University of Gdańsk

Subject card

Subject name and code	Diploma lecture - Essentials of genetic engineering, PG_00081853		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish During the course, elements in English are used (animations reinforcing the program content, excerpts from lectures/statements by experts in the field, and educational films).
Semester of study	6	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Bionanotechnology -> Department of Molecular Biotechnology -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Agnieszka Żylicz-Stachula	
	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	This course prepares students theoretically for research in biotechnology labs. It covers techniques in genetic engineering and synthetic biology, teaching the basics of genetic manipulation, gene cloning, and gene editing technologies. Applications in medicine, agriculture, and biotechnology are explored. The course also discusses anticipated developments, opportunities, and challenges in modern genetic engineering, as well as ethical, safety, and social impacts of these practices.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEML3_K01] Identifies the level of her/his own knowledge and skills and the need for continuous learning and personal development.	1. understands the need for continuous education, 2. demonstrates caution and critical thinking in receiving and interpreting information about genetic engineering available in mass media, 3. recognizes and appreciates the opportunities presented by modern biotechnology and genetic engineering, 4. is sensitive to the potential environmental and societal threats posed by modern genetic engineering, 5. understands the need to communicate new achievements in biotechnology and genetic engineering to the public and can convey this information in an understandable manner,	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[CHEML3_W02] Describes the properties of elements and the most important chemical compounds, enumerates the methods of their preparation and methods of analysis.	1. lists, characterizes, and understands methods used in molecular biotechnology and genetic engineering, 2. lists and characterizes chemical components and basic molecular tools used in genetic engineering, including molecular probes, cloning vectors, polymerases, DNA ligases, endonucleases, exonucleases, and other DNA-modifying enzymes,	[SW4] test/exam - oral or written
[CHEML3_W03] Explains the relationship between the structure of matter and its observed properties.	1. understands and describes the structure and properties of DNA, RNA, and proteins, 2. understands and describes the processes of replication, transcription, and translation, 3. describes selected mechanisms of gene expression regulation,	[SW4] test/exam - oral or written
[CHEML3_U08] Presents in an understandable way the basic facts about chemistry using a scientific language typical of chemical sciences.	1. designs DNA primers and PCR reaction conditions, 2. analyzes DNA sequences, 3. reads and analyzes DNA chromatograms, 4. identifies sequences recognized by restriction endonucleases and predicts DNA digestion products with these enzymes, 5. designs gene expression systems, 6. describes practical applications of the molecular techniques and tools learned, 7. proposes the use of specific molecular techniques and tools to solve a given problem,	[SU1] oral statement/conversation/ discussion [SU5] implementation of a problem task

Subject contents

genetic engineering, molecular biotechnology and synthetic biology: concepts, history, achievements, perspectives, risks; transgenic microorganisms and animals; properties and applications of fluorescent proteins; various PCR variants in genetic engineering and molecular diagnostics (definition, selected modifications and example applications); nucleic acid isolation techniques; electrophoretic techniques; molecular cloning procedures and high-throughput approach; basic molecular tools (vectors, polymerases, ligases, nucleases, phosphatases and other DNA-modifying enzymes); restriction endonucleases and their applications; methods for introducing recombinant DNA into cells; methods for selecting positive bacterial clones; hybridization techniques

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	0.0%	52.0%
10-minute presentation	0.0%	20.0%
simulation excercises	0.0%	28.0%

Recommended reading

Basic literature	Mandatory literature is not required to pass the course.

	Supplementary literature	1. Lewandowska Ronnegren A., Techniki laboratoryjne w biologii molekularnej. Medpharm, Wrocław, 2023 2. Węgleński, P.; Genetyka molekularna. Wydawnictwo naukowe PWN, wyd. 6, 2006, Warszawa, 2024 3. Brown, T.A.; Genomy. Wydawnictwo naukowe PWN, Warszawa, 2019 4. Kristiansen, B., Ratledge, C. Podstawy biotechnologii. Wydawnictwo Naukowe PWN, wyd. 1, 2011, Warszawa, 2024 5. Buckingham, M.L.; Molecular diagnostics: Fundamentals, Methods and Clinical Applications. F.A. Davis Company, 2019
	eResources addresses	
Example issues/ example questions/ tasks being completed	The template DNA after site-directed mutagenesis can be removed by: a) digestion with the restriction endonuclease DpnI, b) extraction using organic compounds (phenol/chloroform), c) ethanol precipitation, d) digestion with a nonspecific nuclease. Complete the following sentence: "..... is the enzyme used in genetic engineering to dephosphorylate the ends of a DNA molecule."	
Work placement	Not applicable	

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