazl**, B. Kulisic, G. Sakellaris, J. Hao, M. Planinić. The potential of brewer's spent grain in the circular bioeconomy : state of the art and future perspectives. *Front. Bioeng. Biotechnol.*, 2022, **10**, 1-15, doi: [10.3389/fbioe.2022.870744](https://doi.org/10.3389/fbioe.2022.870744).

P. Žnidaršič-Plazl. Biocatalytic process intensification *via* efficient biocatalyst immobilization, miniaturization, and process integration. *Curr. Opin. Green Sustain. Chem.*, 2021, **32**, 100546, doi: [10.1016/j.cogsc.2021.100546](https://doi.org/10.1016/j.cogsc.2021.100546).

M. Tišma, **P. Žnidaršič-Plazl**, G. Šelo, I. Tolj, M. Šperanda, A. Bucić-Kojić, M. Planinić. *Trametes versicolor* in lignocellulose-based bioeconomy : state of the art, challenges and opportunities. *Bioresour. Technol.*, 2021, **330**, 124997, doi: [10.1016/j.biortech.2021.124997](https://doi.org/10.1016/j.biortech.2021.124997).

M. Seručnik, F. A. Vicente, Ž. Brečko, J.A.P. Coutinho, S.P.M. Ventura, **P. Žnidaršič-Plazl**. Development of a Microfluidic Platform for R-Phycoerythrin Purification Using an Aqueous Micellar Two-Phase System. *ACS Sustainable Chem. Eng.*, 2020, **8** (46), 17097-17105, doi: [10.1021/acssuschemeng.0c05042](https://doi.org/10.1021/acssuschemeng.0c05042)

F. Strniša, M. Bajić, P. Panjan, I. Plazl, A.M. Sesay, **P. Žnidaršič-Plazl**. Characterization of an enzymatic packed-bed microreactor : Experiments and modeling. *Chem. Eng. J.*, 2018, 350: 541-550, doi: [10.1016/j.cej.2018.05.028](https://doi.org/10.1016/j.cej.2018.05.028).

BIOREAKCIJSKO INŽENIRSTVO

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioreakcijsko inženirstvo
Course title:	Bioreaction Engineering
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037283
Koda učne enote na članici/UL Member course code:	3785

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	15	0	10	80	5

Nosilec predmeta/Lecturer: Igor Plazl

Izvajalci predavanj: Igor Plazl
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.

Prerequisites:

Graduates of uniform master programmes and 2nd cycle programmes of biomedical, biotechnical, mathematical and natural sciences

Vsebina:

- biokemijska inženirska analiza in modeliranje;
- bioprocena kinetika: rast mikroorganizmov (Monod, rast na več substratih, inhibicija,...), kinetika encimskih reakcij (Michaelis- Menten,...);

Content (Syllabus outline):

- modelling and analysis of biochemical engineering processes;
- bioprocess kinetics: growth of microorganisms (Monod, growth on multiple substrates, inhibition, ...), enzyme kinetics (Michaelis-Menten,...);

<ul style="list-style-type: none"> • snovne in energijske bilance: reakcijski in separacijski bioprocesi; entalpijske spremembe; • osnove dinamike tekočin: idealni in neidealni tokovni modeli, napoved 3D hitrostnih profilov eno- in večfaznih sistemov; • osnove numerične analize: reševanje navadnih diferencialnih enačb: analitična metoda, Eulerjeva metoda, Rungejeva trapezna metoda, Runge-Kutta-klasična metoda četrtega reda, sistem navadnih diferencialnih enačb, numerično integriranje; numerično reševanje parcialnih diferencialnih enačb: eksplicitna in implicitna metoda končnih razlik, analitična in numerična rešitev Laplaceove enačbe; • zapis in reševanje ohranitvenih enačb; • razvoj 2D in 3D matematičnih modelov, ki vključujejo tok tekočin in reakcijsko-difuzijske člene; • uporaba računalniških orodij (npr.: Mathematica, Comsol, Matlab); • izbrani primeri modeliranja bioprocsov (encimska reakcija z raztopljenim katalizatorjem v eno- ali dvofaznem sistemu; biotransformacija v mikroreaktorju s pritrdjenimi encimi ali celicami; šaržni in kontinuirni proces biotransformacije progesterona z imobilizirano biomaso; modeliranje biološke čistilne naprave,...). 	<ul style="list-style-type: none"> • mass and energy balances: reaction and separation bioprocesses; enthalpy changes; • basic fluid dynamics: ideal and nonideal flow models, 3D velocity profile prediction of single and multiphase flow; • numerical analysis basics: ordinary differential equations (exact solutions, Euler's method, Euler trapeze method, Runge-Kutta methods, systems of ordinary differential equations, numerical integration; numerical solution of partial differential equations: explicit and implicit finite difference methods, analytical and numerical solution of Laplace's equation; • conservation equations; • development of 2D and 3D mathematical models considering velocity profile and reaction diffusion dynamics terms; • applications of computational tools (<i>Mathematica, COMSOL, Matlab</i>); • bioprocess modelling of selected cases (modelling and experimental studies on enzyme-catalyzed reaction in a microreactor; biotransformation in a microreactor with surface immobilized enzymes or cells; batch and continuous steroid biotransformation process with immobilized biomass; modelling of a pilot wastewater treatment plant,..).
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> • I. Plazl, M. Lakner, <i>Uvod v modeliranje procesov</i>, Založba FKKT, Univerza v Ljubljani, Ljubljana, 2004, 230 str. • J. Nielsen, J. Villadsen, <i>Bioreaction Engineering Principles</i>, Plenum Press, New York, 1994. • M-L. Shuler, F. Kargi, <i>Bioprocess Engineering: Basic Concepts</i>, Prentice-Hall, Upper Saddle River, NJ, 2002. <p>Tekoča znanstvena periodika / Current scientific periodicals.</p>

Cilji in kompetence:

<p>Pridobitev ali poglobitev znanja za samostojno delo na področju raziskav bioprocsov in njihovega teoretičnega opisa, ter načrtovanje in optimizacija bioprocsov, s poudarkom na okolju in človeku sprejemljivejših tehnologijah.</p>	<h4>Objectives and competences:</h4> <p>To develop skills for independent research work in the field of bio-processes, their theoretical description, design and optimization, with emphasis on environmentally acceptable biotechnologies</p>
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Predvideni študijski rezultati:

<p>Kandidata usposobiti za izvedbo omenjenih raziskav, rezultati katerih bodo predstavljali pomembne prispevke temeljni ali aplikativni znanosti na področju biotehniških znanosti.</p>	<h4>Intended learning outcomes:</h4> <p>Ability for solving various engineering tasks and problems of bioprocess technologies.</p>
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Metode poučevanja in učenja:

<p>Predavanja, seminarji, delo na projektih. Individualni študij s konzultacijami.</p>	<h4>Learning and teaching methods:</h4> <p>Lectures, seminars, project workshops. Individual study with consultation.</p>
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Načini ocenjevanja:

Delež/Weight Assessment:

Vsebina in predstavitev seminarske naloge	30,00 %	Content and presentation of the seminar thesis
Ustni izpit	70,00 %	Oral exam

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

- R. Ambrožič, **I. Plazl**. Development of an electrically responsive hydrogel for programmable *in situ* immobilization within a microfluidic device. *Soft Matter*, **2021**, 17, 6751 – 6764, doi: [10.1039/d1sm00510c](https://doi.org/10.1039/d1sm00510c).
- G.N. Jovanovic, M.Y. Coblyn, **I. Plazl**. Time Scale Analysis & Characteristic Times in Microscale-Based Bio-Chemical Processes: Part II - Bioreactors with Immobilized Cells, and Process Flowsheet Analysis, *Chemical Engineering Science*, **2021**, **236**, 116499, doi: [10.1016/j.ces.2021.116499](https://doi.org/10.1016/j.ces.2021.116499).
- G.N. Jovanovic, M.Y. Coblyn, **I. Plazl**. Time Scale Analysis & Characteristic Times in Microscale-Based Chemical and Biochemical Processes: Part I - Concepts and Origins, *Chemical Engineering Science*, **2021**, **238**, 11650, doi: [10.1016/j.ces.2021.116502](https://doi.org/10.1016/j.ces.2021.116502).
- A. Hubman, **I. Plazl**, T. Urbič. Inertial focusing of neutrally buoyant particles in heterogenous suspensions. *J. Mol. Liq.*, **2021**, **328**, 115410, doi: [10.1016/j.molliq.2021.115410](https://doi.org/10.1016/j.molliq.2021.115410)
- VICENTE, Filipa A., **PLAZL, Igor**, VENTURA, Sónia P. M., ŽNIDARŠIČ PLAZL, Polona. Separation and purification of biomacromolecules based on microfluidics. *Green chemistry*, ISSN 1463-9262, 21 Jul. **2020**, vol. 22, iss. 14, str. 4391-4410
- Strniša, F., Bajić, M., Panjan, P., **Plazl, I.**, Sesay, A.M., Žnidaršič Plazl, P. Characterization of an enzymatic packed-bed microreactor : experiments and modeling. *Chemical engineering journal*, ISSN 1385-8947. [Print ed.], 15. Oct. **2018**, vol. 350, str. 541-550

BIOTEHNOLOGIJA REPRODUKCIJE ŽIVALI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biotehnologija reprodukcije živali
Course title:	Animal reproduction biotechnology
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)			izbirni

Univerzitetna koda predmeta/University course code: 0640311

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
0	10	10	0	5	100	5

Nosilec predmeta/Lecturer: Peter Dovč

Izvajalci predavanj:	Peter Dovč
Izvajalci seminarjev:	
Izvajalci vaj:	
Izvajalci kliničnih vaj:	
Izvajalci drugih oblik:	
Izvajalci praktičnega usposabljanja:	

Vrsta predmeta/Course type: Individualno raziskovalni /individual research

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina:	Content (Syllabus outline):
- Sinhronizacija estrusa in superovulacija, Pregled metod za sinhronizacijo spolnega cikla pri različnih živalskih vrstah in postopki za superovulacijo. Pridobivanje jajčnih celic. Pridobivanje jajčnih celic s punkcijo foliklov in vitro, morfološka presoja jajčnih celic in ocena razvojnega potenciala - In vitro maturacija in in vitro fertilizacija. Maturacija jajčnih celic in vitro, kapacitacija semena in in vitro fertilizacija. - Kultivacija predimplantacijskih zarodkov Kultivacija zarodkov od oploditve do	Estrus synchronization and superovulation Overview of methods for sexual cycle synchro- nization in different animal species and procedures for superovulation—Harvesting of oocytes—Oocyte retrieval by in vitro follicle puncture, morphological assessment of oocytes and assessment of developmental potential—In vitro maturation and in vitro fertilization In vitro egg maturation, seed capacity and in vitro fertilization.—Cultivation of preimplantation embryos Cultivation of embryos

<p>brsteče blastociste, spremljanje morfoloških sprememb, uravnavanje celičnega cikla - Izolacija posameznih celic iz 2-8 celičnih zarodkov. Mikrokirurška osamitev posameznih celic iz predimplantacijskih zarodkov, kultivacija in izolacija celokupne RNA - Genotipizacija posameznih celic (scPCR) Genetska diagnostika posameznih celic (spol, dedne napake), mozaicizem, maternalno dedovanje - Mikrokirurški postopki. Mehanska in ultrazvočna delitev zarodkov, transfer embrionalnih celic, mikroinjiciranje - Transkriptomika posameznih celic Kv kvantifikacija maternalne in embrionalne genske ekspresije, spremljanje transkriptomске dinamike</p>	<p>from fertilization to budding blastocyst, monitoring of morphological changes, cell cycle regulation—Isolation of individual cells from 2-8 cell embryos—Microsurgical isolation of individual cells from preimplantation embryos, cultivation and isolation of total RNA—Single cell genotyping (scPCR) Genetic diagnostics of individual cells—(gender, hereditary defects), mosaicism, maternal inheritance—Microsurgical procedures—Mechanical and ultrasonic embryo division, embryonic cell transfer, microinjection—Transcriptomics of individual cells, Quantification of maternal and embryonic gene expression, monitoring of transcriptomic dynamics</p>
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Temeljna literatura in viri/Readings:

<p>Heiner Niemann, Christine Wrenzycki (2018): Animal Biotechnology 1, Reproductive Biotechnologies ISBN 978-3-319-92327-7, DOI 10.1007/978-3-319-92327-7, Springer International Publishing AG. Juan Carlos Gardón and Katy Satué (2021) Biotechnologies Applied to Animal Reproduction. ISBN 9781771888714, Apple Academic Press. Jose L. Estrada (2019) Biotechnology of Reproduction. Special issue of Animals ISSN 2076-2615</p>

Cilji in kompetence:

Slušatelji spoznajo osnovne postopke povezane z biotehnoškimi ukrepi v reprodukciji domačih živali. Seznanijo se z metodami za pridobivanje, gojenje in manipulacijo zarodkov. Ta znanja povežejo z bioinformacijskimi pristopi in analizami za proučevanje genske ekspresije v predimplantacijskem stanju in z metodami genomske diagnostike. komparativni pristop omogoča razvijanje adaptiranih metod za genetsko/genomsko spremljanje uravnavanja genske ekspresije med oploditvijo in implantacijo.

Objectives and competences:

Students learn the basic procedures associated with biotechnological measures in the reproduction of domestic animals. They become acquainted with methods for obtaining, culturing and manipulating embryos. They combine this knowledge with bioinformatics approaches and analyzes to study gene expression in the preimplantation state using genomic diagnostic methods. The comparative approach enables the development of adapted methods for genetic / genomic monitoring of the regulation of gene expression from fertilization to implantation.

Predvideni študijski rezultati:

Znanje in razumevanje:
Študentje se seznanijo z osnovnimi principi embriogeneze in biotehnoškimi možnostmi za poseganje v razvoj zarodka. Poleg tega pridobijo tehnična in bioinformacijska znanja za spremljanje genske ekspresije v predimplantacijskih zarodkih.

Intended learning outcomes:

Knowledge and understanding:
Students gain basic knowledge about early embryogenesis and biotechnological methods for its manipulation. In addition, they get technical and bioinformatic knowledge for the survey of gene expression in preimplantational embryos.

