

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	KEMIJA BIOMOLEKUL
Course Title:	CHEMISTRY OF BIOMOLECULES

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Biokemija, 2. stopnja	/	2.	4.
USP Biochemistry, 2 nd Cycle	/	2 nd	4 th

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: BI2112

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	/	45 LV	/	/	75	5

Nosilec predmeta / Lecturer: doc. dr. Bogdan Štefane / Dr. Bogdan Štefane, Assistant Professor

Jeziki / Languages:

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Ogljikovi hidrati. Tipične lastnosti monosaharidov, oligosaharidov in polisaharidov. Kemijske in spektroskopske metode za določanje strukture monosaharidov. Blokada glikozidne OH skupine in pravih alkoholnih skupin. Pregled sinteznih metod: descendente in ascendentne sinteze. Sprememba konfiguracije na enem, dveh ali več kiralnih centrih. Načini sinteze oligosaharidov. Sinteze s tvorbo nove glikozidne vezi. Sinteza na trdnem nosilcu. Polisaharidi. Heteropolisaharidi: glikoproteini in proteoglikani. Metode določanja strukture polisaharidov.
Amino kisline. Lastnosti aminokislin. Priprava

Content (Syllabus outline):

Carbohydrates, their properties. Chemical and spectroscopic methods for structure determination of monosaccharides. Interconversion of monosaccharides: inversion of configuration at the chiral centres, other methods. Oligosaccharides and polysaccharides: synthesis of oligosaccharides, properties of glycoproteins and proteoglycans, structure determination of simple polysaccharides. Amino acids. Synthesis of α -amino acids. Asymmetric synthesis. β -amino acids. Other amino acids. Typical transformations of α -amino acids. Formation of the peptide bond. Activation of the carboxylic component. Activation of N-terminal α -amino acid. Azide method, mixed anhydrides, application of

α -aminokislin. Aminiranje, reduktivno aminiranje in aminiranje s premestitvami. Sinteze preko izocianidov. Kondenzacija aldehydov z aktivnimi metilenskimi spojinami. Asimetrične sinteze. β -Aminokislina. Ostale aminokislina. Reakcije aminokislin. Oksidativno deaminiranje. *N*-Alkiliranje in *N*-aciliranje. *N*-Amino derivati. Nekatere zaščite aminskega in karboksilnega dela molekule. Primeri tvorbe peptidne vezi.

Nukleozidov in nukleotidi. Osnovne karakteristike nukleozidov. *N*-nukleozidi. Načini sintez preko srebrovih in živosrebrovih soli. Uporaba dialkoksi pirimidinov ter sililnih derivatov purinov in pirimidinov. Tvorba heterocikličnega obroča po glikozilaciji. Interkonverzija nukleozidov. Ciklonukleozidi. Aciklo nukleozidi. *C*-nukleozidi: interkonverzija *C*-nukleozidov, Noyori-jeva sinteza. Reakcije nukleozidov. Tvorba nukleotidov. Uvedba difosfatne skupine. Pristop k sintezi oligonukleotidov.

Terpeni in steroidi. Karakteristike terpenov, monoterpeni, seskviterpeni, diterpeni, triterpeni in tetraterpeni. Primer izolacije in aplikacije monoterpena v večstopenjski sintezi. Steroidi, osnovni tipi steroidov, steroli in žolčne kisline. Nekatere transformacije steroidov.

Laboratorijske vaje: izvedba večstopenjskih sintez s področja aminokislin, terpenov in steroidov.

carbodiimides, CDI and similar reagents. Synthesis on solid supports. Nucleosides and nucleotides: *N*-nucleosides, cyclonucleosides, acyclo nucleosides, *C*-nucleosides: Noyori synthesis, typical reactions of nucleosides. Nucleotides: protection of the sugar, base and the phosphate group. Formation of internucleotide bond. Terpenes and steroids. Monoterpenes and sesquiterpenes. Diterpenes. Triterpenes and tetraterpenes: squalene, β -carotene, lycopene. Isolation and application of monoterpene in multistep synthesis. Steroids. Classification and properties. Sterols. Bile acids and bile. Transformations of steroids.

Temeljna literatura in viri / Readings:

- J. Mann, R. S. Davidson, J. B. Hobbs, D. V. Banthrope, J. B. Harborne: Natural Products. Their Chemistry and Biological Significance, Longman, Harlow, 1995, 455 pp (approximately 90 pages).
- N. L. Benoiton: Chemistry of Peptide Synthesis, CRC Press, Taylor & Francis Group, 2006, 290 pp (approximately 55 pages). The literature required for an individual seminar is available in our library.

