UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	EVOLUCIJSKA IN POPULACIJSKA GENETIKA
Course title:	EVOLUTIONARY AND POPULATION GENETICS

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Varstvo okolja in ekotehnologije, 2. stopnja	/	2.	/
Environmental Protection and Eco-technologies, 2nd level	/	2nd	/

Vrsta predmeta / Course type Izbirni predmet / Optional course

Univerzitetna koda predmeta / University course code: EPG

Predavanja Lectures	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
20	10	10	/	80	4

Nosilec predmeta / Lecturer: prof. dr. Elena Bužan

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Znanje genetike	Basic in genetics

Vsebina:	**Content (Syllabus outline):**
Poglavitne teme: • Pojem molekularne evolucije • Nevtralna teorija • Evolucijske spremembe nukleotidnih zaporedij (modeli, genetske razdalje) • Molekularna ura • Molekularna filogenetika • Uvod v populacijsko genetiko • Genetska in fenotipska raznolikost (vzdrževanje genetske raznovrstnosti, frekvence alelov, frekvence genotipov, heterozigotnost) • Molekularne metode in vzorčenje v populacijski genetiki • Molekularni markerji: jedrni, kloroplastni, mitohondrijski • Evolucijski dejavniki in njihovi vplivi na genetsko strukturo populacij: naravna selekcija, parjenje, delitev populacij, migracije (naključno parjenje, parjenje v	**Main topics:** • The concept of molecular evolution • Neutral theory • Evolutionary changes in nucleotide sequences (models, genetic distance) • Molecular clock • Molecular phylogenetics • Introduction to population genetics • Genetic and phenotypic diversity (maintenance of genetic diversity, allele frequencies, genotype frequencies, heterozygosity) • Molecular methods and sampling in population genetics • Molecular markers: nuclear, chloroplast, mitochondrial • Evolutionary factors and their effects on genetic structure of populations: natural selection, mating, fragmentation of populations, migration (random mating,

sorodstvu, inbreeding depresija, inbreeding koeficient, heterozigotnost v populacijah, Wright's F statistika, modeli migracije)	inbreeding, inbreeding depression, inbreeding coefficient, heterozygosity within populations, Wright's F statistic, models of migration)

Temeljna literatura in viri / Textbooks:

Obvezna / Required:

Page, R.D. M. Homles, E.C. 2004. Molecular Evolution: a phylogenetic approach. Blackwell Science
Fred W. Allendorf, W. Chris Funk, Sally N. Aitken, Margaret Byrne, and Gordon Luikart. 2022. Conservation and the Genomics of Populations. 3rd edition. Oxford University Press

Priporočena / Recommended:

Avise J. C .2004. Molecular Markers, Natural History, and Evolution, Sinauer Associates
Felsenstein, J. 2004. Inferring phylogenies. Sinauer associates, Sunderland
Lowe A., Harris S., Ashton P. 2004. Ecological genetics. Blackwell Publising, 326 str. Izbrana poglavja.
Templeton A.R. 2006. Population Genetics and Microevolutionary Theory. A John Wiley & Sons., Washington

Cilji in kompetence:

Predmetno specifični cilji in kompetence:

- Študentje/ke razumejo posebnosti molekularne evolucije ter uporabo bioinformatike v molekularni evoluciji in filogenetiki Seznanijo se še z nastankom populacij in njihovo strukturo v prostoru.
- Na predavanjih bodo študenti/ke pridobili teoretično znanje, ki ga bodo nadgradili na praktičnih primerih v okviru računskih vaj. Z obravnavanjem bistvenih problemov v okviru predmeta se bodo študentje/ke seznanili z različnimi raziskovalnimi metodami in tehnikami, ki jim bodo omogočale poglabljanje in pridobivanje novih znanj, razvoj kritične misli ter sposobnost sintetiziranja.

Splošne kompetence:

- poseben poudarek predmeta je na vsebinah merjenja raznolikosti populacij (heterozigotnost, distribucija in frekvence alelov, genotipov) ter na dejavnikih, ki na raznolikost populacije vplivajo (selekcija, genetski drift, mutacije, pretok genov).

