UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Evolucijska genomika
Course title:	Evolutionary Genomics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Nanoznanosti in nanotehnologije, 3. stopnja Nanosciences and Nanotechnologies, 3rd cycle	Bioznanosti Biosciences	1	1

Vrsta predmeta / Course type	Izbirni / Elective
Univerzitetna koda predmeta / University course code:	NANO3-797

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	15			15	105	5

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transfered to individual work.*

Nosilec predmeta / Lecturer:	Prof. dr. Dušan Kordiš

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina, angleščina / Slovenian, English
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Predznanje biologije, genetike in biokemije je potrebno za študij in razumevanje procesov v bioloških sistemih.	Knowledge in biology, genetics and biochemistry acquired at the undergraduate level.

Vsebina:	**Content (Syllabus outline):**
- Kaj je genom? - Razumevanje genomskih zaporedij - Anatomija eukariontskih in prokariontskih genomov - Regulacija delovanja genoma - Struktura in dinamika genomov in proteomov - Molekularni vzroki evolucije genomov - Vzorci genomske evolucije - Filogenetika in filogenomika - Evolucija proteinov Laboratorijske vaje (računalniške): - Genomske podatkovne baze - Specializirane proteomske databaze - Evolucijske analize genomskih sekvenc - Evolucijske analize proteomov	- What is a genome? - Understanding a genome sequence - Genome anatomies (eukaryotes vs prokaryotes) - Regulation of genome activity - Structure and dynamics of genomes and proteomes - Molecular basis of genome evolution - Paterns of genome evolution - Molecular phylogenetics and phylogenomics - Protein evolution Laboratory work (computational): - Genome databases - Protein and proteome databases - Evolutionary analyses of genome sequences - Evolutionary analyses of proteomes

Temeljni literatura in viri / Readings:

1. Brown, T.A. (2017) Genomes. 4th Edition, Garland Science.
2. Caetano-Anollés, G. (2010) Evolutionary Genomics and Systems Biology. Wiley-Blackwell.
3. Pagel, M. & Pomiankowski A. (2008) Evolutionary Genomics and Proteomics. Sinauer.
4. Lynch, M. (2007) The Origins of Genome Architecture. Sinauer.

Cilji in kompetence:

Študenti pridobijo znanje o organizaciji, delovanju in analizi celotnih genomov (prokariontskih in evkariontskih) z evolucijskega vidika, pomen razumevanja informacij, ki so skrite v genomskih sekvencah, ter mehanizmov in vzorcev evolucije genomov. Študenti bodo spoznali in uporabljali specializirane genomske in proteomske podatkovne baze ter metode molekularne evolucije za prepoznavanje in ovrednotenje evolucije posameznih genomskih komponent.

Splošne kompetence:

- obvladanje raziskovalnih metod, postopkov in procesov, razvoj kritične in samokritične presoje;
- razvoj sposobnosti uporabe znanja v praksi;
- razvoj komunikacijskih sposobnosti in spretnosti, posebej komunikacije v mednarodnem okolju;
- kooperativnost, delo v skupini (in v mednarodnem okolju).

Predmetno-specifične kompetence:

Študij tega predmeta je nujna podlaga za to, da bo študent razumel, kako se genomi in njegove komponente spreminjajo s časom. Predstavljene raziskovalne metode bodo študenti lahko uporabljali na različnih strokovnih področjih. Pridobljeno znanje jim bo pomagalo pri uporabi izjemno kompleksnih genomskih podatkov pri reševanju različnih problemov iz sodobne biologije ter pri interpretaciji rezultatov, pridobljenih iz genomskih in proteomskih podatkovnih baz.

Objectives and competences:

Students will acquire a thorough understanding of genome organization and activity, of complete genome analysis (prokaryotic and eukaryotic), and mechanisms and patterns of genome evolution. Students will be able to extract and understand the enormous amount of information that is hidden in genome sequences. Students will learn how to use the specialized genome and proteome databases, and diverse approaches that are necessary for the evolutionary analyses of different genome components.

General Competences:

- the student will master research methods, procedures and processes and develop skills to critically asses his activities;
- the student will develop skills to transfer the ideas from the basic knowledge pool into applications;
- the student will develop communications skills to present research achievement in the international environment;
- training for team work (in international environment).

Course Specific Competences:

This course prepares students to work on the evolutionary analysis of complex genome data. Students will understand how and why the genomes and genome components change in time. Students can use acquired research methods in different fields of life sciences. Acquired knowledge will enable students to use very complex genome data in solving different problems in modern biology and to understand the results obtained from the analysis of the genome and proteome databases.

Predvideni študijski rezultati:

Znanje in razumevanje

Študent pri predmetu pridobi znanje o nastanku, strukturni organizaciji, delovanju, regulaciji in evoluciji genomov. Pridobljeno znanje omogoča študentom razumevanje izjemno kompleksnih genomskih podatkov. Študent se nauči uporabljati

Intended learning outcomes:

Knowledge and Comprehension

Students will acquire knowledge about the origin, structural organization, functioning, regulation and evolution of genomes. This will enable them to understand the extremely complex genomic data. Students will learn how to use genomic databases.

genomske podatkovne baze. Uporaba Študij tega predmeta je nujna podlaga za to, da bo študent razumel, kako se genomi in njegove komponente spreminjajo s časom. Predstavljene raziskovalne metode bodo študenti lahko uporabljali na različnih strokovnih področjih. Pridobljeno znanje jim bo pomagalo pri uporabi izjemno kompleksnih genomskih podatkov pri reševanju različnih problemov iz sodobne biologije ter pri interpretaciji rezultatov, pridobljenih iz genomskih podatkovnih baz. Refleksija Študent pridobi sposobnost kompleksnega biološkega načina razmišljanja in razvije zmožnost abstraktne predstave o organizaciji, delovanju in evoluciji genomov. Prenosljive spretnosti Izkušnje pri reševanju problemov. Timsko delo (pri vajah). Zbiranje in interpretiranje rezultatov ter njihovo kritično vrednotenje. Uporaba tuje literature. Podajanje poročil o opravljenem delu.	Application The course gives students the indispensable basis for the understanding of the evolution of genomes and their components. Students will be able to apply research methods presented during the course to various research fields. The acquired knowledge will help them to use the highly complex genomic data when solving various problems of modern biology, as well as to interpret the results obtained from genomic and proteomic databases. Analysis Students will develop the ability to complex biological thinking, as well as the capacity for the abstraction of genome organization, functioning and evolution. Skill-transference Ability Problem-solving skills. Teamwork (at Laboratory work). Obtaining and interpreting results and their critical evaluation. Use of scientific literature. Writing reports on the practical work performed.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Seminarji • Konzultacije	• Lectures • Seminars • Consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
seminar	50 %	seminar
ustni izpit	50 %	oral exam

Reference nosilca / Lecturer's references:

1. Župunski V. and **Kordiš D.** (2016). Strong and widespread action of site-specific positive selection in the snake venom Kunitz/BPTI protein family. Sci Rep. 6:37054.
2. Kokošar J. and Kordiš D. (2013). Genesis and regulatory wiring of retroelement-derived domesticated genes: a phylogenomic perspective. Mol Biol Evol. 30:1015-1031.
3. Kordiš D. (2011). Extensive intron gain in the ancestor of placental mammals. Biol Direct. 6:59.
4. Kordiš D. (2009). Transposable elements in reptilian and avian (Sauropsida) genomes. Cytogenet Genome Res. 127:94-111.
5. Kordiš D. and Turk V. (2009). Phylogenomic analysis of the cystatin superfamily in eukaryotes and prokaryotes. BMC Evol Biol. 9:266.