Metode poučevanja in učenja:

Seminarji, konzultacije, laboratorijske vaje.

Learning and teaching methods:

Seminars, consultations, laboratory exercises.

Načini ocenjevanja:

- seminarska naloga na temo eksperimentalne embriologije
- pisni izpit

Delež/Weight

40,00 %
60,00 %

Assessment:

- Seminar work on experimental embryology
- Written Exam

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Peter DOVČ

1. PRPAR MIHEVC, Sonja, OGOREVC, Jernej, DOVČ, Peter. Markers and antibodies for characterization of goat mammary tissue and the derived primary epithelial cell cultures. *Revista Brasileira de Zootecnia*, ISSN 1806-9290, 2020, vol. 49, e 20180164, str. 1-9, ilustr. https://www.rbz.org.br/wp-content/uploads/articles_xml/1806-9290-rbz-49-e20180164/1806-9290-rbz-49-e20180164.pdf, doi: 10.37496/rbz4920180164. [COBISS.SI-ID 19192579], [JCR, SNIP, WoS do 10. 7. 2020: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0, Scopus do 22. 9. 2020: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0] kategorija: 1A3 (Z); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB točke: 23.62, št. avtorjev: 3

2. URH, Kristian, KOLENC, Živa, HROVAT, Maj, SVET, Luka, DOVČ, Peter, KUNEJ, Tanja. Molecular mechanisms of syndromic cryptorchidism : data synthesis of 50 studies and visualization of gene-disease network. *Frontiers in endocrinology*, ISSN 1664-2392, 26 Jul 2018, vol. 9, no. 425, str. 1-11, ilustr. <https://www.frontiersin.org/articles/10.3389/fendo.2018.00425/full>, doi: 10.3389/fendo.2018.00425. [COBISS.SI-ID 4109704], [JCR, SNIP, WoS do 9. 2. 2020: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.33, Scopus do 29. 2. 2020: št. citatov (TC): 3, čistih citatov (CI): 3, čistih citatov na avtorja (CIAu): 0.50] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB točke: 15.32, št. avtorjev: 6

3. OGOREVC, Jernej, OREHEK, Sara, DOVČ, Peter. Cellular reprogramming in farm animals : an overview of iPSC generation in the mammalian farm animal species. *Journal of animal science and biotechnology*, ISSN 2049-1891, 2016, vol. 7, no. 10, str. 1-9. <http://jasbsci.biomedcentral.com/articles/10.1186/s40104-016-0070-3>, doi: 10.1186/s40104-016-0070-3. [COBISS.SI-ID 3700616], [JCR, SNIP, WoS do 14. 1. 2021: št. citatov (TC): 17, čistih citatov (CI): 17, čistih citatov na avtorja (CIAu): 5.67, Scopus do 29. 2. 2020: št. citatov (TC): 18, čistih citatov (CI): 18, čistih citatov na avtorja (CIAu): 6.00] kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB točke: 43.36, št. avtorjev: 3

4. OGOREVC, Jernej, DOVČ, Peter. Relative quantification of beta-casein expression in primary goat mammary epithelial cell lines. *Genetics and molecular research*, ISSN 1676-5680, 2015, vol. 14, no. 2, str. 3481-3490. <http://www.funpecrp.com.br/gmr/year2015/vol14-2/pdf/gmr4796.pdf>, doi: 10.4238/2015.April.15.12. [COBISS.SI-ID 3540360], [JCR, SNIP, WoS do 13. 1. 2021: št. citatov (TC): 7, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 2.50, Scopus do 28. 12. 2020: št. citatov (TC): 7, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 2.50] kategorija: 1A4 (Z); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB točke: 24.41, št. avtorjev: 2

5. ZORC, Minja, OBŠTETER, Jana, DOVČ, Peter, KUNEJ, Tanja. Genetic variability of microRNA genes in 15 animal species. *Journal of genomics*, ISSN 1839-9940, 2015, vol. 3, str. 51-56, ilustr. <http://www.jgenomics.com/v03p0051.pdf>, doi: 10.7150/jgen.11246. [COBISS.SI-ID 3516296] kategorija: 1C (Z); uvrstitev: MBP; tip dela je verificiral OSICB točke: 7.5, št. avtorjev: 4

6. ŠTIMPFEL, Martin, SKUTELLA, Thomas, CVJETIČANIN, Branko, MEZNARIČ, Marija, DOVČ, Peter, NOVAKOVIĆ, Srdjan, ŠKERL, Petra, VRTAČNIK-BOKAL, Eda, VIRANT-KLUN, Irma. Isolation, characterization and differentiation of cells expressing pluripotent/multipotent markers from adult human ovaries. *Cell and tissue research*, ISSN 0302-766X, Nov. 2013, vol. 354, no. 2, str. 593-607, ilustr., doi: 10.1007/s00441-013-1677-8. [COBISS.SI-ID 30679001], [JCR, SNIP, WoS do 11. 11. 2020: št. citatov (TC): 36, čistih citatov (CI): 33, čistih citatov na avtorja (CIAu): 3.67, Scopus do 26. 9. 2020: št. citatov (TC): 39, čistih citatov (CI): 37, čistih citatov na avtorja (CIAu): 4.11] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICM točke: 8.89, št. avtorjev: 9

7. PRPAR MIHEVC, Sonja, MARTIGNANI, Eugenio, DOVČ, Peter, BARATTA, Mario. Identification of goat mammary stem/ progenitor cells. *Biology of reproduction*, ISSN 0006-3363, vol. 86, no. 4, str. 1-7. <http://www.biolreprod.org/content/early/2012/01/09/biolreprod.111.095489.full.pdf+html>, doi: 10.1095/biolreprod.111.095489. [COBISS.SI-ID 3095176], [JCR, SNIP, WoS do 11. 10. 2020: št. citatov (TC): 18, čistih citatov (CI): 15, čistih citatov na avtorja (CIAu): 3.75, Scopus do 25. 9. 2020: št. citatov (TC): 19, čistih citatov (CI): 15, čistih citatov na avtorja (CIAu): 3.75] kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB točke: 27.25, št. avtorjev: 4

8. CIRKVENČIČ, Nina, NARAT, Mojca, DOVČ, Peter, BENČINA, Dušan. Distribution of chicken cathepsins B and L, cystatin and ovalbumin in extra-embryonic fluids during embryogenesis. *British Poultry Science*, ISSN 0007-1668, 2012, vol. 53, no. 5, str. 623-630, doi: 10.1080/00071668.2012.729131. [COBISS.SI-ID 3132296], [JCR, SNIP, WoS do 14. 4. 2019: št. citatov (TC): 4, čistih citatov (CI): 4, čistih citatov na avtorja

(CIAu): 1.00, Scopus do 25. 4. 2019: št. citatov (TC): 5, čistih citatov (CI): 5, čistih citatov na avtorja (CIAu): 1.25] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICB

BIOTSKE INTERAKCIJE V AGROEKOSISTEMIH IN VARSTVO RASTLIN

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Biotske interakcije v agroekosistemih in varstvo rastlin
Course title:	Biotic interactions in agroecosystems and plant protection
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037242
Koda učne enote na članici/UL Member course code:	3744

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	40	0	0	10	180	10

Nosilec predmeta/Lecturer: Stanislav Trdan

Izvajalci predavanj: Franci Aco Celar, Marina Dermastia, Stanislav Trdan
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina: Inter- in intraspecifični odnosi v agroekosistemih. Interakcije med rastlinami, njihovimi škodljivci (žuželke, pršice, ogorčice) ali fitopatogenimi organizmi (glive, bakterije, virusi, viroidi, fitoplazme) in koristnimi organizmi v agroekosistemu. Škodljivčeva izbira gostitelja. Vpliv biotičnega stresa na izpad pridelka. Infekcijski procesi pri fitopatogenih organizmih. Vplivanje patogenov na metabolne	Content (Syllabus outline): Inter- and intraspecific relationships in agroecosystems. Interactions between plants, their pests (insects, mites, nematodes) or phytopathogenic organisms (fungi, bacteria, viruses, viroids, phytoplasmas) and beneficial organisms in agroecosystems. Host-plant selection by the pest. Influence of biotic stress on the yield loss. Infection processes in phytopathogenic organisms. Influence of
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<p>processe gostiteljskih rastlin. Obrambne reakcije rastlin proti patogenom. Konstitutivna in inducibilna odpornost. Specifičnost odnosov med gostiteljem in parazitom. Poljsko in laboratorijsko določevanje odpornosti škodljivih organizmov. Neciljno delovanje fitofarmaceutskih sredstev in biotičnih agensov. Vmesni posevki, privabilni posevki, prekrivni posevki, antagonistične rastline, antifidanti, naravna fitofarmaceutska sredstva: koncepti in mehanizmi delovanja. Praktična uporaba biopesticidov (glive, bakterije, virusi). Laboratorijsko gojenje škodljivih in koristnih žuželk in drugih živali ter mikroorganizmov. Laboratorijsko in poljsko preizkušanje biopesticidov in biotičnih agensov (plenilske in parazitoidne žuželke, plenilske pršice, entomopatogene ogorčice).</p>	<p>pathogens on metabolic processes of the host plants. Plant defence reactions against pathogens. Constitutive and inducible resistance. Specificity of relationships between hosts and their parasites. Field and laboratory evaluation of pest organisms resistance. Non-target effect of pesticides and biological control agents. Intercrops, trap crops, cover crops, antagonistic plants, antifeedants, natural plant protection products: concepts and mechanisms. Practical use of biopesticides (fungi, bacteria, viruses). Laboratory rearing of harmful and beneficial insects and other animals and microorganisms. Laboratory and field evaluation of biopesticides and biological control agents (predatory insects, parasitoids, predatory mites, entomopathogenic nematodes) efficacy.</p>
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Temeljna literatura in viri/Readings:

<p>Agrios, G. 2005. Selective chapters from book Plant pathology, 6th edition. Academic Press: 1100 str., ISBN 9780128224298.</p> <p>Pimentel, D. 2002. Encyclopedia of pest management. Taylor & Francis, Boca Raton, London, New York, Singapore: 929 str., ISBN 0-8247-0632-3.</p> <p>- Dodatna literatura / Supplementary literature sources:</p> <p>Dermastia, M. 2010. Pogled v rastline. Ljubljana, Nacionalni inštitut za biologijo: 237 str., ISBN 978-961-92543-4-9.</p> <p>Gillings M. 2004. Plant Microbiology, BIOS Scientific Publ: 390 str.; ISBN-10: 1859962246.</p> <p>Peterson, R.K.D., Higley, L.G. 2000. Biotic stress and yield loss. CRC Press, Boca Raton, London, New York, Washington: 261 str., ISBN 0-8493-1145-4.</p> <p>Pimentel, D. 2002. Encyclopedia of pest management. Taylor & Francis, Boca Raton, London, New York, Singapore: 929 str., ISBN 0-8247-0632-3.</p> <p>Prell, H.H., Day, P.R. 2000. Plant fungal pathogen interaction – A classical and molecular view. Springer-Verlag, Berlin etc., 214 str. ISBN 3-540-66727-X.</p> <p>van Lenteren, 2003. Quality control and production of biological control agents. CABI Publishing, Wallingford: 327 str., ISBN 0-85199-688-4.</p> <p>Vidhyasekarn, P. 2007. Fungal pathogenesis in plants and crops; Molecular biology and host defence mechanisms, 2nd edition. CRC Press, Boca Raton, 498 str., ISBN 0-8493-9867-3.</p> <p>in revijalni članki s področja, tekoča periodika, druga učna gradiva...</p>
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Cilji in kompetence:

<p>Temeljni izobraževalni cilj je poglobitev znanja na področju inter- in intraspecifičnih odnosov med živimi organizmi v agroekosistemih ter načinov njihovega podnebnim in geografskih razmeram Slovenije prilagojenega zatiranja, s poudarkom na okolju in človeku sprejemljivejših metodah.</p>	<p>Objectives and competences:</p> <p>Fundamental objective of the course is deepening the knowledge in the fields of inter- and intraspecific relationships between living organisms in agroecosystems and the knowledge about the methods of their control, which are adapted to Slovenian climate and geographical conditions, with special emphasis on environmentally and human acceptable methods.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Predviden študijski rezultat je kandidatovo razumevanje odnosov med živimi organizmi (zlasti na relaciji rastline – škodljivi organizmi – koristni organizmi) v agroekosistemih.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>Intended learning outcome is to qualify the candidate to understand the relationships between living organisms (especially in relation plants – harmful organisms – beneficial organisms) in agroecosystems.</p>
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Metode poučevanja in učenja:	Learning and teaching methods:
Predavanja, seminarji, konzultacije, samostojno delo.	Lectures, seminars, consultations, individual work.

Načini ocenjevanja:	Delež/Weight	Assessment:
pisni izpit pisni izpit Pogoja za opravljanje študijskih obveznosti – pisnega izpita je zagovor seminarja Pogoja za opravljanje študijskih obveznosti – pisnega izpita: - zagovor seminarja	70,00 %	Conditions for performing study obligations - written exam is seminar performed written exam Conditions for performing study obligations - written exam: - seminar performed
samostojno delo študenta	30,00 %	individual work of the student

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

TRDAN STANISLAV

ROT, Mojca, MAISTRELLO, Lara, COSTI, Elena, **TRDAN, Stanislav**. Biological parameters, phenology and temperature requirements of *Halyomorpha halys* (Hemiptera: Pentatomidae) in the Sub-Mediterranean climate of Western Slovenia. *Insects*. 2022, vol. 13, no. 10, art. 956, 15 str. ISSN 2075-4450.

<https://www.mdpi.com/2075-4450/13/10/956>. [COBISS.SI-ID [126473731](#)].

VIDRIH, Matej, TURNŠEK, Anja, RAK CIZEJ, Magda, BOHINC, Tanja, **TRDAN, Stanislav**. Results of the single release efficacy of the predatory mite *Neoseiulus californicus* (McGregor) against the two-spotted spider mite (*Tetranychus urticae* Koch) on a hop plantation. *Applied sciences*. 2021, vol. 11, iss. 1, art. 118, str. 1-13, ilustr. ISSN 2076-3417. <https://doi.org/10.3390/app11010118>. [COBISS.SI-ID [44502275](#)].

