



Subject card

Subject name and code	Bioorganic Chemistry and Stereochemistry, PG_00058276						
Field of study	Biotechnology						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Organic Chemistry -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Maria Milewska				
	Teachers		prof. dr hab. inż. Maria Milewska dr inż. Andrzej Skwarecki dr hab. Sławomir Makowiec				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		2.0		18.0	50
Subject objectives	Broadening of knowledge on biologically active compounds, especially concerning structure-activity relationship, including the optically active molecules.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_K02] is aware of the limitations and the necessity of continuous development of knowledge and technology; understands the need for education and constant training		The student updates the knowledge and improves professional skills; understands the need for education and training throughout life		[SK2] Assessment of progress of work		
	[K7_U04] is able to predict potential properties of biomolecules and biologically active compounds on the basis of knowledge of their chemical structure and apply methods of molecular modelling of biomolecules		Student is able to predict potential chemical properties of biologically active compounds, based on knowledge of their chemical structure		[SU2] Assessment of ability to analyse information		
	[K7_W02] has advanced knowledge of structure and activity of enzymes and biologically active compounds also in pharmacological context, knows basic instrumental methods of qualitative and quantitative analysis and activity studies of biomolecules		The student is able to predict the biological activity of a molecule based on information about the structure of enzymes		[SW1] Assessment of factual knowledge		

Subject contents	<p>Biostereochemistry</p> <p>1) The conformation of carbon compounds - molecular geometry parameters; conformations of linear compounds non-binding interactions; conformations of cyclic compounds - boat and chair conformations of six-membered rings; anomeric effect2) Configuration and chirality of the molecule - symmetry elements and symmetry operations; point symmetry groups examples of molecules; chiral molecules with one stereogenic center; molecules containing more than one stereogenic center; <i>meso</i>, <i>erythro/threo</i> and <i>syn/anti</i> configuration; epimers; chirality of molecules without stereogenic centers - axial chirality, plane chirality and internally dissymmetric molecules; rules for separating enantiomers3) Carbohydrates - stereochemical issues in carbohydrates; pyranose ring - configuration and conformation; interactions between substituents in pyranose rings; ring size determination, pyranose and furanose forms; anchimeric support neighboring group effect4) Amino acids - stereochemical issues in amino acids; peptide bond structure;Ramachandran chart; racemisation of amino acids and their derivatives5) Organocatalysts Synzymes; types of organocatalysts; reactions catalyzed by organocatalysts; enantiomeric and diastereomeric excess; catalysis mechanisms using synzymes6) Steroids - structure of steroids; steroid reactivity; stereochemical problems in steroids</p> <p>Bioorganic Chemistry</p> <p>1. Nucleic acids Basic interactions in DNA. Biosynthesis, chemical synthesis and separation of DNA. Chemical reactions involving DNA. RNA structure. RNA biosynthesis and degradation.</p> <p>2. Proteins and peptides Chemical synthesis of peptides on the solid phase. Protein kinases and proteases mechanisms of action. Enzymes using organic cofactors.</p> <p>3. Carbohydrates - Chemistry and enzymology of the glycosidic bond. Glycans: polysaccharides. Glycans: glycoproteins. Chemical synthesis of oligosaccharides.</p> <p>4. Polyketides Chemical structure and biosynthesis. Polyketides in the human body. Other natural polyketides</p> <p>5. Terpenes Human terpenes chemical structure and biosynthesis. Other terpenes of natural origin.</p> <p>6. Chemical basis of biology Atomic and molecular orbitals. Intermolecular forces. Prebiotic chemistry</p> <p>7. Transmission of information in biological systems Transmission of information without affecting transcription processes. Intracellular receptors. G protein-related receptors. Receptors with tyrosine kinase activity. Ion channels.</p>		
Prerequisites and co-requisites	Knowledge of basic principles of organic chemistry		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written examination part II - Bioorganic Chemistry	55.0%	50.0%
	Written examination part I - Biostereochemistry	55.0%	50.0%
Recommended reading	Basic literature	<p>1. D. van Vranken, G. Weiss, Introduction to Bioorganic Chemistry and Chemical Biology, Garland Science Taylor & Francis Group, New York and London 2013</p> <p>2. E. L. Eliel, S. H. Wilen, L. N. Mander STEREOCHEMISTRY OF ORGANIC COMPOUNDS, J. Wiley&Sons, Inc., 1994</p> <p>3. M. Nogradi STEREOCHEMIA. PODSTAWY I ZASTOSOWANIA, PWN Warszawa, 1988</p> <p>4. I. Z. Siemion BIOSTEREOCHEMIA, PWN Warszawa, 1985</p>	
	Supplementary literature	<p>1. G. L. Patrick, An introduction to medicinal chemistry sixth edition, Oxford University Press, Oxford 2017</p> <p>2. P. Kafarski, B. Lejczak, Chemia Bioorganiczna, Polskie Wydawnictwo Naukowe 1994</p> <p>3. C. H. Wong, G. M. Whitesides ENZYMES IN SYNTHETIC ORGANIC CHEMISTRY, Pergamon 1995</p>	
	eResources addresses	Adresy na platformie eNauczanie: Chemia Bioorganiczna i Biostereochemia - Moodle ID: 33536 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33536	
Example issues/ example questions/ tasks being completed	Determine the R / S configuration of all the stereogenic mevinoline centers		
Work placement	Not applicable		