University of Gdańsk

Subject card

Subject name and code	Biophysics of biologically active compounds, PG_00153615		
Field of study	Biotechnology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Biophysics -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Jacek Piosik	
	Teachers		

Lesson types

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	5.0	15.0	50

Subject objectives

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.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHMU2_W05] The graduate possesses in-depth knowledge of methods used in the field of exact and natural sciences, necessary to understand biological phenomena and processes at the molecular level, and the connection of this knowledge with medical sciences.	The student has knowledge of biophysical and computational methods and their practical use in understanding complex biotechnology issues.	[SW4] test/exam - oral or written
[BIOTECHMU2_W01] The graduate has in-depth knowledge of complex biological phenomena at the molecular level and knows their importance for biotechnology, is able to analyze them in an interdisciplinary approach and assess their ethical, social and environmental implications.	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 consciously combines knowledge acquired in previous stages of education with knowledge acquired on an ongoing basis to solve problems in the field of biotechnology; consciously deepens and updates knowledge and improves qualifications related to biotechnology in the field of exact and natural sciences and medical and health sciences.	The student can apply the basic laws of physics to solve research problems in biotechnology.	[SK4] test/exam - oral or written

Subject contents

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).

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

Document generated electronically. Does not require a seal or signature.