LAZNIK, Žiga, MAJČIĆ, Ivana, **TRDAN, Stanislav**, MALAN, Antoinette P., PIETERSE, Annika, ROSS, Jenna L. Is *Phasmarhabditis papillosa* (Nematoda: Rhabditidae) a possible biological control agent against the Spanish slug, *Arion vulgaris* (Gastropoda: Arionidae)? *Nematology*. 2021, vol. 23, no. 5, str. 577-585. ISSN 1388-5545. DOI: [10.1163/15685411-bja10063](https://doi.org/10.1163/15685411-bja10063). [COBISS.SI-ID [35110403](#)].

BOHINC, Tanja, HORVAT, Aleksander, OCVIRK, Miha, KOŠIR, Iztok Jože, RUTNIK, Ksenija, **TRDAN, Stanislav**. The first evidence of the insecticidal potential of plant powders from invasive alien plants against rice weevil under laboratory conditions. *Applied sciences*. 2020, vol. 10, iss. 21, art. 7828, 16 str., ilustr. ISSN 2076-3417. <https://www.mdpi.com/2076-3417/10/21/7828>, DOI: [10.3390/app10217828](https://doi.org/10.3390/app10217828). [COBISS.SI-ID [35753731](#)].

SOLAR, Anita, ŠTAMPAR, Franci, VEBERIČ, Robert, **TRDAN, Stanislav**. How much walnut husk fly (*Rhagoletis completa* Cresson) affects nut quality of different walnut cultivars?. *European journal of horticultural science*. 2020, vol. 85, no. 1, str. 63-74. ISSN 1611-4426. DOI: [10.17660/eJHIS.2020/85.1.7](https://doi.org/10.17660/eJHIS.2020/85.1.7). [COBISS.SI-ID [9446777](#)].

LAZNIK, Žiga, KOŠIR, Iztok Jože, KOŠMELJ, Katarina, MUROVEC, Jana, JAGODIČ, Anamarija, **TRDAN, Stanislav**, KOCJAN AČKO, Darja, FLAJSŠMAN, Marko. Effect of *Cannabis sativa* L. root, leaf and inflorescence ethanol extracts on the chemotrophic response of entomopathogenic nematodes. *Plant and soil*. [Print ed.]. 2020, vol. 455, iss. 1, str. 367-379. ISSN 0032-079X. DOI: [10.1007/s11104-020-04693-z](https://doi.org/10.1007/s11104-020-04693-z). [COBISS.SI-ID [27604995](#)].

LAZNIK, Žiga, BOHINC, Tanja, FRANIN, Kristijan, MAJČIĆ, Ivana, **TRDAN, Stanislav**. Efficacy of invasive alien plants in controlling Arionidae slugs. *Spanish journal of agricultural research*. 2020, vol. 18, no. 1 (e1001), 13 str. ISSN 2171-9292. DOI: [10.5424/sjar/2020181-15542](https://doi.org/10.5424/sjar/2020181-15542). [COBISS.SI-ID [9437817](#)].

TRDAN, Stanislav, VUČAJNK, Filip, BOHINC, Tanja, VIDRIH, Matej. The effect of a mixture of two plant growth promoting bacteria from Argentina on the yield of potato, and occurrence of primary potato diseases and pest - short communication. *Acta agriculturae Scandinavica. Section B, Soil and plant science*. 2019, vol. 69, no. 1, str. 89-94. ISSN 0906-4710. DOI: [10.1080/09064710.2018.1492628](https://doi.org/10.1080/09064710.2018.1492628). [COBISS.SI-ID [8995449](#)].

VOGLAR, Grega E., MRAK, Tanja, KRŽMAN, Mitja, JAGODIČ, Anamarija, **TRDAN, Stanislav**, LAZNIK, Žiga. Effect of contaminated soil on multitrophic interactions in a terrestrial system. *Plant and soil*. [Print ed.]. Feb. 2019, vol. 435, iss. 1/2, str. 337-351, graf. prikazi, tabele. ISSN 0032-079X.

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CELAR ACO FRANCI

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Phytoplasma solani" infection in the field. European journal of plant pathology. 2018, vol. 150, iss.3, str. 653-668. ISSN 0929-1873. <http://dx.doi.org/10.1007/s10658-017-1310-x>, DOI: [10.1007/s10658-017-1310-x](https://doi.org/10.1007/s10658-017-1310-x). [COBISS.SI-ID [4396623](#)]

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BIOZNANOST IN KIRURGIJA

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Bioznanost in kirurgija
Course title:	Biosciences and surgery
Članica nosilka/UL	UL ZF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0640280

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	15	5	0	0	95	5

Nosilec predmeta/Lecturer: Saba Battelino

Izvajalci predavanj: Saba Battelino, Drago Dolinar
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični /theoretical

Jeziki/Languages: Predavanja/Lectures: Angleščina, Slovenščina
Vaje/Tutorial: Angleščina, Slovenščina

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

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških znanosti. Splošni pogoji za vpis na doktorski študij.

Prerequisites:

Graduates of unified master's degree programs and 2nd degree programs of biomedical and biotechnical sciences.
General conditions for enrollment in doctoral studies.

Vsebina:

1. Pregled najpogostejših kirurških načinov zdravljenja bolezni ušes ter lateralne in sprednje lobanjske baze
2. Pregled vloge tujih in telesu lastnih materialov in substanc v otorinolaringologiji
3. Sestava, priprava in uporaba plazme, bogate s trombociti in zunajceličnimi vezikli v medicini.

Content (Syllabus outline):

1. An overview of the most common surgical treatments for ear disease and the lateral and anterior skull-base
2. Review of the role of foreign and the body's own materials and substances in otorhinolaryngology
3. Composition, preparation and use of platelet-rich plasma and extracellular vesicles in medicine.

<p>4. Pregled uporabe mitomicina v zdravljenju zoženosti zunanega sluhovoda</p> <p>5. Pregled uporabe vsadkov v otorinolaringologiji</p> <ol style="list-style-type: none"> 1. polžev vsadek 2. kostno-vsodran slušni pripomoček <p>6. Merila za oceno izida zdravljenja</p> <ol style="list-style-type: none"> 1. objektivna: merjenje površin, klinični točkovniki, itd.. 2. subjektivna: merila za oceno z zdravjem povezane kakovosti življenja <p>7. Pregled najpogostejših biokompatibilnih materialov in novih tehnologij v ortopedski kirurgiji</p> <p>8. Pregled pojavov na površinah brezementnih endoprotez kolka (omočljivost, hrapavost in odziv celic)</p> <p>9. Pregled procesov osteointegracije deponiranih multifunkcijskih nanostrukturiranih plasti na površini kovinskih biokompatibilnih materialov z namenom izboljšati osteointegracijo vsadka s kostjo.</p>	<p>4. Review of the use of mitomycin in the treatment of external auditory canal narrowing</p> <p>5. Review of the use of implants in otorhinolaryngology</p> <ol style="list-style-type: none"> 1. cochlear implant 2. bone-anchored hearing aid <p>6. Criteria for assessing treatment outcome</p> <ol style="list-style-type: none"> 1. objective: surface measurement, clinical scores etc. 2. subjective: health-related quality of life questionnaires <p>7. An overview of the most common biocompatible materials used in orthopedic surgery</p> <p>8. Review of phenomena the surface of uncemented hip endoprostheses (surface wetting and roughness and cell response)</p> <p>9. Review of osteointegration processes of multifunction coatings on nanostructured surface of metallic materials with the aim to improve osteointegration between implant and bone.</p>
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Temeljna literatura in viri/Readings:

- Battelino S. Avdiometrija, vestibulometrija in avdiološka elektroakustika v vsakdanji praksi: učbenik za tečajnike avdiometrije in vestibulometrije, avdiološke elektroakustike, logopede, študente splošne in dentalne medicine, specializante otorinolaringologije, klinične logopedije in nevrologije ter specializante medicine dela, prometa in športa [Internet]. Katedra za otorinolaringologijo Medicinske fakultete; 2017.
- Battelino S, Hocevar-Boltezar I, Zargi M. Intraoperative use of mitomycin C in fibrous atresia of the external auditory canal. *Ear Nose Throat J.* 2005 Dec;84(12):776-9. PMID: 16408556.
- Vozel D, Steiner N, Božanič Urbančič N, Mladenov D, Battelino S. Slovenian Cross-Cultural Adaptation and Validation of Health-Related Quality of Life Measures for Chronic Otitis Media (COMQ-12), Vertigo (DHI, NVI) and TINNITUS (THI). *Zdr Varst.* 2020 Jun 25;59(3):120-127. doi: 10.2478/sjph-2020-0016. PMID: 32952712; PMCID: PMC7478096.
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- Vozel D, Battelino S. Preparation of platelet- and extracellular vesicle-rich gel and its role in the management of cerebrospinal fluid leak in anterior and lateral skull-base surgery. V: *Zbornik recenziranih prispevkov* [Internet]. Ljubljana: Zdravstvena fakulteta; 2020. str. 47–58. Dostopno na: http://www2.zf.uni-lj.si/images/stories/datoteke/Zalozba/Sokraska_2019.pdf, <https://repositorij.uni-lj.si/IzpisGradiva.php?id=113167&lang=slv>
- Vozel D, Božič D, Jeran M, Jan Z, Pajnič M, Pađen L, idr. The role of platelet-and extracellular vesicle-rich plasma in the treatment of temporal bone cavity inflammation : a randomized controlled trial. V: *Zbornik recenziranih prispevkov* [Internet]. Ljubljana: Zdravstvena fakulteta; 2020. str. 41–52. Dostopno na: <https://repositorij.uni-lj.si/IzpisGradiva.php?id=113109&lang=slv>
- DOLINAR, Drago. Novosti v endoprotetiki kolčnega in kolenskega sklepa. V: PAVLOVČIČ, Vinko (ur.). *Novosti v ortopediji*. Ljubljana: Ortopedska klinika, Klinični center. 2008, str. 99-105. [COBISS.SI-ID [24231129](#)]
- LOTRIČ-FURLAN, Stanka, DOLINAR, Drago, KOŠAK, Robert, KOTAR, Tadeja. Kirurške okužbe sklepov in kosti = Surgical infections of joints and bones. V: BEOVIČ, Bojana (ur.), STRLE, Franc (ur.), ČIŽMAN, Milan (ur.). *Zbornik predavanj : [okužbe, ki potrebujejo kirurško zdravljenje]*. Ljubljana: Sekcija za kemoterapijo SZD: Klinični center, Klinika za infekcijske bolezni in vročinska stanja: Univerza v Ljubljani, Medicinska fakulteta, Katedra za infekcijske bolezni in epidemiologijo. 2007, str. 185-201. [COBISS.SI-ID [23114201](#)]
- Park J. B., & Bronzino J. D.(eds.) (2003) "Biomaterials Principles and Applications", CRC Press Beer F., Johnston E., & Dewolf J. (2001) "Mechanics of Materials" 3rd Edition McGraw- Hill

Budinski K. G., & Budinski M. K.(2001) Edition, "Engineering Materials Properties and Selection" 7th Edition, Prentice Hall.

- Benham P. P., Crawford R. J., & Armstrong C. G.(1996) "Mechanics of Engineering Materials" 2nd Edition, Addison Wesley Longman LTD
- Bronzino J. D. (Ed) (1999), "The Biomedical Engineering Handbook", 2nd Edition

Cilji in kompetence:

Spoznava uporabe biokemičnih, bioaktivnih pripravkov, mehanskih ter elektromagnetnih vsadkov ter pripravkov iz telesnih tekočin ljudi pri izboljševanju rezultatov klasičnih kirurških tehnik na področju:

- Kroničnih vnetij senčnične kosti
- Zdravljenju kroničnih vnetij srednjega ušesa
- Zagotavljanju sluha gluhih osebami
- Zapori operativnih pristopov na stranski in sprednji lobanjski bazi.

Študent pridobi osnovno znanje za razumevanje na področju bio inženirskih materialov in tkiv za aplikacije v ortopedski kirurgiji in rehabilitaciji

Objectives and competences:

Learns about the use of biochemical, bioactive preparations, mechanical and electromagnetic implants and preparations from human body fluids in improving the results of classical surgical techniques in the field of:

- Chronic temporal bone inflammation
- Treatment of chronic otitis media
- Hearing rehabilitation in deaf people
- Closure of surgical approaches to the lateral and anterior skull-base.

Student get the basic knowledge and understanding in the field of bio engineering materials and tissues for the applications in orthopedic surgery and rehabilitation

Predvideni študijski rezultati:

Znanje in razumevanje:

- Interdisciplinarni znanstveni pristopi pri kirurškem zdravljenju
- Pomen izboljševanja klasičnih kirurških tehnik
- Metode sledenja kirurškim rezultatov
- Identifikacija neuspehov klasičnih kirurških tehnik
- Iskanje področij in načinov za izboljševanje končnih rezultatov
- Metode sledenja kirurških rezultatov na osnovi raziskav predčasno odpovedanih endoprotez kolka in kolena
- Iskanje novih kombinacij biomaterialov za izboljšanje dobe trajanja vsadkov

Intended learning outcomes:

Knowledge and understanding:

- Interdisciplinary scientific approaches in surgical treatment
- The importance of improving classical surgical techniques
- Methods of tracking surgical results
- Identification of failures of classical surgical techniques
- Finding areas and ways to improve the treatment outcome
- Methods of following surgical results on the base of the investigations of prematurely failed hip and knee endoprosthesis
- Finding new biomaterials combinations with the aim to improve lifetime of implants

Metode poučevanja in učenja:

Predavanja, diskusijske delavnice predstavljenih seminarjev
 Demonstracija že vpeljanih biomedicinskih metod v kirurgiji
 Predstavitev dosedaj obstoječe literature
 Seznanitev z potekajočimi raziskavami
 Smernice za nadaljnje razvijanje področja

Learning and teaching methods:

Lectures, discussion workshops of presented seminars
 Demonstration of already introduced biomedical methods in surgery
 Presentation of existing literature
 Familiarization with ongoing research
 Guidelines for further development of the field

Načini ocenjevanja:

Delež/Weight

Assessment:

Ustni in ali pisni izpit	50,00 %	Written or oral examination;
Priprava in zagovor seminarja	20,00 %	Written seminar and its presentation;
Vsebinska priprava manjšega projekta	30,00 %	Preparation of the short project.