Objectives and competences:

Specific competences:

- Students will be able to understand specifics of molecular evolution and application of bioinformatics into molecular evolution and phylogenetics.The origin of populations and their structure in space.
- Lectures will provide theoretical knowledge, which will be upgraded in the tutorials with practical computational exercises and case-studies. By addressing key problems in the course the students will learn different research methods and techniques that will allow them to acquire new skills and develop critical thinking.

General competences:

- students obtain detailed insight on measuring genetic diversity of populations (heterozygosity, distribution and allele frequencies, genotypes) and factors that affect this diversity (selection, genetic drift, mutations, gene flow).

Predvideni študijski rezultati:

Znanje in razumevanje:

Študenti bodo z vsebinami predmeta evolucijska in populacijska genetika dobijo podrobnejši vpogled v molekularno osnovo raznolikosti živega sveta ter vzorce in mehanizme spreminjanja molekule DNA.. Spoznali bodo specifična orodja statistične genetike, njihove omejitve in potrebe po njihovem izboljšanju glede na razvoj raziskav.

Prenosljive/ključne spretnosti in drugi atributi:

Intended learning outcomes:

Knowledge and understanding:

With this subject students will gain a detailed insight into the molecular basis of diversity of the living world and the patterns and mechanisms of DNA change. Students will also learn about the nature of the data in biological research and the most important biological databases and their use.

Transferable/key skills and other attributes:

Obvladovali bodo naravo podatkov v bioloških raziskavah in z najpomembnejšimi biološkimi podatkovnimi zbirkami ter njihovo uporabo	They will be competent for using the specific tools of statistical genetics, their limitations and their need for improvement in relation the development of research.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Oblike dela: • frontalna oblika predavanj • praktične računalniške vaje • samostojno delo študentov/tk • **Metode dela:** • razlaga • dialog, diskusija • proučevanje praktičnih primerov	**Forms of teaching:** • In - class lectures • Practical computer exercises • Individual work of students **Teaching methods**: • Explanation • Discussion, debate • Case study

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pogoj za pristop k izpitu: opravljene vaje Končna ocena pri predmetu sestoji iz dveh delov: • Seminar s predstavitvijo • zaključnega izpita (ki zajema samostojno obdelavo genetskih podatkov in njihova interpretacija Ocenjevalna lestvica: ▪ zadostno 6: 60–67 % ▪ dobro 7: 68–75 % ▪ prav dobro 8: 76–83 % ▪ prav dobro 9: 84–90 % ▪ odlično 10: 91–100 %		A prerequisite for access to the exam: finalised exercise Final evaluation of the course consists of two parts: • seminar with public • presentation • and final exam (involving the independent processing and interpretation of genetic data) Grading scale: ▪ Sufficient D (6): 60–67% ▪ Good C (7): 68–75% ▪ Very good B (8): 76–83% ▪ Very good B+ (9): 84–90% ▪ Excellent A (10): 91–100%

Materialni pogoji za izvedbo predmeta :	**Material conditions for subject realization:**
• Računalniška učilnica	• Computational room

Obveznosti študentov:	**Student's commitments:**
Obvezna udeležba na računskih vajah Izdelava projektne naloge	Mandatory attendance at computational exercises Preparation of a project paper

Reference nosilca predmeta:

Pedagoško delo:

- Predavateljica pri predmetih na Univerzi na Primorskem

Znanstveno-raziskovalno delo:

- Vodja skupine za molekualrno ekologijo
- Članica Programske skupine

Strokovno delo in izbrane strokovne publikacije:

- Poročila za končne naročnike MVZI, ZGS, DRI

Priznanja in nagrade:

- Glasnik znanosti in za zanstveno odličnost

Lecturer's references:

Pedagogic activities:

- Lecturer in courses at the University of Primorska

Scientific and research work:

- Head of the Molecular Ecology Group
- Member of the Programme Group

Professional work and selected professional publications:

- Reports for stakehodlers : MVZI, ZGS, DRI

Awards:

- Glasnik znanosti (Herald of Science) and award for scientific excellence

Izbrani znanstveni članki / Selected scientific papers:

