



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Genetika evkariotov
Course title:	Genetics of Eukaryotes

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Univerzitetni študijski program Ekologija z naravovarstvom, 1.stopnja		3.	5.
Undergraduate university programme Ecology with Nature Conservation, 1st degree		3rd	5th

Vrsta predmeta / Course type

Obvezni/Obligatory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30		30			90	5

Nosilec predmeta / Lecturer:

Metka Šiško

Jeziki /
Languages:

Predavanja /
Lectures:

Slovenski /Slovene

Vaje / Tutorial:

Slovenski /Slovene

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

Vsaka izmed naštetih obveznosti v načinih
ocenjevanja mora biti opravljena s pozitivno oceno.

Prerequisites:

Each of the mentioned commitments must be
assessed with a passing grade.

Vsebina:

Predmet obsega vsa ključna poglavja genetike evkariontov:

Molekulska genetika evkariontov – molekularna struktura in replikacija genetskega materiala, molekularne lastnosti in funkcije genov.

Citogenetika in fizikalne osnove dednosti evkariontov – struktura in funkcija kromosomov, celična delitev, gametogeneza, oploditev.

Kvalitativna genetika evkariontov – nevezani geni, Mendlova pravila, dednost kvalitativnih lastnosti, genske interakcije, poliploidija (evploidija, anevploidija), statistično testiranje segregacijskih razmerij, vezani geni, crossing – over, genetske mape, genetika spola.

Populacijska genetika evkariontov – struktura populacij, populacijsko ravnotežje, migracije, mutacije, selekcija, inbreeding, incest.

Kvantitativna genetika evkariontov – srednje vrednosti in variance posameznih generacij, izračunavanje heritabilnosti.

Izobraževalni proces (še posebej eksperimentiranje) bo upošteval vse veljavne moralno – etične omejitve.

Content (Syllabus outline):

The subject includes all essential parts of genetics (of eukaryotes):

Molecular genetics of eukaryotes – molecular structure and replication of the genetic material, molecular properties and function of genes.

Cytogenetics and physical basis of heredity of eukaryotes chromosome structure and function, cell division, gametogenesis, fertilisation.

Mendelian genetics – inheritance of qualitative traits, Mendelian rules, genetic linkage, polyploidy (euploidy, aneuploidy), statistical testing of segregation ratios, genetic linkage, crossing – over, genetic maps, genetics of sex.

Population genetics of eukaryotes – structure of populations, population equilibrium, migrations, mutations, selection, inbreeding.

Quantitative genetics of eukaryotes – generation mean values and variances, estimation of heritability.

Teaching approach, especially practical experimentation, will consider all existing moral and ethical rules.

Temeljna literatura in viri / Readings:

- Šiško, M. (2022). Zbirka računskih nalog iz genetike (1. izd.). Univerza v Mariboru, Univerzitetna založba. <https://press.um.si/index.php/ump/catalog/book/667>
- Griffiths, A. J. F., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). Introduction to genetic analysis (8th ed., str. XVI, 782). W. H. Freeman.
- Goldberg, M., & Fischer, J. (2024). Genetics: from genes to genomes (str. 1 zv. (loč. pag.)). McGraw Hill.
- Jones, S. (2000). Introducing genetics (str. 175). Icon Books; Totem Books

Dodatna uporabna literatura:/ Additional useful literature:

- Elrod, S. L., & Stansfield, W. D. (2002). Schaum's outline of theory and problems of genetics (4th ed., str. VII, 500).
- McGraw-Hill. Peterlin, B., & Writzl, K. (2003). Humana genetika (1. izd., str. 79). Cankarjeva založba.

- Sušnik, F., & Vesel, B. (1998). Populacijska genetika (1. izd., str. 51). DZS.

Cilji in kompetence:

- Poznavanje in razumevanje molekulske genetike, citogenetike, kvalitativne genetike, populacijske genetike in kvantitativne genetike evkariontov .
- Zmožnost poznavanja in razumevanja genetike za reševanje problemov povezanih s prenosom lastnosti na potomstvo.
- Zmožnost interpretiranja podatkov na osnovi laboratorijskih opazovanj in meritev glede na njihovo pomembnost in njihovega povezovanja z ustrezno teorijo.

