University of Gdańsk

Subject card

Subject name and code	Biomolecules - structure, synthesis and properties (M02_B1), PG_00196903		
Field of study	Biotechnology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Bachelor's 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	6.0
Learning profile	academic	Assessment form	exam
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Katarzyna Węgrzyn	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	78.0	0.0	0.0	0.0	0.0	78

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	78	10.0	62.0	150

Subject objectives

Program block 01 in Module 02 aims to provide detailed knowledge about the structure and properties of biomolecules (such as active low- and medium-molecular-weight compounds as well as proteins, nucleic acids, sugars and lipids) that create more complex biological systems, cellular compartments. By completing the program block, the student will gain detailed knowledge about the synthesis of biomolecules. The student will also gain knowledge related to the use of biomolecules' isolation methods and their biochemical, biophysical and bioinformatic analysis.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHL3_W07] The graduate has advanced knowledge of the rules of operation and the possibilities of using research techniques and tools used in biotechnology.	Student has advanced knowledge about the synthesis of biomolecules. The student has also knowledge related to the use of biomolecules' isolation methods and their biochemical, biophysical and bioinformatic analysis.	[SW4] test/exam - oral or written
[BIOTECHL3_W01] The graduate possesses structured and advanced knowledge of biological phenomena at the molecular level and understands their importance for biotechnology.	Student has advanced knowledge about the structure and properties of biomolecules (such as active low- and medium-molecular-weight compounds as well as proteins, nucleic acids, sugars and lipids) that create more complex biological systems, cellular compartments.	[SW4] test/exam - oral or written

Subject contents	F1. Introduction • Compounds C, H, O, N, P, and S as the basis of life on Earth, primary synthesis • Core structures of simple biomolecules and their derivatives • Structures composed of simple repeating units • Main families of chemical compounds and connections between compounds from different families F2. Carbohydrates • Structure of simple and complex sugars (homo- and heteroglycans) • Transformations of simple sugars • Synthesis of complex sugars F3. Nucleic Acids • Structure of nitrogenous bases, nucleosides, and nucleotides, glycosidic and phosphoester bonds • Structure of oligonucleotides and nucleic acids, anhydride bonds of phosphoric acid, peptide analogs of nucleic acids, synthesis of oligonucleotide probes • Interconversions of nucleic acids, levels of genetic information transfer • Components of DNA, base pairing, tautomeric forms, B-helix shape, sequence recognition, DNA topology • Components of RNA, differences in spatial structure, spatial structures • DNA synthesis, replication models • Chromosome segregation • Replication forks, direction of DNA synthesis • *E. coli* polymerases • DNA helicase, topoisomerase, gyrase, SSB protein, polC holoenzyme, beta clamp • Coordination of leading and lagging strands, removal of Okazaki fragments, initiation at oriC, decatenation • Mutations, mutagens, DNA polymerase slippage • DNA repair systems • Emergency replication, homologous recombination, site-specific recombination • RNA synthesis • Linking transcription and translation via ppGpp • Synthesis and processing of rRNA and tRNA • Antibiotics inhibiting the replication process F4. Proteins • Structure of amino acids, peptide bond, oligopeptides • Protein structure (primary, secondary, tertiary, and quaternary structure); modular structures of proteins • Protein synthesis • Post-translational modifications of proteins • Proteins degradation in a cell F5. Lipids • Structure and biosynthesis of fatty acids • Modifications of fatty acids • Structure and biosynthesis of phospholipids, glycolipids, and triacylglycerols • Structure and biosynthesis of sphingolipids, ether lipids, suberin, cutin, and waxes • Structure and biosynthesis of cholesterol and plant isoprenoids F6. Analysis of Biomolecules methods • Chromatographic methods • Methods used in the analysis of nucleic acids and proteins • Methods used in the analysis of lipids • Databases and bioinformatics methods
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
F1-F6	51.0%	60.0%
Comprehensive integrating exam exam	50.0%	40.0%

Recommended reading	Basic literature	• Biochemistry, The Chemical Reactions of Living Cells. David E. Metzler, vol. 1 & 2. Second Edition, Elsevier, Academic Press, 2004 • Biochemistry, J.M. Berg, J.L. Tymoczko, L. Stryer, Scientific Publishing House PWN, Warsaw 2013 • LIPIDS - Chris Somerville, John Browse, Jan Jaworski, John Ohlrogge. In: Biochemistry & Molecular Biology of Plants. B. Buchanan, W. Gruissem, R. Jones, Eds. 2000, American Society of Plant Physiologist, Rockville, Maryland, USA (or 2nd edition, ISBN: 978-0-470-71421-8; Published 2015 by John Wiley & Sons, Ltd) • Plant Physiology. J. Kopcewicz and S. Lewak, Eds. 2002. Scientific Publishing House PWN Warsaw • Molecular Cell Biology, Lodish et al., edition IX (2021) • Molecular Biology of the cell, Alberts et al., editionVII (2022) • Genomes, A.T. Brown, edition IV (2018), PWN • Molecular Biology of the Gene, Watson et al., 7th edition (2014) • Genes XI, Lewin, 11th edition (2014)
	Supplementary literature	• Molecular Genetics, Węgleński et al., 6th edition (2012), PWN • Molecular Biology of Bacteria, Baj and Markiewicz, 1st edition (2012), PWN • Essential Cell Biology, Alberts et al., 2nd edition (2005), PWN • Principles of Biochemistry, Lehninger, 5th edition (2008) • Molecular Cloning, Sambrook and Russel, 4th edition (2012) • Molecular Cloning - A Laboratory Manual by Sambrook, Fritsch, and Maniatis • Molecular Cloning - A Laboratory Manual. 4th edition, (2012) Green, Sambrook • Materials prepared by the instructor • Materials independently searched and selected by students related to the classes using library resources and electronic sources
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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