Ocenjevalna lestvica:

Grading system:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

- Vozel D, Steiner N, Božanić Urbančič N, Mladenov D, Battelino S. Slovenian Cross-Cultural Adaptation and Validation of Health-Related Quality of Life Measures for Chronic Otitis Media (COMQ-12), Vertigo (DHI, NVI) and TINNITUS (THI). *Zdr Varst.* 2020 Jun 25;59(3):120-127. doi: 10.2478/sjph-2020-0016. PMID: 32952712; PMCID: PMC7478096.
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- VOZEL, Domen, PUKL, Peter, GROŠELJ, Aleš, ANIČIN, Aleksandar, STROJAN, Primož, BATTELINO, Saba. The importance of flaps in reconstruction of locoregionally advanced lateral skull-base cancer defects : a tertiary otorhinolaryngology referral centre experience. *Radiology and oncology.* [Print ed.]. 2021, vol. 55, no. 3, str. 323-332, viii, ilustr. ISSN 1318-2099. DOI: 10.2478/raon-2021-0012. [COBISS.SI-ID 59567619], [JCR, SNIP, WoS, Scopus]
- JENSTERLE SEVER, Mojca, FERJAN, Simona, BATTELINO, Tadej, KOVAČ, Jernej, BATTELINO, Saba, ŠUPUT, Dušan, VOVK, Andrej, JANEŽ, Andrej. Does intervention with GLP-1 receptor agonist semaglutide modulate perception of sweet taste in women with obesity : study protocol of a randomized, single-blinded, placebo-controlled clinical trial. *Trials.* Jul. 2021, vol. 22, str. 1-12, ilustr. ISSN 1745-6215. <https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-021-05442-y>, DOI: 10.1186/s13063-021-05442-y.
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- BOŽANIĆ URBANČIČ, Nina, VOZEL, Domen, STEINER, Nejc, HRIBAR, Manja, FOŠNARIČ, Iztok, ŠIFRER, Robert, URBANČIČ, Jure, BATTELINO, Saba (avtor, korespondenčni avtor). Consequences of stapes surgery on tongue morphological characteristics in narrow band imaging, gustatory function and general sensation : a prospective tertiary center study. *Applied sciences.* 2022, vol. 12, iss. 7, str. 1-15. ISSN 2076-3417. <https://www.mdpi.com/2076-3417/12/7/3248>, DOI: 10.3390/app12073248.

Drago Dolinar

- BOŠNJAK, Klemen, KOCJANČIČ, Boštjan, DOLINAR, Drago, POMPE, Borut. The use of an intra-oral scanner for patellar surface analysis in total knee arthroplasty = Uporaba intraoralnega skenerja za analizo površin pogačice pri totalni artroplastiki kolena. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2021, vol. 55, iss. 1, str. , doi: [10.17222/mit.2020.115](https://doi.org/10.17222/mit.2020.115)
- MOLIČNIK, Andrej, JANŠA, Jošt, KOCJANČIČ, Boštjan, KRALJ-IGLIČ, Veronika, DOLINAR, Drago. Secondary hip dysplasia increases risk for early coxarthrosis after Legg-Calve-Perthes disease. A study of 255 hips. *Computer methods in biomechanics and biomedical engineering*, ISSN 1025-5842, 2019, vol. 22, no. 14, str. 1107-1115, ilustr., doi: [10.1080/10255842.2019.1634193](https://doi.org/10.1080/10255842.2019.1634193).
- KOCJANČIČ, Boštjan, LAPOŠA, Andrej, DOLINAR, Drago. The importance of sonication and pre-operative antimicrobial therapy = Pomen sonikacije pri predoperativni antibiotični terapiji. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], 2019, letn. 53, št. 6, str. 913-918, , doi: [10.17222/mit.2019.130](https://doi.org/10.17222/mit.2019.130)
- DOLINAR, Drago, GORENŠEK, Matevž, JENKO, Monika, GODEC, Matjaž, ŠETINA, Barbara, DONIK, Črtomir, KOCIJAN, Aleksandra, DEBELJAK, Mojca, KOCJANČIČ, Boštjan. Biomaterials in endoprosthetics = Biomateriali v endoprotetiki. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], jan.-feb. 2018, letn. 52, št. 1, str. 89-98, doi: [10.17222/mit.2017.196](https://doi.org/10.17222/mit.2017.196).
- KOCJANČIČ, Boštjan, SUHODOLČAN, Lovro, AVSEC, Klemen, GODEC, Matjaž, ŠETINA, Barbara, DONIK, Črtomir, JENKO, Monika, DOLINAR, Drago. Impaction grafting of large acetabular defects = Rekonstrukcija velikih acetabularnih defektov z metodo impaktiranja kostnih presadkov. *Materiali in tehnologije*, ISSN 1580-2949. [Tiskana izd.], nov.-dec. 2018, letn. 52, no. 6, str. 695-702, ilus, doi: [10.17222/mit.2018.036](https://doi.org/10.17222/mit.2018.036).

DENDROEKOLOGIJA, RASTNE IN STRUKTURNE ZNAČILNOSTI GOZDNIH SESTOJEV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Dendroekologija, rastne in strukturne značilnosti gozdnih sestojev
Course title:	Dendroecology, growth and structure characteristics of forest stands
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037335
Koda učne enote na članici/UL Member course code:	3838

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	10	15	0	5	85	5

Nosilec predmeta/Lecturer: Tomislav Levanič

Izvajalci predavanj: Matija Klopčič, Tomislav Levanič
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Dokončan drugostopenjski študij biologije, biotehnologije, gozdarstva, krajinske arhitekture ali primerljivih programov, lahko tudi končan univerzitetni študij po starih programih za omenjene smeri.
Upoštevajo se tudi splošni pogoji za vpis na doktorski študij

Prerequisites:

Completed second degree of studies of biology, biotechnology, forestry and landscape architecture or from comparable programs; eligible are also old programmes of above mentioned studies.
The general requirements for admission to doctoral studies are required

Vsebina:

Dendroekologija: osnove dendrokronološkega dela, načrtovanje vzorčenja, odvzem vzorcev, priprava za

Content (Syllabus outline):

Dendroecology: fundamentals of dendroecological research, sampling design, sample collection,

<p>merjenje, kontrola podatkov, datiranje in sinhroniziranje. Opis branike kot osnovne enota dendrokronologije. Anomalije branik. Tehnike standardizacije dendrokronoloških podatkov ter povezava med okoljskimi dejavniki (klima, ostali dejavniki) in različnimi podatki, vezanimi na braniko (širina, razmerje med ranim in kasnim lesom, širino ranega in kasnega lesa, gostoto, izotopsko zgradbo,...).</p> <p>Rastni procesi v sestoji: modeliranje rasti in razvoja sestojev. Napovedljivost in usmerljivost razvoja sestojev. Analiza in modeliranje kakovostne zgradbe sestoja ter vrednostnih karakteristik gozdnih ekosistemov. Kalkulacija in napoved donosov v sestoji. Odzivi gozdov na ukrepanje.</p>	<p>measurements, quality control of measured data, crossdating and synchronising. Tree-ring as a basic unit of dendrochronological studies, tree-ring anomalies. Standardisation of dendrochronological time series and statistical connection with environmental data (climate, other factors). Study of different tree-ring parameters, such as width, early- to latewood ratio, stable isotope composition,...)</p> <p>Growth processes in forest stands: modelling of growth and development of forest stands. Ability to predict and to guide forest stand development; analysis and modelling of stand quality structure, value characteristics of forest ecosystems. Calculations and forecasting of forest stand yields; response of forest on management activities</p>
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Temeljna literatura in viri/Readings:

<p>Cook, E. R. / Kairiukstis, L. A., 1989. Methods of dendrochronology (applications in the environmental sciences).- Dordrecht, Boston, London, Kluwer academic publishers, 394 s.</p> <p>Hans-Peter Kahle, Timo Karjalainen, Annette Schuck, Göran I. Ågren, Seppo Kellomäki, Karl Mellert, Jörg Prietzel, Karl-Eugen Rehfuss and Heinrich Spiecker (editors). 2008. Causes and Consequences of Forest Growth Trends in Europe - Results of the Recognition Project. EFI, Research Report 21, Brill Academic Publishers: Leiden, Boston, Köln, 262 s.</p> <p>Kimmins, J. P., 1997. Forest Ecology: A Foundation for Sustainable Management. Prentice Hall, Upper Saddle River, New Jersey, 596 str.</p> <p>Legendre, P., Legendre L. 1998. Numerical Ecology. Developments in Environmental Modelling, 20, Elsevier Science, 870 s.</p> <p>Levanič, T. Dendrokronologija – skripta.</p> <p>Pretzsch, H. 2001. Modellierung des Waldwachstums. Parey Berlin, 341 s.</p> <p>In revijalni članki s področja, tekoča periodika, druga učna gradiva...</p>

Cilji in kompetence:

<p>Cilj je spoznati aktualne raziskovalne vsebine in tehnike s področij dendroekologije in prirastoslovja.</p>	<p>Objectives and competences:</p> <p>The aim is to learn about current research topics and techniques in the fields of dendroecology and growth and yield studies.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Kandidat pridobi znanja o strukturi, rasti, razvoju gozdnih sestojev, njihovi odzivnosti na izvedene ukrepe in druge vplive. Spozna osnove dendroekologije; osvoji tehnike vzorčenja, merjenje, datiranja in sinhroniziranja drevesnih branik. Seznanitev z modeliranjem razvoja gozdnih sestojev ter z dendrokronološkimi metodami modeliranja odziva dreves na okoljske dejavnike.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding:</p> <p>The student acquires knowledge about the structure, growth and development of forest stands, their responsiveness to the measures taken and other environmental factors. Learn the basics of dendroecology; get familiar with the techniques of sampling, measurement, crossdating and synchronization of tree-ring sequences. Become familiar with the modelling techniques for the development of forest stands and with dendrochronological methods of modelling the response of trees to environmental factors.</p>
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Metode poučevanja in učenja:

<p>Predavanja (izbrane vsebine), konzultacije, laboratorijske in seminarske vaje, terensko delo, vključitev v raziskovalni projekt.</p>	<p>Learning and teaching methods:</p> <p>Lectures (selected topics), consultations, laboratory and tutorials, fieldwork, inclusion in the research project.</p>
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Načini ocenjevanja:	Delež/Weight	Assessment:
Seminarske naloge in izpit. Ocena izpita je povprečje ocene izpita, ocene seminarских del in ocene raziskovalne uspešnosti kandidata.	100,00 %	Seminar papers and exam. Exam score is the average of the assessment exam, evaluation seminar of the research and evaluation of student performance.

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Tomislav Levanič

- MÉSZÁROS, Ilona, ADORJÁN, Balázs, NYITRAI, Balázs, KANALAS, Péter, **LEVANIČ, Tom**. Long-term radial growth and climate-growth relationships of *Quercus petraea* (Matt.) Liebl. and *Quercus cerris* L. in a xeric low elevation site from Hungary. *Dendrochronologia*. 2022, vol. 76, art. 126014, 13 str. ISSN 1612-0051.
- KOSTIĆ, Saša, **LEVANIČ, Tom**, ORLOVIĆ, Saša, MATOVIĆ, Bratislav, STOJANOVIĆ, Dejan. Turkey oak (*Quercus cerris* L.) is more drought tolerant and better reflects climate variations compared to pedunculate oak (*Quercus robur* L.) in lowland mixed forests in northwestern Serbia: a stable carbon isotope ratio ($\delta^{13}C$) and radial growth approach. *Ecological indicators: integrating monitoring, assessment and management*. 2022, vol. 142, art.109242, str. 1-11, ilustr. ISSN 1470-160X.
- DORADO LIÑÁN, Isabel, AYARZAGÜENA, Blanca, BABST, Flurin, XU, Guobao, GIL, Luis, BATTIPAGLIA, Giovanna, BURAS, Allan, ČADA, Vojtěch, CAMARERO, Jesús J., CAVIN, Liam, **LEVANIČ, Tom**, PRISLAN, Peter, et al. Jet stream position explains regional anomalies in European beech forest productivity and tree growth. *Nature communications*. 2022, vol. 13, art. 2015, 10 str. ISSN 2041-1723.
- LEVANIČ, Tom**, ŠTRAUS, Hana. Effects of climate on Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) growth Southeast of the European Alps. *Plants*. 2022, iss. 12, art. 1571, 20 str., ilustr. ISSN 2223-7747.
- NUSSBAUMER, Anita, GESSLER, Arthur, BENHAM, Sue, DE CINTI, B., ETZOLD, Sophia, INGERSLEV, Morten, JACOB, Frank, LEBOURGEOIS, François, **LEVANIČ, Tom**, MARJANOVIĆ, Hrvoje, et al. Contrasting resource dynamics in mast years for European Beech and Oak - a continental scale analysis. *Frontiers in forests and global change*. vol. 4, article 689836, 17 str. ISSN 2624-893X.
- JEVŠENAK, Jernej, TYCHKOV, Ivan, GRIČAR, Jožica, **LEVANIČ, Tom**, TUMAJER, Jan, PRISLAN, Peter, ARNIČ, Domen, POPKOVA, Margarita, SHISHOV, Vladimir V. Growth-limiting factors and climate response variability in Norway spruce (*Picea abies* L.) along an elevation and precipitation gradients in Slovenia. *International journal of biometeorology*. 2021, vol. 65, iss. 2, str. 311-324. ISSN 0020-7128.
- NECHITA, Constantin, IORDACHE, Andreea Maria, LEMR, Karel, **LEVANIČ, Tom**, PLUHACEK, Tomas. Evidence of declining trees resilience under long term heavy metal stress combined with climate change heating. *Journal of cleaner production*. [Print ed.]. 2021, vol. 317, 11 str., ilustr. ISSN 0959-6526.
- KOSTIĆ, Saša, WAGNER, Wolfgang, ORLOVIĆ, Saša, **LEVANIČ, Tom**, ZLATANOV, Tzvetan, GORŠIĆ, Ernest, KESIĆ, Lazar, MATOVIĆ, Bratislav, TSVETANOV, Nikolay, STOJANOVIĆ, Dejan. Different tree-ring width sensitivities to satellite-based soil moisture from dry, moderate and wet pedunculate oak (*Quercus robur* L.) stands across a southeastern distribution margin. *Science of the total environment*. [Online ed.]. 2021, vol. 800, article 149536, 11 str., ilustr. ISSN 1879-1026.
- LEVANIČ, Tom**, JEVŠENAK, Jernej, HAFNER, Polona. Stable isotopes reveal climate signal hidden in tree rings of endemic Balkan Pines. *Atmosphere*. 2020, iss. 2, article 135, 19 str., ilustr. ISSN 2073-4433.
- COCOZZA, Claudia, PAOLETTI, Elena, MRÁK, Tanja, ZAVADLAV, Saša, **LEVANIČ, Tom**, KRAIGHER, Hojka, GIOVANNELLI, Alessio, HOSHIKA, Yasutomo. Isotopic and water relation responses to ozone and water stress in seedlings of three oak species with different adaptation strategies. *Forests*. [Online ed.]. 2020, vol. 11, iss. 8, 15 str., ilustr. ISSN 1999-4907.
- DE SOTO, Lucía, CAILLERET, Maxime, STERCK, Frank, JANSEN, Steven, KRAMER, Koen, ROBERT, Elisabeth M.R., AAKALA, Tuomas, AMOROSO, Mariano M., BIGLER, Christof, CAMARERO, Jesus Julio, ČUFAR, Katarina, **LEVANIČ, Tom**, et al. Low growth resilience to drought is related to future mortality risk in trees. *Nature communications*. 2020, vol. 11, iss. 1, str. 1-9, ilustr. ISSN 2041-1723.

