

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Biokemija
Course title:	Biochemistry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Farmacija, 2. stopnja		1.	2.
Pharmacy, 2. level		1.	2.

Vrsta predmeta / Course type obvezni/obligatory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Clinical training	Druge oblike študija Other forms of study	Samost. delo Individual work	ECTS
30	15				45	3

Nosilec predmeta / Lecturer: red. prof. dr. Uroš Potočnik

Jeziki / Predavanja / Lectures: slovenski/slovene
Languages: Vaje / Tutorial:

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

Vsebina:

- Uvod v biokemijo, molekulske osnove življenja, voda, biološko pomembni elementi, ioni in glavne skupine biomolekul.
- Uvod v strukturo beljakovin.
- Beljakovine: splošna zgradba in lastnosti, razdelitev po funkciji (encimi, transportne, skladiščne, kontraktilne, strukturne, obrambne in regulatorne beljakovine).
- Fibrilarne in globularne beljakovine.
- Encimi: splošne značilnosti in osnove encimske kinetike.
- Biokemijske komponente celic in tkiv
- Prebavni encimi, uvod v metabolne poti – regulacija metaboličnih poti, glavni eksperimentalni pristopi za študij metabolizma
- Oksidativni procesi v celici in pridobivanje energije
- Metabolizem ogljikovih hidratov, uravnavanje sinteze in razgradnje ogljikovih hidratov
- Metabolizem maščobnih kislin in trigliceridov
- Metabolizem nukleotidov in nukleinskih kislin, uravnavanje metabolizma nukleotidov, bolezni povezane z metabolizmom nukleotidov
- Metabolizem aminokislin, prebava proteinov, razgradnja aminokislin, biosinteza neesencialnih aminokislin, uravnavanje hitrosti metabolizma aminokislin, bolezni povezane z metaboličnimi

Content (Syllabus outline):

- Introduction to the biochemistry, molecular bases of life, water, elements and ions of biological importance, classification of biomolecules.
- Introduction to the protein structure.
- Proteins: general structure and characteristics, classification by the function (enzymes, transport, contractile, accumulative, defence and regulatory proteins).
- Fibrillar and globular proteins.
- Enzymes: general features and bases of enzymatic kinetics.
- Biochemical components of cells and tissues.
- Digestive enzymes; introduction to the metabolic pathways, major experimental approaches to the study of metabolism.
- Oxidative processes in the cell and energy generation.
- Metabolism of carbohydrates, regulation of anabolism and catabolism of carbohydrates.
- Metabolism of fatty acids and triglycerides.
- Metabolism of nucleotides and nucleic acids, regulation of their metabolism, diseases.
- Metabolism of amino acids and proteins, anabolism and catabolism of essential and non-essential amino acids, regulation of metabolism, diseases that arose

<p>defekti v metabolizmu aminokislin; aminokislina kot izhodne snovi v biosintezah biološko pomembnih spojin</p> <ol style="list-style-type: none"> 13. Pomen biokemije za razlago in zdravljenje bolezni 14. Biosinteza proteinov, usmerjanje, znotrajcelični transport, zvijanje, kontrola kvalitete, degradacija 15. Vloga hormonov v uravnavanju metaboličnih procesov 16. Metabolizem goriv v različnih metabolnih stanjih (po obroku, med obroki, dolgotrajno stradnanje) 17. Metabolične značilnosti posameznih tkiv in organov. Skeletna mišica, srčna mišica, jetra, maščevje, ledvica, živčevje, krvni elementi, koža, oko, pljuča, vezivno tkivo 18. Medsebojna odvisnost in vloga organov v metaboličnih procesih pri človeku. 19. Biokemija krvnih skupin in koagulacija krvi; 20. Metabolne bolezni, vključno z dednimi sindromi 	<p>from metabolic disorders, amino acids as precursors in biosynthesis of biologically important molecules.</p> <ol style="list-style-type: none"> 13. Importance of biochemistry for disease explanation and treatment. 14. Biosynthesis of proteins, conformations, folding, quality control, intracellular transport, protein degradation. 15. Role of hormones in the regulation of metabolic processes. 16. Fuel metabolism in different states (the feed state, absorptive state, prolonged fasting). 17. Metabolic characteristics of individual tissues and organs (skeletal muscle, heart muscle, liver, adipose tissue, kidneys, nervous system, blood elements, skin, eye, lungs, connective tissue). 18. Interrelation and interactions of the organs in the metabolism of human body. 19. Biochemistry of blood groups and coagulation. 20. Metabolic diseases, including hereditary syndromes.
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Temeljni literatura in viri / Readings:

