GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Chemistry of Proteins and Nucleic Acids, PG_00037518		
Field of study	Biotechnology		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group 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	4	Language of instruction	Polish
Semester of study	7	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Microbiology -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Piątek	
	Teachers		

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

Introduction to protein and nucleic acid structure and function.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W06		
K6_W02		

Subject contents

LECTURE Physicochemical properties of amino acids: side chain properties, chirality of amino acids. Structural implication of the peptide bond: electronic structure, definitions of dihedral angles , and . Sterically allowed regions of dihedral angles the Ramachandran plot. Protein secondary structures - interactions: hydrogen bonds, VdW interactions, hydrophobic efect. Classification of secondary structures: right handed -helix, 310-helix, -helix, parallel beta sheet, antiparallel beta sheet, mixed beta sheet, loop regions. The moment dipole of -helix, intrisinic twist of beta sheets. Adjustment of secondary structures in protein structures. Geometry of interactions between helices: the knobs in the hole and ridges in the grooves packed. Geometry of interactions sheet/ sheet, sheet/ helix. Methods of presentation of secondary structures in protein structures. Topology diagrams as method of representation protein triaty structure. Supersecondary structures (motifs) secondary structure elements with a specific geometric arrangement frequently found in proteins. Domain the fundamental functional and structurally stabile unit of protein tertiary structure. Tertiary protein structure the -domain structures: the coiled-coil arrangement, examples: GCN4 transcription factor; the four-helix bundle domain, examples: cytochrome b562, Rop protein. Other -domain structures: the hemoglobin structural aspects of sickle-cell anemia, the bacterial muramidase. Tertiary protein structure the alpha-beta domains. The alpha-beta barrel (TIM barrel), examples: triosephosphate isomerase, methylmalonyl-coenzyme A mutase, pyruvate kinase. The alpha-beta twisted open-sheet domains method of prediction of protein active sites by identification of Rossman fold. The alpha-beta-horseshoe fold, example: ribonuclease inhibitor. Tertiary protein structure the beta structures. The up-and-down barrels, examples: retinol-binding protein RBP, superoxide dismutase SOD. The proteins with Greek key and jelly roll motifs. The Neuraminidase and the hemagglutinin proteins of influenza virus as examples of structures containing the antiparallel beta sheet and jelly roll motifs. Thermodynamic aspects of protein stability. The hydrophobic effect as a dominate force in protein folding. The thermodynamic parameters describing protein folding/unfolding: H, S and Cp. Phenomena of protein cold denaturation. The differential scanning calorimetry technique. The nucleic acids structure and function. The ribozymes structure, function and application. Methods of chemical synthesis of peptides and nucleic acids.

Prerequisites and co-requisites

Fundamentals of biochemistry and physical chemistry.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Two selection tests during the semester.</td><td>60.0%</td><td>0.0%</td></tr>
<tr><td>Lecture - the final evaluation includes an oral examination - for the classroom mode.</td><td>60.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>A.Fersht, Structure and Mechanism in protein science, Freeman 2000.

A.Cooper, Biophysical Chemistry, RSC 2004.

C.Branden & J.Tooze, Introduction to protein structure, Garland 1999.</td></tr>
<tr><td>Supplementary literature</td><td>No requirements</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Impact of amino acid residue structure on protein function.

Influence of peptide bond structure on the process of protein folding.

Enzymatic catalysis on the example of serine proteases.

Secondary structure of proteins - association with the structure of peptide bond and properties of side residues.

Kinetic and thermodynamic stability of proteins.

Hierarchical structure of proteins - motives and domains.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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