UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	MOLEKULARNA EVOLUCIJA IN RAZVOJ
Course Title:	MOLECULAR EVOLUTION AND DEVELOPMENT

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	**/**	**3.**	**2.**
USP Biochemistry, 1st Cycle	**/**	**3rd**	**2nd**

Vrsta predmeta / Course Type: Izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: BK

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

Nosilec predmeta / Lecturer: Doc. dr. Vera Župunski / Dr. Vera Župunski, Assistant Professor

Jeziki / Languages:

Predavanja / Lectures:	**slovenski / Slovenian**
Vaje / Tutorial:	**slovenski / Slovenian**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Spremembe v DNA, RNA in proteinih, ki povzročijo evolucijo: mutacije, sinonimne, nesinonimne, genetski zdrs, selekcija. Analiza hitrosti evolucijskih sprememb: evolucija vpliva na celotna zaporedja ali le na določenih mestih, poteka različno hitro skozi čas, molekularna ura, razlika na ravni organizma, zaporedij. Evolucijska divergenca: kako nastanejo spremembe na nivoju populacije; vplivi, kot so izolacija, fitnes. Evolucijske sile: selekcija in nevtralna evolucija. Primeri konvergentne in divergentne evolucije, iskanje predniških zaporedij. Opis evolucijskih modelov: metode razdalj, ML, MP, Bayes.	Changes in DNA, RNA, and proteins that drive evolution: Mutations, synonymous, non-synonymous, genetic drift, selection. Estimating mutation rates: in whole sequences or site-specific, molecular clock, differences in analysis of sequences or organisms. Evolutionary divergence: implications in population, effects of isolation, fitness. Driving forces of evolution: selection, neutral evolution. Examples of convergent and divergent evolution, ancestral sequences. Evolutionary models: distance methods, Maximum Likelihood, Maximum Parsimony, Bayes.

Evolucija človeka: razvoj organizma in vrste. Molekularne osnove razvoja človeškega embrija: od spolnih celic do mehanizmov oploditve in razvoja embrija. Molekularne osnove razvoja organov (organogeneza iz ektoderma, mezoderma in endoderma). Molekularni procesi regeneracije organov in staranja.	Human evolution and development. Molecular basis of human embryo development: from gametes to mechanisms of fertilisation and embryonic development. Molecular basis of organogenesis (ectoderm, endoderm, mesoderm). Molecular processes of regeneration and ageing.

Temeljna literatura in viri / Readings:

- Lindell Bromham: An Introduction to Molecular Evolution and Phylogenetics, Oxford University Press, 2016 (glavni vir)
- Masatosh Nei and Sudhir Kumar: Molecular Evolution and Phylogenetics, Oxford University Press, 2000 (izbrana poglavja)
- Michael J.F. Barresi and Scott F. Gilbert: Developmental Biology, OUP USA, 2020 (izbrana poglavja)
- Nico van Straalen, Dick Roelofs: Human Evolution and Development, Textbook for Life Sciences, Amsterdam University Press, 2019 (izbrana poglavja)

Cilji in kompetence:	**Objectives and Competences:**
Pri predmetu bodo študenti pridobili osnovna znanja o molekularni evoluciji in molekularnih mehanizmih razvoja organizma. Po opravljenih obveznostih bodo študenti sposoben razumeti molekularne procese, ki vodijo v razvoj, in uporabljati osnovne metode molekularne evolucije.	The objectives of the course is to provide students with a basic knowledge of molecular evolution and development. Upon completion of the course, students will be able to understand molecular mechanisms of development and apply basic methods of molecular evolution.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študenti se pri predmetu seznanijo s pomembnimi pojmi in metodami molekularne evolucije, kot so spremembe, ki vodijo evolucijo, pomen molekularne ure, vrste evolucije. Na osnovi primerov se znanje poglobi in pridobi razumevanje molekularnih mehanizmov, ki vodijo v razvoj organizmov.	<u>Knowledge and Comprehension</u> Knowledge of principles and methods of molecular evolution such as molecular clock, distance determination, driving forces for evolution. Using the examples, students deepen their knowledge and improve their understanding of molecular mechanisms of development.
<u>Uporaba</u> Pridobljeno znanje predstavlja razširitev osnovnega biokemijskega znanja in spodbuja študenta k povezovanju znanja in reševanju problemov. Predmet je podlaga za	<u>Application</u> The course broadens essential biochemical knowledge and encourages students to integrate this knowledge and solve problems. The course topics provide the indispensable

razumevanje bolj kompleksnih procesov na ravni genoma in organizma.	foundation for understanding more complex processes at the level of genomes and organisms.
Refleksija Poleg znanj o molekularni evoluciji in razvoju bo študent razvil sposobnost razmišljanja o molekularnih mehanizmih in posledicah na nivoju organizma.	Analysis Students acquire knowledge in course topics and develop the ability of thinking from molecular mechanisms to the level of an organism.
Prenosljive spretnosti Samostojno in skupinsko delo pri vajah in pripravi seminarjev. Analiza in ovrednotenje rezultatov, pisanje poročil. Sposobnost uporabe strokovne literature.	Skill-transference Ability Individual and group work in practicals and preparation of seminars. Analysis and evaluation of results, report writing. The ability to use scientific literature.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, laboratorijske vaje, individualni in skupinski seminarji.	Lectures, practicals, and individual and group seminars.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga Pisni izpit Pogoj za pristop k izpitu: opravljene laboratorijske vaje in seminarska naloga.	**25** **75**	Seminar work Written exam Requirements for exam admission: completed laboratory practicals and seminar work.

Reference nosilca / Lecturer's references:

ŽUPUNSKI, Vera, GUBENŠEK, Franc, KORDIŠ, Dušan. Evolutionary dynamics and evolutionary history in the RTE clade of non-LTR retrotransposons. *Molecular biology and evolution*. 2001, vol. 18, str. 1849-1863. ISSN 0737-4038. [COBISS.SI-ID 16218919]

ŽUPUNSKI, Vera, KORDIŠ, Dušan, GUBENŠEK, Franc. Adaptive evolution in the snake venom Kunitz/BPTI protein family. *FEBS letters*. [Print ed.]. 2003, vol. 547, str. 131-136. ISSN 0014-5793. [COBISS.SI-ID 17648423],

ŽUPUNSKI, Vera, KORDIŠ, Dušan. Strong and widespread action of site-specific positive selection in the snake venom Kunitz/BPTI protein family. *Scientific reports*. 2016, vol. 6, str. 37054-1-37054-12. ISSN 2045-2322. DOI: 10.1038/srep37054. [COBISS.SI-ID 29935911],