TEMEJNA LITERATURA:

1. D.E. Nelson, M.M. Cox, Lehninger Principles of Biochemistry, 8th Ed. New York : Macmillan Learning, 2021.

DODATNA LITERATURA:

1. Temelji biokemije. Boyer, Rodney F. Ljubljana : Študentska založba, 2005. Jezik – slovenski. ISBN -961-242-041-6.
2. Michael Lieberman, Allan Marks, Alisa Peet.: Marks' basic medical biochemistry : a clinical approach. 5th ed., [international ed.]. – Philadelphia [etc.] : Wolters Kluwer Health, ISBN 1-4963-8772-4 (broš.); 978-1-4963-8772-1 (broš.); cop. 2018.
3. N. V. Bhagavan, Chung-Eun Ha.: Essentials of Medical Biochemistry 2nd Edition With Clinical Cases, Paperback ISBN: 9780124166875 ; Imprint: Academic Press ; Published Date: 1st June 2015.
4. Berg JM. Biochemistry. 9th ed. New York: Macmillan International; 2019.
5. Voet D, Voet JG, Pratt CW. Voet's principles of biochemistry. Global, 5th ed. Hoboken: Wiley; 2016.

Cilji in kompetence:

Cilj tega predmeta je nadgraditi znanja iz splošne kemije in poznavanje kemijske zgradbe molekul in reakcij, ter spoznati in poglobljeno razumeti biokemijske reakcije in procese v človeškem organizmu. Študent se bo spoznal z biomolekulami v človeškem telesu in s temeljnimi zakonitostmi ter mehanizmi biokemijskih procesov. Ti predstavljajo osnovo za razumevanje življenjskih procesov v zdravem in bolezenskem stanju organizma. Biokemija je povezana z vsebinami molekularna biologija in biologija celice, študent bo tudi lažje razumel patofiziologijo, farmakologijo in večino kliničnih predmetov.

Objectives and competences:

The objective of this course is to upgrade the knowledge in general chemistry and chemical structures of molecules and reactions, and to learn and understand at the deep level the biochemical reactions and processes in the human body. Students will get acquainted with biomolecules in the human body and with fundamental characteristics and mechanisms of biochemical processes. These represent the basis for understanding the life processes in the healthy or pathological state of the organism. Biochemistry is related to other life sciences and will help the students to better understand Molecular Biology, Cell Biology, Pathophysiology, Pharmacology and most of the clinical subjects.

Predvideni študijski rezultati:**Intended learning outcomes:**Znanje in razumevanje:

Študent pridobi znanje iz biokemijskih procesov, ki omogoča živim organizmom normalno delovanje in vzdrževanje optimalnih koncentracij celičnih sestavin in telesnih tekočin ter rast in razmnoževanje.

Ob koncu predmeta je študent sposoben navesti in strukturno opisati pglavitne makromolekule v celicah in tkivih ter pojasniti njihove funkcije v celici.

Študent razume in zna predstaviti biokemijske reakcije in molekularne procese ter razložiti transportne pojave, ki potekajo v človeškem organizmu.

Biokemija integrira molekularne osnove temeljnih življenjskih procesov in je nujna za razumevanje vzrokov bolezni ter molekularnih pristopov zdravljenja. Študent ob koncu predmeta zna interpretirati molekularne mehanizme delovanja zdravega organizma in povezati okvare v metabolnih poteh z nastankom bolezni.

Prenesljive/ključne spretnosti in drugi atributi:

Študent spozna delovanje organizma na molekularni ravni in razvije spretnosti dela v skupini ter komputacijske spretnosti.

Knowledge and understanding:

Students acquire the fundamental knowledge of biochemical processes that enable living organisms to function normally and to maintain optimal concentrations of cellular components and body fluids, and are required for growth and reproduction.

