

**Subject card**

<b>Subject name and code</b>	Biophysics of biologically active compounds, PG_00153615						
<b>Field of study</b>	Biotechnology						
<b>Date of commencement of studies</b>	October 2024	<b>Academic year of realisation of subject</b>			2024/2025		
<b>Education level</b>	Master's studies	<b>Subject group</b>			Optional subject group		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	1	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	1	<b>ECTS credits</b>			2.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>	Laboratory of Biophysics -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr hab. Jacek Piosik				
	<b>Teachers</b>		dr hab. Jacek Piosik				
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	30		5.0		15.0	50
<b>Subject objectives</b>	<p>The aim of the course is to relay knowledge about the basic physical laws and the possibility of applying them in examining biochemical processes and in broadly-understood biotechnology. Presentation of the basics of modeling complex research systems and biochemical processes and of applying these methods in biotechnology. Students will acquire current knowledge concerning qualitative and quantitative examination of interference between small molecule compounds and macromolecules (nucleic acids), nanoparticles, and with other small molecule compounds, get to know the mechanisms of action of anticancer drugs, toxins, and exogenic mutagens and cancerogens. They will acquire an ability to analyze and interpret experimental results, listen with understanding, solve tasks and think critically. In consequence, they will acquire an ability to relay the knowledge acquired during classes and its further use in subsequent course of studies and in raising their qualifications in the field of broadly-understood biotechnology.</p>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOTECHMU2_W01] The graduate knows and understands complex biological phenomena at the molecular level, their importance for biotechnology	The student knows the basic physical laws and their application in biotechnology. The student knows the basic interactions of low molecular compounds and nanoparticles with macromolecules. The student knows the mechanisms of action of basic anticancer drugs.	[SW4] test/exam - oral or written
	[BIOTECHMU2_K01] The graduate is willing to constantly improve, update knowledge and raise qualifications in the field of biotechnology, he/she knows the limitations of his/her own knowledge	The student can apply the basic laws of physics to solve research problems in biotechnology.	[SK4] test/exam - oral or written
	[BIOTECHMU2_W05] The graduate knows and understands the methods used in science and natural sciences necessary to understand biological phenomena and processes at the molecular level	The student has knowledge of biophysical and computational methods and their practical use in understanding complex biotechnology issues.	[SW4] test/exam - oral or written
Subject contents	<p>Basic physical laws and physical units, elements of the structure of matter wave and corpuscular theory, phenomena arguing for wave and corpuscular theory, Louis de Broglie dualism of mass, radioactivity, electron shells, orbitals, chemical bonds covalent and ionic, van-der-Waals and hydrogen interactions. The structure and properties of water, water as an environment for biochemical reactions. The structure of the DNA double helix stabilization mechanisms, various kinds of bonds between complementary base pairs. DNA as a target of various small molecule compounds (ligands). Overview of the mechanisms of interaction between various ligands and DNA: covalent bonds of ligands with DNA (electrophiles, nucleophiles), physical-chemical interactions (intercalation, bis- and multi-intercalation, interactions in the major and minor groove of DNA). Thermodynamics of DNA and ligand association. Overview of models of ligand-DNA interactions (McGhee von Hippel model) and research methodology of such interactions. Overview of selected ligands (mutagenesis, toxins, anti-cancer drugs) and the mechanisms of their biological activity. Presentation of a selected methodology used in examining such substances (physical chemical methods, spectrophotometry, spectrofluorometry, circular dichroism, calorimetry, flow calorimetry and others) as well as computational methods. Overview of small molecule compounds interactions in aqueous solutions. Thermodynamic models of mixed association of ligands, with particular focus on the differences between the discussed models. Presentation of research methods of such interactions and computational techniques. Overview of possibilities of modulating ligands biological activity through interactions with other small molecule compounds (e.g. methylxantines). Thermodynamic modeling of such processes and overview of experimental and computational methods. Elements of chemoprevention. Overview of selected methods of examining ligands biological activity (mutagenesis tests, cytotoxicity tests, examination of cell cycle perturbation).</p>		
Prerequisites and co-requisites	Basic course of inorganic and organic chemistry, physics, biochemistry and biophysics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test	51.0%	100.0%
Recommended reading	Basic literature	Handbooks of chemistry, biochemistry, physics and biophysics.	
	Supplementary literature	None	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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