12. OGNJENOVIC, Mladen, **LEVANIČ, Tom**, POTOČIĆ, Nenad, UGARKOVIĆ, Damir, INDIR, Krunoslav, SELETKOVIĆ, Ivan. Interrelations of various tree vitality indicators and their reaction to climatic conditions on a European beech (*Fagus sylvatica* L.) = Plot međuovisnost različitih indikatora vitaliteta stabala i njihov odziv na klimatske uvjete na plohi obične bukve (*Fagus sylvatica* L.). *Šumarski list*. 2020, vol. 144, iss. 7/8, str. 351-365. ISSN 0373-1332.
13. JEVŠENAK, Jernej, GORŠIĆ, Ernest, STOJANOVIĆ, Dejan, MATOVIĆ, Bratislav, **LEVANIČ, Tom**. Sapwood characteristics of *Quercus robur* species from the south-western part of the Pannonian Basin. *Dendrochronologia*. 2019, vol. 54, str. 64-70, ilustr. ISSN 1125-7865.
14. CAILLERET, Maxime, DAKOS, Vasilis, JANSEN, Steven, ROBERT, Elisabeth M.R., AAKALA, Tuomas, AMOROSO, Mariano M., ANTOS, Joe A., BIGLER, Christof, BUGMANN, Harald, CACCIANAGA, Marco, ČUFAR, Katarina, **LEVANIČ, Tom**, et al. Early-warning signals of individual tree mortality based on annual radial growth. *Frontiers in plant science*. 2019, vol. 9, 14 str., ilustr. ISSN 1664-462X.
15. YU, Kailiang, SMITH, William K., TRUGMAN, Anna T., CONDIT, Richard, HUBBELL, Stephen P., SARDANS, Jordi, PENG, Changhui, ZHU, Kai, PEÑUELAS, Josep, CAILLERET, Maxime, **LEVANIČ, Tom**, GESSLER, Arthur, SCHAUB, Marcus, FERRETTI, Marco, ANDEREGG, William R. L. Pervasive decreases in living vegetation carbon turnover time across forest climate zones. *Proceedings of the National Academy of Sciences of the United States of America*. 2019, vol. 116, iss. 49, str. 24662-24667, ilustr. ISSN 0027-8424.
16. ČATER, Matjaž, **LEVANIČ, Tom**. Beech and silver fir's response along the Balkan's latitudinal gradient. *Scientific reports*. 2019, vol. 9, article 16269, 14 str. ISSN 2045-2322.
17. BERTA, Alen, **LEVANIČ, Tom**, STOJSAVLJEVIĆ, Denis, KUŠAN, Vladimir. Site index and volume growth Percentage determination for privately owned uneven-aged Stands of *Quercus pubescens* and *Quercus ilex* along the Croatian Adriatic coast. *South-east European forestry*. 2019, vol. 10, iss. 1, str. 65-75, ilustr. ISSN 1849-0891.

Matija Klopčič

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2. **KLOPČIČ, Matija**, ROZMAN, Andrej, BONČINA, Andrej. Evidence of a climate-change-induced shift in European beech distribution : an unequal response in the elevation, temperature and precipitation gradients. *Forests*. [Online ed.]. vol. 13, art. 1311, 16 str. ISSN 1999-4907, DOI: 10.3390/f13081311. [COBISS.SI-ID 118899715]
3. BONČINA, Živa, TRIFKOVIĆ, Vasilije, ROSSET, Christian, **KLOPČIČ, Matija**. Evaluation of estimation methods for fitting the three-parameter Weibull distribution to European beech forests. *IForest*. 2022, vol. 15, iss. 6, str. 484-490, ISSN 1971-7458, DOI: 10.3832/ifor4145-015. [COBISS.SI-ID 132338691]
4. SANTOPUOLI, Giovanni, TEMPERLI, Cristian, ALBERDI, Iciar, BARBEITO, Ignacio, BOŠELA, Michal, BOTTERO, Alessandra, **KLOPČIČ, Matija**, LESIŃSKI, Jerzy, PANZACCHI, Pietro, TOGNETTI, Roberto. Pan-European sustainable forest management indicators for assessing climate-smart forestry in Europe. *Canadian journal of forest research*. 2021, vol. 51, iss. 12, str. 1741-1750. ISSN 0045-5067, DOI: 10.1139/cjfr-2020-0166. [COBISS.SI-ID 36862979]
5. KAŠANIN-GRUBIN, Milica, HUKIĆ, Emira, BELLAN, Michal, BIALEK, Kamil, BOŠELA, Michal, COLL, Lluís, CZACHAROWSKI, Marcin, GAJICA, Gordana, GIAMMARCHI, Francesco, GÖMÖRYOVÁ, Erika, DEL RIO, Miren, DINČA, Lucian, ĐOGO MRAČEVIĆ, Svetlana, **KLOPČIČ, Matija**, MITROVIĆ, Suzana, PACH, Maciej, RANDJELOVIĆ, Dragana, RUIZ-PEINADO, Ricardo, SKRZYSZEWSKI, Jerzy, ORLIĆ, Jovana, ŠTRBAC, Snežana, STOJADINOVIĆ, Sanja, TONON, Giustino, TOSTI, Tomislav, UHL, Enno, VESELINOVIĆ, Gorica D., VESELINOVIĆ, Milorad, ZLATANOV, Tzvetan, TOGNETTI, Roberto. Soil erodibility in European mountain beech forests. *Canadian journal of forest research*. 2021, vol. 51, iss. 12, str. 1846-185 ISSN 0045-5067. DOI: 10.1139/cjfr-2020-0361. [COBISS.SI-ID 86156291]
6. IRAUSCHEK, Florian, BARKA, Ivan, BUGMANN, Harald, COURBAUD, Benoit, ELKIN, Che, HLÁSNY, Tomáš, **KLOPČIČ, Matija**, MINA, Marco, RAMMERT, Werner, LEXER, Manfred J. Evaluating five forest models using multi-decadal inventory data from mountain forests. *Ecological*

modelling. [Print ed.]. 2021, vol. 445, article 109493, 11 str. ISSN 0304-3800, DOI: 10.1016/j.ecolmodel.2021.109493. [COBISS.SI-ID 85939203]

7. PRETZSCH, Hans, HILMERS, Torben, UHL, Enno, BIELAK, Kamil, BOŠELA, Michal, DEL RIO, Miren, DOBOR, Laura, FORRESTER, David I., NAGEL, Thomas Andrew, PACH, Maciej, AVDAGIĆ, Admir, BELLAN, Michal, BINDER, Franz, BONČINA, Andrej, BRAVO, Felipe, DE-DIOS-GARCÍA, Javier, DINCA, Lucian, DROZDOWSKI, Stanislaw, GIAMMARCHI, Francesco, HOEHN, Maria, IBRAHIMSPAHIĆ, Aida, JAWORSKI, Andrzej, **KLOPČIČ, Matija**, KURYLYAK, Viktor, LÉVESQUE, Mathieu, LOMBARDI, Fabio, MATOVIĆ, Bratislav, ORDÓÑEZ, Cristóbal, PETRÁŠ, Rudolf, RUBIO-CUADRADO, Alvaro, STOJANOVIĆ, Dejan, SKRZYSZEWSKI, Jerzy, STAJIĆ, Branko, SVOBODA, Miroslav, VERSACE, Soraya, ZLATANOV, Tzvetan, TOGNETTI, Roberto. European beech stem diameter grows better in mixed than in mono-specific stands at the edge of its distribution in mountain forests. *European journal of forest research* (Internet). 2021, vol. 140, iss. 1, str. 127-145. ISSN 1612-4677, DOI: 10.1007/s10342-020-01319-y. [COBISS.SI-ID 2998659]
8. DEL RIO, Miren, VERGARECHEAA, Marta, HILMERS, Torben, ALDAYE, Josu G, AVDAGIĆ, Admir, BINDERHH, Franz, BOŠELA, Michal, DOBOR, Laura, FORRESTER, David I., HALILOVIĆ, Velid, IBRAHIMSPAHIĆ, Aida, **KLOPČIČ, Matija**, LÉVESQUE, Mathieu, NAGEL, Thomas Andrew, SITKOVA, Zuzana, SCHÜTZE, Gerhard, STAJIĆ, Branko, STOJANOVIĆ, Dejan, UHL, Enno, ZLATANOV, Tzvetan, TOGNETTI, Roberto, PRETZSCH, Hans. Effects of elevation-dependent climate warming on intra- and inter-specific growth synchrony in mixed mountain forests. *Forest Ecology and Management*. [Online ed.]. 2021, vol. 479, article 118587, 10 str. ISSN 1872-7042, DOI: 10.1016/j.foreco.2020.118587. [COBISS.SI-ID 32976387]
9. **KLOPČIČ, Matija**. Preverjanje uporabnosti modela SiWaWa za simuliranje razvoja čistih bukovih in smrekovih enomernih sestojev v Sloveniji. *Gozdarski vestnik: slovenska strokovna revija za gozdarstvo*. [Tiskana izd.]. 2021, letn. 79, št. 1, str. 3-20, ilustr. ISSN 0017-2723. [COBISS.SI-ID 54039299]
10. **KLOPČIČ, Matija**, POLJANEC, Aleš, DOLINAR, Mojca, KASTELEC, Damijana, BONČINA, Andrej. Ice-storm damage to trees in mixed Central European forests : damage patterns, predictors and susceptibility of tree species. *Forestry*. Jan. 2020, vol. 93, iss. 3, str. 430-443. ISSN 0015-752X, DOI: 1093/forestry/cpz068. [COBISS.SI-ID 5637286]
11. JEVŠENAK, Jernej, **KLOPČIČ, Matija**, MALI, Boštjan. The effect of harvesting on national forest carbon sinks up to 2050 simulated by the CBM-CFS3 model : a case study from Slovenia. *Forests*. [Online ed.]. 2020, iss. 10, article 1090, 16 str. ISSN 1999-4907, DOI: 10.3390/f11101090. [COBISS.SI-ID 32930819]
12. HILMERS, Torben, AVDAGIĆ, Admir, BARTKOWICZ, Leszek, BIELAK, Kamil, BINDER, Franz, BONČINA, Andrej, DOBOR, Laura, FORRESTER, David I., HOBI, Martina, IBRAHIMSPAHIĆ, Aida, **KLOPČIČ, Matija**, NAGEL, Thomas Andrew, et al. The productivity of mixed mountain forests comprised of *Fagus sylvatica*, *Picea abies*, and *Abies alba* across Europe. *Forestry*. 2019, vol. 92, iss. 5, str. 512-522. ISSN 0015-752X. DOI: 10.1093/forestry/cpz035. [COBISS.SI-ID 5412006]

DENDROLOGIJA IN GOZDNI GENSKI VIRI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Dendrologija in gozdni genski viri
Course title:	Dendrology and forest genetic resources
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037336
Koda učne enote na članici/UL Member course code:	3839

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	30	0	0	0	85	5

Nosilec predmeta/Lecturer: Robert Brus

Izvajalci predavanj: Robert Brus
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Zahtevani so splošni pogoji za vpis na doktorski študij.

Prerequisites:

General prerequisites for the enrollment in the doctoral study are required.