Cilji in kompetence:

Študent pozna osnovne karakteristike nekaterih biološko pomembnih spojin. Obvlada principe njihove priprave, transformacij in uporabe pri sintezi primernih

Objectives and Competences:

Student is familiar with characteristics and reactivity of some biologically relevant compounds. They are also capable of planning

derivatov. Spozna uvedbo in odcep osnovnih zaščitnih skupin. Pridobljeno znanje mu omogoča načrtovanje sintez nekaterih naravnih spojin in njihovih derivatov

synthesis, transformations, and other manipulations of targeted biologically important compounds. Students gain knowledge of typical protecting groups used in transformations of bioorganic molecules.
Competences:
Ability to plan and execute the synthesis of biologically relevant compounds.

Predvideni študijski rezultati:

Znanje in razumevanje

Poznavanje strukture pomembnih bioloških spojin, njihove reaktivnosti in različnih možnosti njihovih transformacij.

Uporaba

Poznavanje navedene vsebine bo omogočilo razviti sposobnost študenta, da pridobljeno znanje uporabi v razumevanju bioloških procesov.

Refleksija

Zavedanje, da lahko z enostavnimi substrati, ki jih študent spozna pri tem predmetu, učinkovito rešimo sicer zapletene poti do številnih biološko aktivnih spojin.

Prenosljive spretnosti

Pri predmetu se študenti z reševanjem različnih problemov izurijo v uporabi znanja, analitičnega mišljenja in uporabe literaturnih virov.

Intended Learning Outcomes:

Knowledge and Comprehension

Student understands and is familiar with:
-structures of important biological compounds
-reactivity and basic transformations of biological compounds

Application

Mastered knowledge will help student to solve different synthetic problems of biologically important compounds.

Analysis

Student is capable of recognising different types of biological compounds and also plans their transformations.

Skill-transference Ability

During the course, student will be able to solve theoretical problems, improve his analytical way of thinking and get familiar with literature sources.

Metode poučevanja in učenja:

Predavanja in laboratorijske vaje.

Learning and Teaching Methods:

Lectures, seminar work, training by analytically solving theoretical problems.

Načini ocenjevanja:

Pisni izpit

Delež (v %) /

Weight (in %)

Assessment:

Written exam

Reference nosilca / Lecturer's references:

- BERANIČ, Nataša, **ŠTEFANE, Bogdan**, BRUS, Boris, GOBEC, Stanislav, LANIŠNIK-RIŽNER, Tea. New enzymatic assay for the AKR1C enzymes. V: PLAPP, Bryce (ur.), et al. *Enzymology and molecular biology of carbonyl metabolism*, (Chemico-Biological Interactions, ISSN 0009-2797, vol. 202, iss. 1/3). Amsterdam: Elsevier, 2013, str. 204-209, ilustr., doi: [10.1016/j.cbi.2012.12.003](https://doi.org/10.1016/j.cbi.2012.12.003). [COBISS.SI-ID [30357465](https://www.cobiss.si/id/30357465)]

- SOSIČ, Izidor, MIRKOVIĆ, Bojana, ARENZ, Katharina, **ŠTEFANE, Bogdan**, KOS, Janko, GOBEC, Stanislav. Development of new cathepsin B inhibitors: combining bioisosteric replacements and structure-based design to explore the structure-activity relationships of nitroxoline derivatives. *Journal of medicinal chemistry*, ISSN 0022-2623, 2013, vol. 56, no. 2, str. 521-533.

<http://pubs.acs.org/doi/pdf/10.1021/jm301544x>, doi: [10.1021/jm301544x](https://doi.org/10.1021/jm301544x). [COBISS.SI-ID [3370865](#)]

- SOSIČ, Izidor, MIRKOVIĆ, Bojana, TURK, Samo, **ŠTEFANE, Bogdan**, KOS, Janko, GOBEC, Stanislav. Discovery and kinetic evaluation of 6-substituted 4-benzylthio-1,3,5- triazin-2(1H)-ones as inhibitors of cathepsin B. *European Journal of Medicinal Chemistry*, ISSN 0223-5234. [Print ed.], 2011, vol. 46, iss. 9, str. 4648-4656. doi: [10.1016/j.ejmech.2011.08.005](https://doi.org/10.1016/j.ejmech.2011.08.005). [COBISS.SI-ID [3068017](#)],

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