1. BUŽAN, Elena, POTOČNIK, Hubert, POKORNY, Boštjan, POTUŠEK, Sandra, IACOLINA, Laura, GERIČ, Urška, URZI, Felicita, KOS, Ivan. Molecular analysis of scats revealed diet and prey choice of grey wolves and Eurasian lynx in the contact zone between the Dinaric Mountains and the Alps. Frontiers in zoology. 2024, 21, art. 9, str. 1-15,
2. STEFANOVIĆ, Milomir, VELICKOVIC, Nevena, BONČINA, Aja, POTUŠEK, Sandra, MATIĆ, Ivana, DJAN, Mihajla, BUŽAN, Elena. Duplication, recombination and weak selection shape evolution at the MHC class II SLA-DRB1 locus in wild boars from the western Balkans. Mammalian biology. 2024, vol. 104, str. 539-548, ilustr. ISSN 1616-5047. https://link.springer.com/article/10.1007/s42991-024-00433-3, https://doi.org/10.1007/s42991-024-00433-3, DOI: 10.1007/s42991-024-00433-3.
3. STIPOLJEV, Sunčica, BUŽAN, Elena, IACOLINA, Laura, SAFNER, Toni, REZIĆ, Andrea, GALOV, Ana, KRIŽANOVIĆ, Krešimir, AMBARLI, H., BEGO, Ferdinand, GAČIĆ, Dragan P., LAZAR, Peter, MALETIĆ, Vladimir, MARKOV, Georgi, PAPAIOANNOU, Haritakis, SCANDURA, Massimo, ŠPREM, Nikica, et al. Diversity of MHC class II DRB alleles in the Northern chamois genus Rupicapra. Journal of mammalogy. 2024, vol. 105, iss. 2, str. 312-322, ilustr. ISSN 0022-2372. DOI: 10.1093/jmammal/gyae008.
4. HOSTE, Amélie, PERRIÈRE, Charles, CAPBLANCQ, Thibaut, BUŽAN, Elena, ŠPREM, Nikica, CORLATTI, Luca, CRESTANELLO, Barbara, BROQUET, Thomas, PELLISSIER, Loïc, YANNIC, Glenn, et al. Projection of current and future distribution of adaptive genetic units in an alpine ungulate. Heredity : International journal genetics. 2024, vol. 132, iss. 1, str. 54-66, ilustr. ISSN 0018-067X. https://www.mdpi.com/1660-4601/19/1/131, DOI: 10.1038/s41437-023-00661-2
5. ŠPREM,Nikica, BUŽAN, Elena, SAFNER, Toni. How we look: European wild mouflon and feral domestic sheep hybrids. Current Zoology. 2023, : 10.1126/science.abo6499.
6. CERRI, Jacopo, STENDARDI, Laura, BUŽAN, Elena, POKORNY, Boštjan. Accounting for cloud cover and circannual variation puts the effect of lunar phase on deer–vehicle collisions into perspective. Journal of applied ecology. Online ed. 2023, https://doi.org/10.1111/1365-2664.14432
7. THEISSINGER, Kathrin, FERNANDES, Carlos, FORMENTI, Giulio, BISTA, Iliana, BERG, Paul R., BLEIDORN, Christoph, BOMBARELY, Aureliano, CROTTINI, Angelica, GALLO, Guido R., GODOY, José A., GREBENC, Tine, BUŽAN, Elena, et al. How genomics can help biodiversity conservation. Trends in genetics. 2023, vol. ISSN 1362-4555. https://doi.org/10.1016/j.tig.2023.01.005
8. BUŽAN, Elena, POTUŠEK, Sandra, DUNIŠ, Luka, POKORNY, Boštjan. Neutral and selective processes shape MHC diversity in roe deer in Slovenia. Animals. 2022, iss. 6, art. 723, str. 1-17,, DOI: 10.3390/ani12060723.6-2615/12/6/723/htm,
9. POKORNY,Boštjan, CERRI, Jacopo, BUŽAN, Elena. Wildlife roadkill and COVID-19: a biologically significant, but heterogeneous, reduction. Journal of applied ecology. Online ed. 2022, vol. 59, iss. 5, str. 1291-1301. ISSN 1365-2664.https://doi.org/10.1111/1365-2664.14140, https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.14140,DOI: 10.1111/1365-2664.14140.
10. DUH, Darja, POTUŠEK, Sandra, BUŽAN, Elena. The impact of illegal waste sites on a transmission of zoonotic viruses. Virology journal. 2017, vol. 14, art. no. 134, str. 1-7. ISSN 1743-422X. https://doi.org/10.1186/s12985-017-0798-1, DOI: 10.1186/s12985-017-0798-1