



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Osnove biotehnologije
Course title:	Introduction to biotechnology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Univerzitetni študijski program Biologija, 1. stopnja	/	3	5
Undergraduate university programme Biology, 1 st degree	/	3 rd	5 th

Vrsta predmeta / Course type

Obvezni/Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30			30	15	105	6

Nosilec predmeta / Lecturer:

Jana Ambrožič-Dolinšek

Jeziki /

Languages:

Predavanja / Lectures:

Vaje / Tutorial:

Slovenski / Slovenian

Slovenski / Slovenian

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

Pozitivno ocenjeno laboratorijsko delo in poročilo sta pogoj za pristop k pisnemu delu.
Vsaka obveznost študenta mora biti opravljena s pozitivno oceno.

Prerequisites:

The required pre-condition for written exam is the positively evaluated laboratory work.
Each of the prescribed obligations must be evaluated positively.

Vsebina:

Content (Syllabus outline):

Predmet je pregledna predstavitev biotehnologije, kot multidisciplinarne in interdisciplinarne znanosti in interdisciplinarno povezuje medicinsko, mikrobno in rastlinsko biotehnologijo. Poudarek je na uporabi biotehnologije, vplivu na okolje in človeško družbo.

Medicinski del bo predstavil medicinsko-biotehnološke postopke, ki omogočajo diagnostiko in zdravljenje genetsko pogojenih bolezni, razvoj zdravil, in gensko inženirstvo. Podaja predstavitev medicinske in forenzične biotehnologije.

Mikrobni del zajema in bo predstavil živilsko mikrobno biotehnologijo, mikrobno biotransformacijo in biokatalizo pri proizvodnji produktov (zdravila, biogoriva, ...), mikrobno bioremediacijo za odstranjevanje odpadkov ter novejšje biotehnološke tehnologije z uporabo mikroorganizmov ali njihovih delov. Študenti se bodo seznanili z uporabo bioreaktorjev: namnoževanje mikrobnih starterskih kultur, mehanizem nadzorovanja, kontroliranja in vodenja mikrobnih bioprosesov, princip produktivnosti bioprosesa ter zahteve za prenos v večje (industrijsko) merilo.

Rastlinski del vključuje rastlinske tkivne kulture, genetsko spreminjanje rastlin, fitoremediacijo in biogoriva iz rastlin. Predmet omogoča osnovno razumevanje vpliva rastlinske biotehnologije na kmetijstvo, prehrano, medicino, industrijo in upravljanje z okoljem ter polemizira sporne vidike biotehnologije, povezane z vplivi na okolje in človeško družbo.

This course provides an overview of biotechnology as a multidisciplinary and interdisciplinary science that integrates medical, microbial and plant biotechnology across disciplines. It focuses on the application of biotechnology, its impact on the environment and human society.

The medical part introduces the processes of medical biotechnology that enable the diagnosis and treatment of genetic diseases, the development of drugs and genetic engineering. An introduction to medical and forensic biotechnology is given.

The microbial part covers and presents microbial food biotechnology, microbial biotransformation and biocatalysis to produce products (pharmaceuticals, biofuels, etc.), microbial bioremediation for waste disposal, and newer biotechnological technologies that utilize microorganisms or parts thereof.

Students will learn about the use of bioreactors: the propagation of microbial starter cultures, the mechanisms of monitoring, control and management of microbial bioprocesses, the principle of productivity of bioprocesses and the requirements for transfer to a larger (industrial) scale (scale-up).

The plant part covers plant tissue culture, genetic modification of plants, phytoremediation and biofuels from plants. The course provides a basic understanding of the impact of plant biotechnology on agriculture, the food industry, medicine, industry and environmental management, as well as controversial aspects of biotechnology related to the impact on the environment and human society.

Temeljni literatura in viri / Readings:

Temeljna literatura / Basic literature:

- Thieman, W. J., & Palladino, M. A. (2020). *Introduction to biotechnology* (4th ed., global ed., str. 385, 59). Pearson.
- Ambrožič-Dolinšek, J. (2017). *Laboratorijski priročnik za delo z rastlinskimi tkivnimi kulturami, s poudarkom na mikropropagaciji: laboratorij za fiziologijo rastlin* (str. II, 53). Univerzitetna založba Univerze. <https://doi.org/10.18690/978-961-286-072-1>
- Pipenbaher, N., & Ambrožič-Dolinšek, J. (2014). *Priročnik za delo v laboratoriju s poudarkom na varnosti: laboratorij za fiziologijo rastlin [in] laboratorij za molekularno biologijo* (str. 56). Fakulteta za naravoslovje in matematiko.
- Trček, J. (2018). *Mikrobna biotehnologija: skripta z navodili za vaje za študijski program Biologija* (1. izd.). Univerzitetna založba Univerze. <http://press.um.si/index.php/ump/catalog/book/318>

Priporočena literatura / Recommended readings:

- Biotehnologija, Osnovna znanja* (str. XVI, 815). (1996). Bia.
- Reed, R. H. (2003). *Practical skills in biomolecular sciences* (2nd ed., str. XIV, 538). Pearson education.
- George, Edwin F.; Hall, Michael A.; De Klerk, Geert-Jan. (2008). *Plant Propagation by Tissue Culture*. Springer Netherlands.
- George, Edwin F.; Hall, Michael A.; De Klerk, Geert-Jan. (2008). *Plant Propagation by Tissue Culture*. Springer Netherlands.
- George, E. F. (1993). *Plant propagation by tissue culture. Part 1, The technology* (2nd rev.ed., str. VIII, 574). Exegetics.
- Strachan, T., Lucassen A. (2023). *Genetics and Genomics in Medicine* (2th ed.). CRC Press.
- Izbrani članki iz znanstvenih revij / Selected papers from scientific journals.