Vsebina:

Paleobotanika, paleoekologija, filogenija in biogeografija pomembnejših drevesnih družin, rodov in vrst, genetski vidiki evolucije, evolucijski procesi v naravnih populacijah gozdnih drevesnih vrst in speciacija, zgodovinski razvoj gozdov v svetu in Sloveniji. Ledenodobna zatočišča in poledenodobni razvoj glavnih drevesnih vrst. Raziskave populacij gozdnega drevja: naravna variabilnost in

Content (Syllabus outline):

Paleobotany, paleoecology, phylogeny and biogeography of important tree families, genera and species, genetic aspects of the evolution, evolutionary processes in natural populations of forest tree species and speciation, historical development of forests in the world and in Slovenia. Gglacial refugia and postglacial spread of main tree species. Research of the populations of forest tree species: natural

<p>prilagoditveni potencial izbranih drevesnih vrst, njen pomen in dejavniki, ki ju ogrožajo, novosti iz sistematike.</p> <p>Pomen gozdnih genskih virov in njihovega ohranjanja. Vpliv gospodarjenja z gozdom na genetsko strukturo populacij gozdnega drevja, pomen ohranjanja genetske variabilnosti kot pomembnega prilagoditvenega potenciala naravnih populacij gozdnega drevja. Oblikovanje sodobnih žlahtniteljskih programov za izbrane gozdne drevesne vrste. Biotehnologija v gozdarstvu, njeni možni vplivi na okolje in njihovo vrednotenje. Zunajgozdni nasadi drevesnih vrst, problematika vnašanja tujih drevesnih vrst. Invazivne drevesne vrste, njihov vpliv na stabilnost ekosistemov in možnosti njihovega obvladovanja.</p>	<p>variation and adaptive potential of selected tree species, their importance and threatening factors, new findings in taxonomy.</p> <p>The importance of forest genetic resources and their conservation. The impact of forest management on the genetic structure of populations of forest tree species, the importance of the conservation of genetic variation as important factor of the adaptive potential of the natural populations of forest trees. The design of contemporary forest tree breeding programmes. Biotechnology in forestry, its potential environmental impacts and their evaluation.</p> <p>Plantations of forest tree species outside forest, problems of the introduction of non-nativ tree species. Invasive tree species, their impact on the ecosystem stability and the measures for their management.</p>
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Temeljna literatura in viri/Readings:

<p>- Eriksson G., Ekberg I., Clapham D. 2013. Genetics applied to forestry: an introduction. 3rd ed. Uppsala, Department of Plant Biology and Forest Genetics, Swedish university of agricultural sciences. https://res.slu.se/id/publ/66881</p> <p>- Geburek, T., Turok, J. (eds.), 2005. Conservation and Management of Forest Genetic Resources in Europe. Arbora Publishers, 700 s. https://plus.cobiss.net/cobiss/si/sl/bib/3105446</p> <p>- Roloff, A., et al, 1996-2014. Enzyklopädie der Holzgewächse: Handbuch und Atlas der Dendrologie. Wiley. https://plus.cobiss.net/cobiss/si/sl/bib/2200230</p> <p>- tekoča znanstvena periodika</p>
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Cilji in kompetence:

<p>Izobraževalni cilji so nadgraditi temeljna znanja na področju dendrologije, gozdne genetike in ohranjanja gozdnih genskih virov, prav tako pa poglobiti razumevanje temeljnih mehanizmov in procesov pri gospodarjenju z gozdnimi ekosistemi.</p> <p>Kompetence, ki jih pridobi kandidat, obsegajo poglobljeno znanje s področja in obvladovanje raziskovalnih metod. Pridobljeno poglobljeno temeljno znanje je sposoben povezovati in nadgrajevati z drugimi raziskovalnimi področji.</p>	<p>Objectives and competences:</p> <p>Educational objectives include the upgrade of basic knowledge from the dendrology, forest genetics and conservation of forest genetic resources as well as the improvement of understanding of basic mechanisms and processes in the forest management.</p> <p>Candidates' competences include deepened knowledge from the area and the mastering of research methods. He is capable to upgrade the acquired basic knowledge and to link it with other research areas.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje: slušatelj se usposobi za samostojno raziskovalno delo na obravnavanem področju. Osvoji obvladovanje sodobnih raziskovalnih metod in izvajanja aplikativnih in temeljnih raziskav. Pridobi tudi spretnosti akademskega nastopanja in argumentiranja svojih stališč, prav tako je sposoben razumevanja načinov in pomena povezovanja raziskovalnega, razvojnega in pedagoškega dela.</p>	<p>Intended learning outcomes:</p> <p>Knowledge and understanding: the candidate acquires the qualification for independent research work in the research area. He masters the contemporary research methods and the conduction of applicative and basic research. He acquires the skills of academic presentations and the argumentation of his position. He also understands the techniques and the importance of linking of research, developmental and pedagogical work.</p>
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Metode poučevanja in učenja:

<p>Izbrana poglavja določenih vsebin (predavanja ali konzultacije), voden seminar, izdelava seminarskega dela in njegov zagovor, sodelovanje pri raziskovalnem delu nosilca.</p>	<p>Learning and teaching methods:</p> <p>Selected chapters of certain contents (lectures or consultations), guided seminary, elaboration of seminary work and its defence, participation in the research work of a lecturer.</p>
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Načini ocenjevanja:	Delež/Weight	Assessment:
Ocena izpita je sestavljena iz: - seminarja in njegovega zagovora	50,00 %	Exam grade consists of: - seminar and its defence
- ustnega izpita.	50,00 %	- oral exam.

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Robert Brus

1. KIŠEK, Mateja, JARNI, Kristjan, BRUS, Robert. Hybridisation of *Malus sylvestris* (L.) Mill. with *Malus x domestica* Borkh. and implications for the production of forest reproductive material. *Forests*. [Online ed.]. 2021, iss. 3, article 367, 17 str.
2. GÖMÖRY, Dušan, ZHELEV, Petr, BRUS, Robert. The Balkans : a genetic hotspot but not a universal colonization source for trees. *Plant systematics and evolution*. 2020, vol. 306, iss 1, 9 str.
3. BRUS, Robert, PÖTZELSBERGER, Elisabeth, LAPIN, Katharina, BRUNDU, Giuseppe, ORAZIO, Christophe, STRAIGYTE, Lina, HASENAUER, Hubert. Extent, distribution and origin of non-native forest tree species in Europe. *Scandinavian journal of forest research*. 2019, vol. 34, iss. 7, str. 533-544.
4. HUMAR, Miha, VEK, Viljem, OVEN, Primož, LESAR, Boštjan, KERŽIČ, Eli, HOČEVAR, Miha, BRUS, Robert. Durability and moisture dynamics of Douglas-fir wood from Slovenia. *Frontiers in plant science*. 2022, vol. 13, art. no. 860734, 15 str.
5. KRAJNC, Luka, GRIČAR, Jožica, JEVŠENAK, Jernej, HAFNER, Polona, BRUS, Robert. Tree rings, wood density and climate–growth relationships of four Douglas-fir provenances in sub-Mediterranean Slovenia. *Trees*. 2022, vol. <v tisku>, 17 str.
6. SMOLNIKAR, Peter, BRUS, Robert, JARNI, Kristjan. Differences in growth and log quality of Douglas-Fir (*Pseudotsuga menziesii* (Mirb.) Franco) provenances. *Forests*. [Online ed.]. 2021, iss. 3, article 287, 12 str.

DETERMINACIJA RASTLINSKIH ŠKODLJIVCEV IN BOLEZNI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Determinacija rastlinskih škodljivcev in bolezni
Course title:	Determination of plant pests and diseases
Članica nosilka/UL Member:	UL BF

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037243
Koda učne enote na članici/UL Member course code:	3745

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	0	0	10	80	5

Nosilec predmeta/Lecturer: Stanislav Trdan

Izvajalci predavanj: Maja Ravnikar, Stanislav Trdan
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: izbirni/elective

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina: Detekcijske metode škodljivih organizmov. Diagnostične metode za določevanje vrstne pripadnosti fitopatogenih organizmov: tradicionalne tehnike (simptomatika, morfološko anatomske, selektivni mediji); biokemične tehnike (substratni metabolizem, profil maščobnih kislin, analiza proteinov, analiza nukleinskih kislin) tehnike, molekulska detekcija. Praktični prikaz izolacije in determinacije fitopatogenih gliv in virusov (različne)	Content (Syllabus outline): Methods of detecting harmful organisms. Diagnostic methods for determining species affiliation of phytopathogenic organisms: traditional techniques (symptomatic, morphological anatomic, selective media); biochemical techniques (substrate metabolism, profiles of fatty acids, protein analysis, analysis of nucleonic acids) techniques, molecular detection. Practical demonstration of isolation and determination of phytopathogenic fungus and viruses
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<p>tehnike) iz posameznih rastlinskih delov in substratov. Kochovi postulati v fitopatologiji – potrjevanje povzročitelja bolezni. Načini vzorčenja in hranjenja škodljivih organizmov (s poudarkom na žuželkah in ogorčicah) in mikrobov pred determinacijo (maceracija, dehidracija, koncentracija, RNA/DNA ekstrakcija...) in po njej (priprava preparatov...). Uporaba morfoloških determinacijskih ključev izbranih skupin škodljivih žuželk in fitoparazitskih ogorčic: opisni, opisno-slikovni, slikovni morfološki ključi. Telesni deli škodljivih organizmov (glav, oprsje, zadek idr.), pomembni za morfološko determinacijo. Genetski identifikacijski ključi škodljivih organizmov. Pravilna izbira posameznih diagnostičnih tehnik: prednosti in slabosti. Pomen detekcije in determinacije v preprečevanju širjenja karantenskih škodljivih organizmov.</p>	<p>(various techniques) from individual plant parts and substrates. Koch's postulates in phytopathology – confirming the causative agents of illness. Methods of sampling and storing harmful organisms (with a stress on insects and nematodes) and microbes prior to determination (maceration, dehydration, concentration, RNA/DNA extraction etc.) and after (preparing preparation). Using morphological identification keys of selected groups of harmful insects and phytoparasitic nematodes: descriptive, descriptive-pictorial, pictorial morphological keys. Body parts of harmful organisms (heads, chests, abdomen etc.) important for morphological identification. Genetic identification keys of harmful organisms. Correct choice of individual diagnostic techniques: advantages and weaknesses. Importance of detection and determination in preventing the spread of quarantine pests.</p>
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Temeljna literatura in viri/Readings:

Resh, V.H., Cardé, R.T. 2003. Encyclopedia of Insects. Academic Press, Amsterdam et al., 1266 str., ISBN 0-12-586990-8. <https://plus.cobiss.net/cobiss/si/sl/bib/ul/16180953>

Dodatna literatura / Supplementary literature sources:

Arnett, R.H. 1999. American insects: a handbook of the insects of America north of Mexico. The Sandhill Crane Press, Gainesville: 850 str., ISBN 1-877743-19-4.

Fox, R.T.V. 1993. Principles of diagnostic techniques in plant pathology. CAB International, Wallingford, 213 str., ISBN 0-85198-740-0.

Mound, L., Kibby, G. 1998. Thysanoptera: an identification guide. 2nd Edition. CAB International, Wallingford: 70 str., ISBN 0 85198 634 X.

Paterson, R.R.M., Bridge, P.D. 1994. Biochemical techniques for filamentous fungi. CAB International, Wallingford, 125 str., ISBN 0-85198-899-7.

in

revijalni članki s področja, tekoča periodika, druga učna gradiva...

Cilji in kompetence:

Temeljni izobraževalni cilj je poglobitev znanja za samostojno delo na področju detekcije in morfološke ter molekulske determinacije izbranih skupin škodljivih žuželk, ogorčic, fitopatogenih gliv, virusov, bakterij in fitoplazem.

Objectives and competences:

The basic educational aim is to deepen knowledge for independent work in the field of detection and morphological and molecular determination of selected groups of harmful insects, nematodes, phylogenetic fungi, viruses, bacteria and phytoplasmas.

Predvideni študijski rezultati:

Predviden študijski rezultat je kandidata usposobiti za detekcijo in determinacijo izbrane skupine ali skupin škodljivih organizmov, z namenom uporabe omenjenih znanj v raziskovalnem ali aplikativnem delu.

Intended learning outcomes:

The intended learning outcome is to train the candidate in the detection and determination of a selected group or groups of harmful organisms, with the intention of using this knowledge in research or applied work.

Metode poučevanja in učenja:

Predavanja, seminarji, konzultacije, samostojno delo.

Learning and teaching methods:

Lectures, seminars, consultations, individual work.

Načini ocenjevanja:

pisni izpit Pogoja za opravljanje študijskih obveznosti – pisnega izpita je zagovor

Delež/Weight

70,00 %

Assessment:

- written exam Conditions for performing study obligations - written exam

seminarja Pogoja za opravljanje študijskih obveznosti – pisnega izpita: - zagovor seminarja		is seminar performed Conditions for performing study obligations - written exam is seminar performed
samostojno delo študenta	30,00 %	individual work of the student

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:
TRDAN STANISLAV

ADLER, Cornel, ATHANASSIOU, Christos G., CARVALHO, Maria Otilia, EMEKCI, Mevlüt, GVOZDENAC, Sonja, HAMEL, Darka, RIUDAVETS, Jordi, STEJSKAL, Vaclav, **TRDAN, Stanislav**, TREMATERRA, Pasquale. Changes in the distribution and pest risk of stored product insects in Europe due to global warming : Need for pan-European pest monitoring and improved food-safety. *Journal of Stored Products Research*. [Print ed.]. 2022, vol. 97, art. 101977, 9 str. ISSN 0022-474X. DOI: [10.1016/j.jspr.2022.101977](https://doi.org/10.1016/j.jspr.2022.101977). [COBISS.SI-ID [108815875](#)].

ROT, Mojca, MAISTRELLO, Lara, COSTI, Elena, BERNARDINELLI, Iris, MALOSSINI, Giorgio, BENVENUTO, Luca, **TRDAN, Stanislav**. Native and non-native egg parasitoids associated with brown marmorated stink bug (*Halyomorpha halys* [Stål, 1855]; Hemiptera: Pentatomidae) in Western Slovenia. *Insects*. 2021, vol. 12, no. 6, str. 1-15, art. 505. ISSN 2075-4450. <https://www.mdpi.com/2075-4450/12/6/505>, DOI: [10.3390/insects12060505](https://doi.org/10.3390/insects12060505). [COBISS.SI-ID [65283843](#)].

KREITER, Serge, AMIRI, Karima, DOUIN, Martial, BOHINC, Tanja, **TRDAN, Stanislav**, TIXIER, Marie-Stephane. Phytoseiid mites of Slovenia (Acari: Mesostigmata) : new records and first description of the male of *Amblyseius microorientalis*. *Acarologia*. 2020, vol. 60, iss. 2, str. 203-242. ISSN 0044-586X. DOI: [10.24349/acarologia/20204364](https://doi.org/10.24349/acarologia/20204364). [COBISS.SI-ID [9437049](#)].

TRDAN, Stanislav, LAZNIK, Žiga, BOHINC, Tanja. Thirty years of research and professional work in the field of biological control (predators, parasitoids, entomopathogenic and parasitic nematodes) in Slovenia : A review. *Applied sciences*. 2020, vol. 10, iss. 21, art. 7468, str. 1-12, ilustr. ISSN 2076-3417. <https://doi.org/10.3390/app10217468>, DOI: [10.3390/app10217468](https://doi.org/10.3390/app10217468). [COBISS.SI-ID [34173955](#)].

