University of Gdańsk

Subject card

Subject name and code	Basis of genetic engineering, PG_00207444		
Field of study	Biology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	Bachelor'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	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		

Lesson types

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

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	15	1.0	9.0	25

Subject objectives

The main goal of the course is to familiarize students with the basic concepts and techniques of genetic engineering and its practical application in various areas of our lives. Class participants have the opportunity to acquire skills in: (1) designing experiments related to cloning genes, examining their expression and identifying their protein products; (2) use of publicly available sequence and structure databases; (3) preparing a multimedia presentation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOLL3_W07] knows the development of biology as a science, its connections with other disciplines and the principles of using biological knowledge in the economy and social life, including ways that are entrepreneurial		
[BIOLL3_W05] has advanced knowledge of experimental methods, laboratory and field techniques, and the principles of planning and conducting biological research		
[BIOLL3_U09] is able to learn independently and plan her/his own development in an organized and controlled manner		
[BIOLL3_U05] is able to prepare written papers and oral presentations on biological issues, using specialized terminology		
[BIOLL3_U03] is able to search for, select and critically analyze information from various sources, including scientific literature and electronic databases, as well as read and understand scientific texts in Polish and English		
[BIOLL3_K04] is ready to apply the principles of bioethics, scientific integrity and honesty, including the proper handling of biological material and respect for intellectual property		
[BIOLL3_K01] is ready to critically evaluate her/his biological knowledge and continuously update and develop it, taking into account scientific advances and the needs of practice		

Subject contents

The main topic of the lecture is the process of cloning genes of both prokaryotic and eukaryotic origin in various expression systems. During the classes, the following topics are discussed: selected prokaryotic vectors (plasmids, phages, cosmids) and eukaryotic vectors; enzymology of genetic engineering; stages of the gene cloning process (including mRNA purification, cDNA synthesis, identification of the cloned gene); basic methods used in genetic engineering (DNA sequencing, PCR, RT-PCR, nucleic acid hybridization techniques: Southern blot, Northern blot); popular expression systems such as the bacterial expression system involving T7 phage RNA polymerase; identification of protein products of cloned genes (immunodetection and protein microsequencing). The lecture topics are selected to cover a coherent thematic and experimental sequence from the process of gene cloning to obtaining a purified protein, i.e. the product of the cloned gene.

Prerequisites and co-requisites

Completed courses: Biochemistry, Molecular biology with biotechnology. Knowledge of the structure and properties of basic types of biological macromolecules, molecular mechanisms of the flow of genetic information and the regulation of its expression.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
completion of final work - preparation of a project for cloning a selected gene or written assessment with test questions and open tasks	51.0%	100.0%

Recommended reading

Basic literature

A.1. Used during classes

The course is an original study based on many years of study of source materials and my own research work.

A.2. studied independently by the student

Original experimental and review works provided by the lecturer and source materials selected by the student. Lecture materials provided by the lecturer. Buchnowicz J. (ed.). 2012. Molecular biotechnology. Genetic modifications, progress, problems. PWN, Warszawa. Brown T. A. 2009. Genomes. PWN, Warsaw.

	Supplementary literature	**Additional 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, Warszawa. Hanych, B. Kędzierska, S., Walderich B., Uznański, B. and 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: 1-8. Kędzierska, S., Wawrzynów, A. and Taylor A. (1996) The Rz1 gene product of bacteriophage lambda is a lipoprotein localized in the outer membrane of *Escherichia coli*. Gene, 168: 1-8
	eResources addresses	
Example issues/ example questions/ tasks being completed	**Sample problem tasks: 1.** Propose a bacterial expression system that could be used for efficient overproduction of a protein well tolerated by host cells (full sequence of experiments from cloning to obtaining a purified protein). **2.** Propose a bacterial expression system that could be used for efficient overproduction of a protein poorly tolerated by host cells (full sequence of experiments from cloning to obtaining a purified protein). **3.** Suggest experiments that would enable testing the activity of a potential promoter of the selected gene.	
Work placement	Not applicable	

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