Cilji in kompetence:

- Seznaniti študente z biotehnologijo kot multidisciplinarno in interdisciplinarno znanost.
- Seznaniti študente z genskimi manipulacijami, uporabo biotehnologije in različnimi področji biotehnologije.
- Usposobiti študente za prepoznavanje pomena in vpliva biotehnologije na okolje in človeško družbo.
- Seznaniti z nasprotujočimi vidiki biotehnologije.
- Praktično usposobiti študente za raziskovalno delo s področja biotehnologije.

Objectives and competences:

- Introduction of students to biotechnology as a multidisciplinary and interdisciplinary science.
- To introduce students to genetic manipulation, the applications of biotechnology and the different areas of biotechnology.
- To enable students to recognise the importance and impact of biotechnology on the environment and human society.
- Introduction to the conflicting aspects of biotechnology.
- Practical training of students in research in the field of biotechnology.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:

- Prepozna različne tipe biotehnologije in njihovo uporabo.
- Ovrednoti vplive biotehnologije na okolje in ljudi.
- Prepoza etične, pravne, ekonomske in socialne vidike biotehnologije.
- Pojasni uporabo mikroorganizmov v različnih biotehnoloških procesih.
- Pojasni možnosti izboljšanja mikrobnih bio-procesov z genetskimi in tehnološkimi pristopi.
- Pojasni biologijo gojenja rastlinskih celic.
- Pojasni genske modifikacije rastlin.
- Pojasni in primerja različne načine razstrupljanja okolja z rastlinami.
- Pojasni in primerja različne možnosti uporabe rastlin za pridobivanje biogoriv.
- Osvoji izbrane biotehnološke metode ter se usposobi za varno delo v laboratoriju.
- Osvoji osnovne spretnosti, pomembne za praktično eksperimentalno delo: opazovanje, merjenje, ravnanje z rastlinskim materialom, kemikalijami, steklovino, osnovnimi aparaturami, zbiranje rezultatov, načrtovanje poskusov, vrednotenje rezultatov, poročanje.

Knowledge and understanding:

- Identify the different types of plant biotechnology and their application using practical examples.
- Explain and evaluate the importance of plant biotechnology in agriculture, nutrition, medicine and industry.
- Assess the impact of biotechnology on the environment and humans.
- Explain the biology of plant cell cultivation.
- Explain the genetic modification of plants.
- Explain and compare different ways of detoxifying the environment using plants.
- Explain and compare different ways of using plants to produce biofuels.
- Learn selected biotechnological methods and be trained to work safely in the laboratory.
- Learn basic skills relevant to practical experimental work: Observation, measurement, handling plant material, chemicals, glassware, basic equipment, collection of results, experimental design, evaluation of results, reporting.
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Metode poučevanja in učenja:

- Predavanja
- Laboratorijske vaje
- Terensko delo

Learning and teaching methods:

- Lectures
- Laboratory exercises
- Field work

Načini ocenjevanja:

- Pisni izpit
- Laboratorijsko delo

Delež (v %) /
Weight (in %)

Assessment:

- Written exam
- Laboratory work

Opombe:

Laboratorijsko delo vključuje poročilo po zaključenih vajah.

Pisni izpit je sestavljen iz treh vsebinskih sklopov (medicinsekga, mikrobnega in rastlinskega) v enakovrednih deležih v skupnem obsegu 75 % končne ocene in se lahko nadomesti s pisnimi kolokviji iz medicinske, mikrobne in rastlinske biotehnologije v prav tako enakovrednih deležih.

Pisni izpit lahko nadomestijo pozitivno opravljeni sprotni kolokviji.

Comments:

The laboratory work includes a colloquium after the exercises.

The written exam consists of three subject parts (medical, microbial, and plant) in equal proportions, making up 75% of the final grade, and can be replaced by written colloquiums in medical, microbial, and plant biotechnology, also in equal proportions.

The written exam can be replaced with written partial examinations.

Reference nosilca / Lecturer's references:

- Ambrožič-Dolinšek, J., Podgrajšek, A., Šabeder, N., Mazej, Z., Urbanek Krajnc, A., Todorović, B., & Ciringer, T. (2023). The potential of berula erecta in vitro for As bioaccumulation and phytoremediation of water environments. *Environmental pollutants & bioavailability*, 35(1, [] 2205010), 12. <https://dk.um.si/IzpisGradiva.php?id=84870>
- Grujić, J. V., Todorović, B., Kranvogel, R., Ciringer, T., & Ambrožič-Dolinšek, J. (2022). Diversity and content of carotenoids and other pigments in the transition from the green to the red stage of Haematococcus pluvialis microalgae identified by HPLC-DAD and LC-QTOF-MS. *Plants*, 11(8), 14. <https://dk.um.si/IzpisGradiva.php?id=88637>
- Ambrožič-Dolinšek, J., Ornik, D., Branda, R., Molnar, Z., & Ciringer, T. (2021). Does biostimulant Agrostemin® exhibit plant growth regulator activities? *Phyton*, 61, 109–116. doi:10.12905/0380.phyton61-2022-0109