University of Gdańsk

Subject card

Subject name and code	Basis of genetic engineering, PG_00048689		
Field of study	Podstawy inżynierii genetycznej (Ćw. laboratoryjne)		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	Bachelor's 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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Microbial Biochemistry -> Department of General and Medical Biochemistry -> Faculty of Biology -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Sabina Kędzierska-Mieszkowska	
	Teachers	prof. dr hab. Sabina Kędzierska-Mieszkowska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	15.0	0.0	0.0	15

E-learning hours included: 0.0

Additional information:

Projektowanie doświadczeń, praca w grupach, dyskusja, przygotowanie prezentacji multimedialnej, konsultacje organizowane w indywidualnych przypadkach

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	15	0.0	0.0	15

Subject objectives

The primary objective of the course is to familiarize students with the basic concepts and techniques of genetic engineering, as well as its practical applications in various areas of life. Participants will have the opportunity to acquire skills in: designing experiments related to gene cloning, studying gene expression, and identifying protein products.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOLL3_W14] the graduate knows the theoretical basis of experimental methods and the most important techniques of the biological sciences	Explains the theoretical foundations of experimental methods and lists the most important methods and techniques used in genetic engineering, biotechnology, and molecular biology.	[SW1] wypowiedź ustna/rozmowa/ dyskusja [SW2] prezentacja/projekt/referat/ raport
[BIOLL3_W10] the graduate is familiar with the development and current state of knowledge and the latest trends in biology, as well as their relationship with other natural disciplines	Is aware of the development and current state of knowledge, as well as the latest research trends in the fields of molecular genetics, molecular biology, medical biology, and biotechnology, and identifies their connections with other natural science disciplines.	[SW1] wypowiedź ustna/rozmowa/ dyskusja [SW2] prezentacja/projekt/referat/ raport
[BIOLL3_W16] the graduate knows and understands the relationship between the achievements of the chosen field of science and discipline of natural sciences and the possibilities of their use in socio-economic life, taking into account the sustainable use of biodiversity	Explains the relationships between the achievements of genetic engineering and their potential applications in socio-economic life, taking into account the principles of sustainable use of biological diversity.	[SW1] wypowiedź ustna/rozmowa/ dyskusja [SW2] prezentacja/projekt/referat/ raport
[BIOLL3_K01] the graduate is ready to evaluate his/her own knowledge and understands the need for continuous learning and development and is open to new ideas	Demonstrates awareness of the limitations of their own knowledge, recognizes the need for continuous learning and professional development, and remains open to new ideas and approaches.	[SK1] wypowiedź ustna/rozmowa/ dyskusja [SK8] obserwacja samodzielnej lub zespołowej pracy studenta
[BIOLL3_U06] the graduate can read with comprehension simple scientific biological texts in Polish and simple texts in English	Reads and understands simple scientific texts in the fields of molecular genetics, molecular biology, biotechnology, and medical biology in Polish, as well as simple texts in English.	[SU1] wypowiedź ustna/rozmowa/ dyskusja [SU2] prezentacja/projekt/referat/ raport
[BIOLL3_K08] the graduate is ready to be honest, reliable and apply the principles of savoir-vivre in his/her academic and professional work	Understands the importance of honesty and integrity in scientific and professional work.	[SK1] wypowiedź ustna/rozmowa/ dyskusja [SK8] obserwacja samodzielnej lub zespołowej pracy studenta
[BIOLL3_U10] the graduate is able to prepare oral presentations in Polish and in a foreign language on specific topics in the field of biology	Is aware of the development and current state of knowledge, as well as the latest research trends in the fields of molecular genetics, molecular biology, medical biology, and biotechnology, and identifies their connections with other natural science disciplines.	[SU1] wypowiedź ustna/rozmowa/ dyskusja [SU5] realizacja zadania problemowego
[BIOLL3_U08] the graduate is able to learn independently, in a focused manner	Learns independently and in a focused manner, striving to expand their existing knowledge in the field of genetic engineering.	[SU1] wypowiedź ustna/rozmowa/ dyskusja [SU2] prezentacja/projekt/referat/ raport
[BIOLL3_U07] the graduate is able to independently search and use available sources of biological information, including electronic sources	Independently searches for and uses available biological information sources, including electronic resources, particularly when preparing a multimedia presentation on a given topic.	[SU1] wypowiedź ustna/rozmowa/ dyskusja [SU2] prezentacja/projekt/referat/ raport

Subject contents

Practical applications of genetic engineering. Achievements and challenges of genetic engineering, including ethical evaluation of its applications. Eukaryotic vectors and artificial chromosomes (BAC, YAC). Use of plants for the production of biopharmaceuticals. Gene therapy, i.e., gene correction. RNA interference. Transgenic organisms. Basics of molecular diagnostics. Site-specific mutagenesis. Real-time PCR and its applications in medicine. RNAseq as a versatile method for transcriptome analysis. GFP as a fundamental tool in molecular biology. Molecular guardians the new face of RNA biology. Overproduction of heterologous proteins in *E. coli*. Methods for purification of recombinant proteins from bacterial cells.

Prerequisites and co-requisites

Completed courses: Biochemistry, Molecular Biology with Biotechnology. Has knowledge of the structure and properties of the main types of biological macromolecules, the molecular mechanisms of genetic information flow, and the regulation of its expression.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Preparation and delivery of a multimedia presentation on a given topic Dodatkowo: Recommended reading: Core reading list	51.0%	90.0%
Participation in discussion	5.0%	10.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Materials studied independently by the student:
Original experimental and review articles provided by the instructor, as well as source materials selected by the student. Lecture materials provided by the instructor.

Key references:
• Buchnowicz J. (ed.). 2012. Molecular Biotechnology: Genetic Modifications, Advances, Problems. PWN, Warsaw.
• Brown T. A. 2009. Genomes. PWN, Warsaw.</td></tr>
<tr><td>Supplementary literature</td><td>Supplementary literature:
• Ledakowicz S. (ed.). 2014. Biochemical Engineering. WNT, Warsaw.
• Berg J. M., Tymoczko J. L., Stryer L. 2009. Biochemistry. PWN, Warsaw.
• Watson J. D. et al. 2006. Recombinant DNA: Genes and Genomes A Short Course. Baskerville Beucher.
• Węgleński P. (ed.). 2007. Molecular Genetics. PWN, Warsaw.
• Hanych B., Kędzierska S., Walderich B., Uznański B., Taylor A. 1993. Expression of the Rz gene and the overlapping Rz1 reading frame present at the right end of the bacteriophage lambda genome. Gene, 129: 18.
• Kędzierska S., Wawrzynów A., Taylor A. 1996. The Rz1 gene product of bacteriophage lambda is a lipoprotein localized in the outer membrane of Escherichia coli. Gene, 168: 18.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Genetic engineering opportunities and risks
2. GFP protein as a fundamental tool in molecular biology
3. Theoretical and practical aspects of RNA interference
4. Overproduction and purification of recombinant heterologous proteins in E. coli cells
5. RNA sequencing a versatile method for transcriptome analysis
6. CRISPR-Cas system from bacterial immunity to genome engineering</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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