At the end of this course, the student is able to list and describe the structures of the main macromolecules in cells and tissues and to explain their functions in the cell.

The student understands and is able to describe biochemical reactions and molecular processes and is able to explain the transport processes occurring in the human organism.

Biochemistry integrates the molecular basis of life processes and is essential for understanding the causes of disease and the molecular approaches for treatment. At the end of the course, the student will be able to interpret the molecular processes in a healthy organism and to associate the defects in metabolic pathways to the development of disease.

Transferable/key skills and other attributes:

The student gains in-depth knowledge of how the organism functions at the molecular level and develops teamwork and computational skills.

Metode poučevanja in učenja:**Learning and teaching methods:**

Predavanja
Seminarji

Lectures
Seminars

V okviru seminarjev se bodo obravnavale aktualne teme s področja predmeta

The seminars will cover trending topics in the subject area

Načini ocenjevanja:**Delež (v %) /
Weight (in %)****Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt)

- pisni izpit

100 %

Type (examination, oral, coursework, project):

- written exam

ŠTUDIJSKE OBVEZNOSTI ŠTUDENTOV

- 80% prisotnost na seminarjih

ACADEMIC OBLIGATIONS OF STUDENTS

- 80% attendance at seminars

POGOJ ZA PRISTOP K IZPITU

- 80% prisotnost na seminarjih

CONDITIONS FOR TAKING THE EXAM

- 80 % attendance at seminars

Reference nosilca / Lecturer's references:

1. PRAŠNIKAR, Erika, KUNEJ, Tanja, KNEZ, Jure, REPNIK, Katja, POTOČNIK, Uroš, KOVAČIČ, Borut. Determining the molecular background of endometrial receptivity in adenomyosis. *Biomolecules*, ISSN 2218-273X, 2020, vol. 10, issue 9, str. [1]-25, ilustr. <https://www.mdpi.com/2218-273X/10/9/1311>, <https://doi.org/10.3390/biom10091311>, doi: 10.3390/biom10091311. [COBISS.SI-ID 28211459], [JCR, SNIP, WoS do 27. 6. 2021: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.17, Scopus do

25. 6. 2021: št. citatov (TC): 1, čistih citatov (CI): 1, čistih citatov na avtorja (CIAu): 0.17] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICM točke: 15.59, št. avtorjev: 6
2. REPAS, Jernej, ZÜGNER, Elmar, GOLE, Boris, BIZJAK, Maruša, POTOČNIK, Uroš, MAGNES, Christoph, PAVLIN, Mojca. Metabolic profiling of attached and detached metformin and 2-deoxy-D-glucose treated breast cancer cells reveals adaptive changes in metabolome of detached cells. *Scientific reports*, ISSN 2045-2322, 2021, 11, art. no. 21354, str. 1-19, ilustr. <https://www.nature.com/articles/s41598-021-98642-0>, doi: 10.1038/s41598-021-98642-0. [COBISS.SI-ID 84179971], [JCR, SNIP, WoS do 27. 4. 2022: št. citatov (TC): 3, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.29, Scopus do 5. 4. 2022: št. citatov (TC): 2, čistih citatov (CI): 2, čistih citatov na avtorja (CIAu): 0.29] kategorija: 1A1 (Z, A', A1/2); uvrstitev: SCI, Scopus, MBP; tip dela je verificiral OSICN točke: 14.99, št. avtorjev: 7
 3. ŠALAMON, Špela, BEVC, Sebastjan, EKART, Robert, HOJS, Radovan, POTOČNIK, Uroš. Polymorphism in the GATM locus associated with dialysis-independent chronic kidney disease but not dialysis-dependent kidney failure. *Genes*, ISSN 2073-4425, Jun. 2021, vol. 12, issue 6, str. [1]-12. <https://www.mdpi.com/2073-4425/12/6/834>, doi: 10.3390/genes12060834. [COBISS.SI-ID 65280515], [JCR, SNIP, WoS do 5. 7. 2021: št. citatov (TC): 0, čistih citatov (CI): 0, čistih citatov na avtorja (CIAu): 0] kategorija: 1A2 (Z, A1/2); uvrstitev: SCI, Scopus, MBP; tip dela še ni verificiran točke: 18.9, št. avtorjev: 5