TRDAN, Stanislav, ČUK, Jana, POŽENEL, Anka, BAVCON KRALJ, Mojca, ROT, Mojca, CARLEVARIS, Branko, ŽEŽLINA, Ivan, VIDRIH, Matej, LAZNIK, Žiga, BOHINC, Tanja. Field testing of different synthetic attractants for mass trapping of common European cockchafer (*Melolontha melolontha* [L.], Coleoptera, Scarabaeidae) adults. *Acta agriculturae Scandinavica. Section B, Soil and plant science*. 2019, vol. 69, no. 2, str. 174-180. ISSN 0906-4710. DOI: [10.1080/09064710.2018.1524020](https://doi.org/10.1080/09064710.2018.1524020). [COBISS.SI-ID [9047673](#)].

BOHINC, Tanja, VUČAJNK, Filip, **TRDAN, Stanislav**. The efficacy of environmentally acceptable products for the control of major potato pests and diseases. *Žemdirbyste : Mokslo žurnalas*. 2019, vol. 106, no. 2, str. 135-142. ISSN 1392-3196. [COBISS.SI-ID [9211257](#)].

RAVNIKAR MAJA

PECMAN, Anja, ADAMS, Ian, GUTIÉRREZ-AGUIRRE, Ion, FOX, Adrian, BOONHAM, Neil, **RAVNIKAR, Maja**, KUTNJAK, Denis. Systematic comparison of nanopore and illumina sequencing for the detection of plant viruses and viroids using total RNA sequencing approach. *Frontiers in microbiology*. 2022, vol. 13, str. 1-14, ilustr. ISSN 1664-302X.

<https://www.frontiersin.org/articles/10.3389/fmicb.2022.883921/full>, DOI: [10.3389/fmicb.2022.883921](https://doi.org/10.3389/fmicb.2022.883921)
ZAJC, Janja, KOGEJ ZWITTER, Zala, FIŠER, Sara, GOSTINČAR, Cene, VICENT, Antonio, GALVAŃ DOMENECH, Anaïs, RICCIONI, Luca, BOONHAM, Neil, **RAVNIKAR, Maja**, KOGOVSŠEK, Polona.

Highly specific qPCR and amplicon sequencing method for detection of quarantine citrus pathogen *Phyllosticta citricarpa* applicable for air samples. *Plant pathology*. 2022, str. 1-16, [in press], ilustr. ISSN 1365-3059. <https://doi.org/10.1111/ppa.13679>, DOI: [10.1111/ppa.13679](https://doi.org/10.1111/ppa.13679)

VUČUROVIĆ, Ana, KUTNJAK, Denis, MEHLE, Nataša, STANKOVIĆ, Ivana, PECMAN, Anja, BULAJIĆ, Aleksandra, KRSTIĆ, Branka, **RAVNIKAR, Maja**. Detection of four new tomato viruses in Serbia using post hoc high-throughput sequencing analysis of samples from a large-scale field survey. *Plant disease*. Sept. 2021, vol. 105, no. 9, str. 2325-2332, ilustr. ISSN 0191-2917.

<https://apsjournals.apsnet.org/doi/10.1094/PDIS-09-20-1915-RE>

BAČNIK, Katarina, KUTNJAK, Denis, PECMAN, Anja, MEHLE, Nataša, TUŠEK-ŽNIDARIČ, Magda, GUTIÉRREZ-AGUIRRE, Ion, **RAVNIKAR, Maja**. Viromics and infectivity analysis reveal the release of

infective plant viruses from wastewater into the environment. *Water research*. 2020, vol. 177, str. 1-11. ISSN 0043-1354. DOI: 10.1016/j.watres.2020.115628

PECMAN, Anja, KUTNJAK, Denis, MEHLE, Nataša, TUŠEK-ŽNIDARIČ, Magda, GUTIÉRREZ-AGUIRRE, Ion, PIRNAT, Patricija, ADAMS, Ian, BOONHAM, Neil, **RAVNIKAR, Maja**. High-throughput sequencing facilitates characterisation of a "forgotten" plant virus : the case of a henbane mosaic virus infecting tomato. *Frontiers in microbiology*. 2018, vol. 9, str. 1-11. ISSN 1664-302X.

<https://www.frontiersin.org/articles/10.3389/fmicb.2018.02739/abstract>, DOI: 10.3389/fmicb.2018.02739

ALIĆ, Špela, GIJSEGEM, F. van, PÉDRON, Jacques, **RAVNIKAR, Maja**, DREO, Tanja. Diversity within the novel *Dickeya fangzhongdai* sp., isolated from infected orchids, water and pears. *Plant Pathology*. 2018, vol. 67, iss. 7, str. 1612-1620. ISSN 0032-0862. DOI: 10.1111/ppa.12866

DIGITALIZACIJA IN MANAGEMENT POSLOVNIH PROCESOV V BIOTEHNIKI

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Digitalizacija in management poslovnih procesov v biotehnik
Course title:	Digitalization and Management of Business Processes in Biosciences
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code: 0640310

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	25	0	0	0	90	5

Nosilec predmeta/Lecturer: Jože Kropivšek

Izvajalci predavanj: Jože Kropivšek
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični/theoretical

Jeziki/Languages: Predavanja/Lectures: Angleščina, Slovenščina
Vaje/Tutorial: Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij

Prerequisites:

General requirements for admission to doctoral programme.

Vsebina:

- Digitalni poslovni modeli v biotehnik
 - Zasnova in razvoj digitalnih poslovnih modelov
 - Sestavine in razvoj strategij digitalizacije
- Management poslovnih procesov v biotehnik
 - Strateški in operativni management poslovnih procesov, vključno z

Content (Syllabus outline):

- Digital business models in Biosciences
- Design and development of digital business models
- Components and development of digitization strategies
- Business process management in Biosciences
- Strategic and operational management of business processes, including modeling and

<p>modeliranjem in optimizacijo (z upoštevanjem možnosti digitalizacije)</p> <ul style="list-style-type: none"> • Izzivi sodobnega managementa podjetij vključujoč sodobna orodja finančne analize • Digitalizacija poslovnih procesov v biotehnikih <ul style="list-style-type: none"> • Koncept Industrija 4.0 in njegova implementacija v podjetjih v biotehnikih • Model digitalnih kompetenc ključnih kadrov in managerskih digitalnih kompetenc <p>Motiviranje zaposlenih v digitalni dobi</p>	<p>optimization (taking into account the possibilities of digitalization)</p> <ul style="list-style-type: none"> • Challenges of modern business management including modern financial analysis tools • Digitalization of business processes in Biosciences • The Industry 4.0 concept and its implementation in Biosciences • Model of digital competencies of key personnel and managerial digital competencies <p>Motivating employees in the digital age</p>
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Temeljna literatura in viri/Readings:

<ul style="list-style-type: none"> • Daft, R. L., Martyn K., Vershinina, N. (2010): Management. Andover : South-Western/Cengage Learning, cop. • Možina, S. et al (2002): Management : nova znanja za uspeh. Radovljica: Didakta. • Rozman, R., Kovač, J. (2012): Management. GV Založba, Ljubljana. • Kovačič, A.; Bosilj V. V. (2005): Management poslovnih procesov – prenova in informatizacija poslovanja s praktičnimi primeri. GV Založba, Ljubljana. • Laudon, K.C. / Laudon, J.P. (2000): Management Information Systems: organization and technology in the networked enterprise. 6th edition. London [etc.] : Prentice Hall International ; Upper Saddle River (New Jersey) [etc.] : Prentice Hall. • Spletni viri / <i>Online resources</i> <p>Najnovejši članki objavljeni v vrhunskih znanstvenih revijah s področja digitalizacije, poslovne informatike in managementa / <i>The latest articles published in top scientific journals in the field of digitalization, business informatics and management</i></p>
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Cilji in kompetence:

<p>Cilji: Študent bo spoznal sodobne digitalne poslovne modele in ključne izzive sodobnega managementa poslovnih procesov v biotehnikih vključujoč digitalne tehnologije in z njimi povezane digitalne kompetence ključnih kadrov.</p> <p>Kompetence: Študent bo usposobljen za konceptualni pogled na delovanje podjetja s poudarkom na razvoju digitalnih poslovnih modelov. Poznal bo koncepte, modele in orodja managementa poslovnih procesov z upoštevanjem možnosti njihove digitalizacije. Znal bo izvesti empirične raziskave in razvijati strategije na teh področjih.</p>
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Objectives and competences:

<p>Objectives: Students will get acquainted with the modern digital business models and key challenges of modern business process management in biosciences, including digital technologies and related digital competencies of key personnel.</p> <p>Competencies: Students will be trained for a conceptual view of the company's operations with an emphasis on the development of digital business models. They will know the concepts, models and tools of business process management, taking into account the possibilities of their digitalization. He will be able to conduct empirical research and develop strategies in these areas.</p>
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Predvideni študijski rezultati:

<p>Znanje in razumevanje: Študent bo razumel in znal celovito obravnavati vsebine in probleme na področju managementa in digitalizacije poslovanja.</p>

Intended learning outcomes:

<p>Knowledge and understanding: The student will understand and be able to adopt holistic view of issues in the field of management and digitalization of business processes</p>
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Metode poučevanja in učenja:

<p>Predavanja Seminar</p>

Learning and teaching methods:

<p>Lectures Seminar</p>

Načini ocenjevanja:

Delež/Weight Assessment:

Pisni/ustni izpit	50,00 %	Written/Oral exam
Seminar	50,00 %	Term paper

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

1. KROPIVŠEK, Jože, GROŠELJ, Petra. Digital development of Slovenian wood industry. *Drvena industrija*. 2020, vol. 71, iss. 2, str. 139-148, ilustr. ISSN 0012-6772. DOI: [10.5552/drvind.2020.1961](https://doi.org/10.5552/drvind.2020.1961). [COBISS.SI-ID [19731203](#)], [JCR, SNIP, WoS, Scopus]
2. PERIĆ, Ivana, GROŠELJ, Petra, SUJOVÁ, Andrea, KALEM, Miljan S., GREGER, Krešimir, KROPIVŠEK, Jože. Analysis of implementation of integrated information systems in Croatian wood processing industry. *Drvena industrija*. 2019, vol. 70, no. 2, str. 129-139. ISSN 0012-6772. https://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=323416. [COBISS.SI-ID [3081609](#)], [JCR, SNIP, WoS do 15. 12. 2019: št. citatov (TC): 1, čistih citatov (CI): 0, Scopus do 3. 12. 2019: št. citatov (TC): 1, čistih citatov (CI): 0]
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DINAMIČNOST CELIČNE ARHITEKTURE

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Dinamičnost celične arhitekture
Course title:	Dynamics of cell architecture
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0037354
Koda učne enote na članici/UL Member course code:	3857

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
20	30	20	0	55	125	10

Nosilec predmeta/Lecturer:

Izvajalci predavanj:

Izvajalci seminarjev:

Izvajalci vaj:

Izvajalci kliničnih vaj:

Izvajalci drugih oblik:

Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type:

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

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

Splošni pogoji za vpis na doktorski študij, zaključen študijski program s področja bioloških, biomedicinskih, biokemijskih, biotehniških smeri ali s širšega področja naravoslovno matematičnih smeri.

Prerequisites:

General prerequisites for enrolment in doctoral studies, completed studies in the biological, biomedical, biochemical, biotechnical or natural sciences - mathematics study programmes.

Vsebina:

1. Organizacija celic, morfogeneza in funkcija tkiv; posebnosti v zgradbi in delovanju evkariontskih celic; interpretacija celične ultrastrukture v povezavi s funkcijo; kopičenje in dinamika rezervnih snovi in

Content (Syllabus outline):

1. Cellular organization, morphogenesis and tissue function; structural and functional characteristics of eukaryotic cell; interpretation of cell ultrastructure and function; accumulation and dynamics of reserve substances and metals;

<p>kovin; sekrecija hitinskih struktur in mehanizmi biomineralizacije v nevretenčarskih epitelijih; interakcije med bakterijami in evkariontskimi celicami; koevolucija mikroorganizmov in gostitelja</p> <p>2. Celično-molekulski procesi in mehanizmi spreminjanja celične zgradbe ter funkcije med delitvijo, diferenciacijo in celično smrtjo. Poudarek na prerazporeditvi endomembranskega sistema, citoskeleta in medceličnih povezav med fiziološko obnovo tkiv.</p>	<p>secretion of chitinous matrices and mechanisms of biomineralization in invertebrate epithelial tissues; interactions of bacteria and eucaryotic cells; coevolution of microorganisms and their hosts</p> <p>2. Cell and molecular processes and mechanisms of altered cellular structure and function during cell division, differentiation and cell death. Focus on reorganization of endomembranes, cytoskeleton and intercellular junctions during tissue regeneration.</p>
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Temeljna literatura in viri/Readings:

<p>Pavelka Margit, Roth Jürgen 2005. Functional Ultrastructure An Atlas of Tissue Biology and Pathology Springer Verlag, Wien, ISBN 3-211-83564-4</p> <p>Paracer S., Ahmadijan V.: Symbiosis: An introduction to biological associations. 291 pages. Oxford University Press (2000). ISBN 0195118073 – Poglavlje 1 (str. 3-13), poglavje 3 (str. 33-50), poglavje 4 (str. 51-62), poglavje 6 (str. 79-88)</p> <p>Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2008) Molecular biology of the cell, 5th edition.</p> <p>Karp, B. Cell and Molecular Biology, 5th Edition, (2008) ISBN-13 978-0-470-04217-5. Poglavlja 7,8,9, 15 in 18; strani 239-42,616-662, 727-774</p> <p>Tekoča znanstvena periodika, pregledni članki iz znanstvenih revij Nature, The Cell in specifičnih znanstvenih publikacij.</p>

Cilji in kompetence:

- pridobivanje specialnih znanj s področja zgradbe in delovanja celice;
- poznavanje in obvladovanje metod dela v celični biologiji;
- poznavanje odnosov med pro- in evkarionti
- zmožnost interpretacije celične funkcije v povezavi z višjimi organizacijskimi ravnmi
- razumevanje dinamike endomembran in procesov regeneracije
- poznavanje celičnih mehanizmov dinamike ionov kovin

Objectives and competences:

- special knowledge on cell function and structure
- understanding and mastering the methods in cell biology
- understanding the interactions between pro- and eucaryotes
- ability to interpret the cell function in relation with higher levels of organization
- understanding of endomembrane dynamics in cell regeneration
- understanding metal ions dynamics