Objectives and competences:

- Knowing and understanding of molecular genetics, cytogenetics, Mendelian genetics, population genetics of eukaryotes, and quantitative genetics of eukaryotes.
- The students will be able to use knowledge for solving problems about transferring traits from parents to offspring.
- The students will be able to interpret data obtained on laboratory observations and measurements and their connection with appropriate theory.

Predvideni študijski rezultati:

Znanje in razumevanje:

- opredeli terminologijo s področja genetike,
- zna naštetih nukleinske kisline in opisati njihovo zgradbo,
- našteje in opiše sekundarne oblike nukleinskih kislin,
- zna razlikovati med različnimi procesi molekulske genetike (podvojevanje DNA, transkripcija in translacija),
- opredeli pojem genska ekspresija,
- na primerih prikaže, kako se lastnosti iz staršev prenašajo na potomstvo,
- zna izračunati frekvence alelov v neki populaciji,
- bo sposoben izračunati srednje vrednosti in variance posameznih generacij, izračunati heritabilnost.

Prenesljive/ključne spretnosti in drugi atributi:

- zna izolirati DNA iz rastlinskega tkiva,
- sposoben samostojne priprave in analize vzorcev za genetske raziskave rastlin,

Intended learning outcomes:

Knowledge and understanding:

- knows terminology in genetics,
- is able to list nucleic acids and describe their structure,
- list and describe secondary nucleic acid forms,
- describes the processes of molecular genetics (DNA replication, transcription and translation),
- explain how gene expression is controlled,
- shows by example how traits are transmitted from parents to offspring,
- can calculate allele frequencies in a population,
- will be able to calculate mean values and variance of individual generations, to calculate heritability.

Transferable / Key Skills and other attributes:

- is able to isolate DNA from plant tissue,
- is able to prepare and analyze samples for plant genetic research,

- zna pripraviti vzorce in uporabiti agarozno elektroforezo za kvalitativno analizo DNA fragmentov.

-can prepare samples and use agarose electrophoresis for qualitative analysis of DNA fragments.
basis of molecular genetics of eukaryotes,
- basis of cytogenetics and physical basis of heredity of eukaryotes ,
- Mendelian genetics – inheritance of qualitative traits,
-basis of population genetics of eukaryotes, and
Will be able to calculate generation mean values and variances, estimation of heritability.

Metode poučevanja in učenja:

Predavanja
Laboratorijske vaje

Learning and teaching methods:

Lectures
Laboratory practicals

Načini ocenjevanja:

Pisni izpit

Delež (v %) /

Weight (in %)

Assessment:

Written exam

100 %

Reference nosilca / Lecturer's references:

1.ŠIŠKO, Metka, IVANČIČ, Anton, ŠUŠEK, Andrej. Determination of raspberry cultivar authenticity based on multiplexed microsatellite fingerprinting. *International journal of fruit science*. [Print ed.]. 2021, vol. 21, no. 1, str. 1018-1029. 8362.

2. ŠIŠKO, Metka, VRŠIČ, Stanko, IVANČIČ, Anton, PULKO, Borut, PERKO, Andrej, ŠUŠEK, Andrej. Origin of Slovenian wild grown grapevines and their genetic relationships. *Mitteilungen Klosterneuburg Rebe und Wein, Obstbau und Früchteverwertung*. 2021, vol. 71, nr. 4, str. 287-299.

3. TERNJAK, Tina, ŠIŠKO, Metka. Intra and between population genetic relationships among wild cherries [*Prunus avium* (L.) L.] based on molecular markers. *Agricoltura*. [Print ed.]. jun. 2022, vol. 19, no. 1, str. 25-32.

4. URBANEK KRAJNC, Andreja, LUTHAR, Zlata, LIPOVŠEK, Matej, IVANUŠ, Anja, MILJUŠ, Staš, BOHANEK, Borut, ŠIŠKO, Metka. Taxonomic analysis of certain taxa of *Epipactis* in Slovenia. *Perspectives in plant ecology, evolution and systematics*. September 2022, vol. 56, [article no.] 125674, str. 1-17.

5. TERNJAK, Tina, BARRENECHE, T., ŠIŠKO, Metka, IVANČIČ, Anton, ŠUŠEK, Andrej, QUERO, Garcia José. Genetic diversity and structure of Slovenian native germplasm of plum species (*P. domestica* L., *P. cerasifera* Erhrh. and *P. spinosa* L.). *Frontiers in plant science*. 2023, vol. 14, [article no.] 1150459, str. 1-17.