Predvideni študijski rezultati:

- Znanje in razumevanje:
- zmožnost interpretacije celične ultrastrukture pro- in evkariontov
 - razumevanje dinamike endomembranskih sistemov in citoskeleta
 - poznavanje celičnih mehanizmov regeneracije
 - uporaba tehnik za analizo celične zgradbe in delovanja
 - zmožnost iskanja in citiranja sodobnih virov s področja biologije celice

Intended learning outcomes:

- Knowledge and understanding:
- interpretation of cell ultrastructure of pro- and eucaryotes
 - understanding of endomembrane and cytoskeleton dynamics
 - understanding cell mechanisms of regeneration
 - mastering techniques for analysis of cell structure and function
 - ability to follow and cite contemporary work in cell biology

Metode poučevanja in učenja:

- Teoretična znanja v obliki diskusij in predavanj s poudarkom na specifičnih vsebinah, praktično delo v laboratoriju, priprava bioloških preparatov za mikroskopiranje, analiziranje mikrografij,

Learning and teaching methods:

- Theoretical knowledge based on discussions and lectures focused to special topics in cell biology, laboratory work, preparation of biological

predstavitev seminarjev, razprave in projektno delo.	samples for microscopy, analysis of micrographs, seminars, consultations and project work
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Načini ocenjevanja:	Delež/Weight	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt): - izpit iz teoretičnih poglavij celične biologije	50,00 %	Type (examination, oral, coursework, project): - exam based on theoretical knowledge in cell biology
- seminar ali predstavitev dela na konferenci	40,00 %	- seminar or presentation at the conference
- laboratorijsko delo	10,00 %	- laboratory work

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Nada Žnidaršič

- ŠOLN, Katarina, **ŽNIDARŠIČ, Nada**, DOLENC KOCE, Jasna. Root growth inhibition and ultrastructural changes in radish root tips after treatment with aqueous extracts of *Fallopia japonica* and *F. xbohemica* rhizomes. *Protoplasma*, ISSN 0033-183X, 2021, str. 1-13, [in press], ilustr., doi: [10.1007/s00709-021-01668-4](https://doi.org/10.1007/s00709-021-01668-4). [COBISS.SI-ID 66701827]
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- **ŽNIDARŠIČ, Nada**, MRAK, Polona, RAJH, Eva, ŽAGAR, Kristina, ČEH, Miran, ŠTRUS, Jasna. Cuticle matrix imaging by histochemistry, fluorescence, and electron microscopy. *Resolution & discovery : new beacon for the microscopy community*, ISSN 2498-8707, 2018, vol. 3, iss. 1, str. 5-12, doi: [10.1556/2051.2018.00052](https://doi.org/10.1556/2051.2018.00052). [COBISS.SI-ID 4679503]
- BOGATAJ, Urban, PRAZNIK, Monika, MRAK, Polona, ŠTRUS, Jasna, TUŠEK-ŽNIDARIČ, Magda, **ŽNIDARŠIČ, Nada**. Comparative ultrastructure of cells and cuticle in the anterior chamber and papillate region of *Porcellio scaber* (Crustacea, Isopoda) hindgut. *ZooKeys*, ISSN 1313-2989, 2018, vol. 801, str. 427-458. <https://doi.org/10.3897/zookeys.801.22395>, doi: [10.3897/zookeys.801.22395](https://doi.org/10.3897/zookeys.801.22395). [COBISS.SI-ID 4911695]
- KISOVEC, Matic, ADEN, Saša, KNAP, Primož, CAJNKO, Miša Mojca, CASERMAN, Simon, FLAŠKER, Ajda, **ŽNIDARŠIČ, Nada**, REPIČ, Matej, MAVRI, Janez, RUAN, Yi, SCHEURING, Simon, PODOBNIK, Marjetka, ANDERLUH, Gregor. Engineering a pH responsive pore forming protein. *Scientific reports*, ISSN 2045-2322, Feb. 2017, vol. 7, str. 42231-1-42231-13. <http://www.nature.com/articles/srep42231.pdf>, doi: [10.1038/srep42231](https://doi.org/10.1038/srep42231). [COBISS.SI-ID 6088986]
- ŠTRUS, Jasna, **ŽNIDARŠIČ, Nada**, MRAK, Polona, BOGATAJ, Urban, VOGT, Günter. Structure, function and development of the digestive system in malacostracan crustaceans and adaptation to

different lifestyles. *Cell and tissue research*, ISSN 0302-766X, 2019, vol. 377, no. 3, str. 415-443, ilustr., doi: [10.1007/s00441-019-03056-0](https://doi.org/10.1007/s00441-019-03056-0). [COBISS.SI-ID [5117263](#)]

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- VITTORI, Miloš, ŽNIDARŠIČ, Nada, KOSTANJŠEK, Rok, ŠTRUS, Jasna. Microscopic anatomy of male tegumental glands and associated cuticular structures in *Titanethes albus* (Crustacea: Isopoda). *Arthropod structure & development*, ISSN 1467-8039, 2012, vol. 41, issue 2, str. 133-144. <http://dx.doi.org/10.1016/j.asd.2011.08.004>, doi: [10.1016/j.asd.2011.08.004](https://doi.org/10.1016/j.asd.2011.08.004). [COBISS.SI-ID [2468943](#)]
- VITTORI, Miloš, KOSTANJŠEK, Rok, ŽNIDARŠIČ, Nada, ŽAGAR, Kristina, ČEH, Miran, ŠTRUS, Jasna. Calcium bodies of *Titanethes albus* (Crustacea: Isopoda) : molt-related structural dynamics and calcified matrix-associated bacteria. *Journal of structural biology*, ISSN 1047-8477, 2012, vol. 180, issue 1, str. 216-225.
- PIPAN TKALEC, Živa, DROBNE, Damjana, VOGEL-MIKUŠ, Katarina, PONGRAC, Paula, REGVAR, Marjana, ŠTRUS, Jasna, PELICON, Primož, VAVPETIČ, Primož, GRLJ, Nataša, REMŠKAR, Maja. Micro-PIXE study of Ag in digestive glands of a nano-Ag fed arthropod (*Porcellio scaber*, Isopoda, Crustacea). V: *Proceedings of the 12th International Conference on Nuclear Microprobe Technology, July 26-30, 2010, Leipzig, Germany*, (Nuclear instruments and methods in physics research, ISSN 0168-583X, B, Beam interactions with materials and atoms, vol. 269, no. 20, 2011). Amsterdam: North-Holland, 2011, vol. 269, no. 20, str. 2286-2291, doi: [10.1016/j.nimb.2011.02.068](https://doi.org/10.1016/j.nimb.2011.02.068). [COBISS.SI-ID [24535591](#)]
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- MILATOVIČ, Maša, KOSTANJŠEK, Rok, ŠTRUS, Jasna. Ontogenetic development of *Porcellio scaber* : staging based on microscopic anatomy. *Journal of crustacean biology*, ISSN 0278-0372, 2010, vol. 30, no. 2, str. 225-234. [COBISS.SI-ID [2163535](#)]
- HILD, Sabine, NEUES, Frank, ŽNIDARŠIČ, Nada, ŠTRUS, Jasna, EPPLE, Matthias, MARTI, Othmar, ZIEGLER, Andreas. Ultrastructure and mineral distribution in the tergal cuticle of the terrestrial isopod *Titanethes albus*. Adaptations to a karst cave biotope. *Journal of structural biology*, ISSN 1047-8477, 2009, vol. 168, no. 3, str. 426-436. <http://dx.doi.org/10.1016/j.jsb.2009.07.017>, doi: [10.1016/j.jsb.2009.07.017](https://doi.org/10.1016/j.jsb.2009.07.017). [COBISS.SI-ID [2060367](#)]
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Mateja Erdani Krefc

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- normal and cancerous urothelial models. *Biomedicines*. [Online ed.]. 2021, vol. 9, iss. 2, str. 1-22, ilustr. ISSN 2227-9059. <https://www.mdpi.com/2227-9059/9/2/218>. [COBISS.SI-ID 52599811],
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Miloš Vittori

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Polona Mrak

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DINAMIKA MIKROBNIH GENOMOV

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Dinamika mikrobnih genomov
Course title:	Dynamics of microbial genomes
Članica nosilka/UL	UL BF
Member:	

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Bioznanosti, tretja stopnja, doktorski	Ni členitve (študijski program)		Celoletni	izbirni

Univerzitetna koda predmeta/University course code:	0566747
Koda učne enote na članici/UL Member course code:	0

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
10	20	0	0	0	95	5

Nosilec predmeta/Lecturer: Marjanca Starčič Erjavec

Izvajalci predavanj: Marjanca Starčič Erjavec, Darja Žgur Bertok
Izvajalci seminarjev:
Izvajalci vaj:
Izvajalci kliničnih vaj:
Izvajalci drugih oblik:
Izvajalci praktičnega usposabljanja:

Vrsta predmeta/Course type: teoretični /theoretical

Jeziki/Languages:	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General criteria for enrollment in PhD studies

Vsebina: Dinamika mikrobnih genomov z različnimi prerazporeditvami in horizontalnimi prenosi DNA ter evolucija novih patogenov. <ul style="list-style-type: none">• Mutageneza, rekombinacija in horizontalni prenosi DNA.• Struktura genomov, stalni in pogrešljivi deli genomov, pangenom.• Genomski otoki, otoki patogenosti, metagenomski otoki.	Content (Syllabus outline): Dynamics of microbial genomes including DNA rearrangements along with horizontal DNA transfer and evolution of novel pathogens. <ul style="list-style-type: none">• Mutagenesis, recombination and horizontal DNA transfer.• Genome structure, core and dispensible genome, panggenome.• Genomic islands, pathogenicity islands, metagenomic islands.
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<ul style="list-style-type: none"> • Mobilni genetski elementi in mehanizmi horizontalnih prenosov DNA (transpozoni, plazmidi, integrativni konjugativni elementi, virusi). • Obrambapredujo DNA. 	<ul style="list-style-type: none"> • Mobile genetic elements and mechanisms of in horizontal DNA transfer (transposons, plasmids integrative conjugative elements, viruses). • Defense mechanisms protecting against foreign DNA.
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Temeljna literatura in viri/Readings:

Raziskovalni in pregledni članki, ki so javno dostopni preko spleta/Research and review papers, available online on the Internet.

Cilji in kompetence:

Cilj predmeta je povezati razumevanje strukture genomov in genetskih elementov z mehanizmi, ki omogočajo dinamiko mikrobnega genoma ter dejavniki okolja, ki vplivajo na to dinamiko. Vsebine predmeta so nadgradnja celično-bioloških, biokemijskih in genetskih predmetov na 1. in 2. stopnji. Pridobljena znanja dajejo študentom osnovo za poglobljeno razumevanje dinamike mikrobnih genomov, potrebno za njegovo doktorsko disertacijo.

Objectives and competences:

The goal of the course is for students to understand the connection of the structure of genomes and genetic elements with the mechanism that conduct the dynamics of the microbial genomes and environmental factors that affect the dynamics of genomes.
The course content is an upgrading of first and second level courses dealing with cell biology, biochemistry and genetics. The obtained knowledge will provide the student an in depth understanding of the dynamics of microbial genomes that is required for his/her PhD thesis.

Predvideni študijski rezultati:

Znanje in razumevanje:
Študent bo pridobil znanje in razumevanje o strukturi genomov, genetskih elementih in mehanizmih horizontalnega genskega prenosa, njihovi uravnavi ter dejavnikih okolja, ki vplivajo na dinamiko mikrobnih genomov

Intended learning outcomes:

Knowledge and understanding:
Students will acquire the knowledge and understanding of genome structure, genetic elements and mechanism of horizontal gene transfer, the regulation and the environmental factors that shape the dynamics of microbial genomes.

Metode poučevanja in učenja:

Pouk je organiziran s predavanji, konzultacijami; seminarsko delo.

Learning and teaching methods:

Lectures, consultations, seminar.

Načini ocenjevanja:

	Delež/Weight	Assessment:
izpit	50,00 %	exam
seminar	50,00 %	seminar

Ocenjevalna lestvica:

5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10

Grading system:

5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:

Marjanca Starčič Erjavec

1. KUZNETSOVA, Marina V., MASLENNIKOVA, Irina L., POSPELOVA, Julia S., ŽGUR-BERTOK, Darja, **STARČIČ ERJAVEC, Marjanca**. Differences in recipient ability of uropathogenic *Escherichia coli* strains in relation with their pathogenic potential. *Infection, genetics and evolution : journal of molecular epidemiology and evolutionary genetics in infectious diseases*. Jan. 2022, vol. 97, article 105160, str. 1-8. ISSN 1567-1348. <https://www.sciencedirect.com/science/article/pii/S1567134821004603?via%3Dihub>, DOI: 10.1016/j.meegid.2021.105160. [COBISS.SI-ID [90850819](#)]

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Darja Žgur-Bertok

1. PREDOJEVIĆ, Luka, KEŠE, **Darja, ŽGUR-BERTOK**, Darja, KORVA, Miša, ERDANI-KREFT, Mateja, STARČIČ ERJAVEC, Marjanca. Cytokine response of the biomimetic porcine urothelial model to different *Escherichia coli* strains. *Applied sciences*. 2022, iss. 17, art. 8567, str. 1-11, ilustr. ISSN 2076-3417. <https://www.mdpi.com/2076-3417/12/17/8567>, DOI: [10.3390/app12178567](https://doi.org/10.3390/app12178567). [COBISS.SI-ID [119475715](#)]
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3. PREDOJEVIĆ, Luka, KEŠE, **Darja, ŽGUR-BERTOK**, Darja, ŽELEZNIK RAMUTA, Taja, VERANIČ, Peter, ERDANI-KREFT, Mateja, STARČIČ ERJAVEC, Marjanca. A biomimetic porcine urothelial model for assessing *Escherichia coli* pathogenicity. *Microorganisms*. 2022, vol. 10, iss. 4, str. 1-16, art. 783, ilustr. ISSN 2076-2607. <https://www.mdpi.com/2076-2607/10/4/783/htm>, DOI: [10.3390/microorganisms10040783](https://doi.org/10.3390/microorganisms10040783). [COBISS.SI-ID [104312323](#)]
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