University of Gdańsk

Subject card

Subject name and code	Basis of genetic engineering, PG_00196864		
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	2.0	8.0	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_U10] The graduate is able to prepare oral presentations in Polish and a foreign language on specific topics in the field of biology	the student has the ability to give oral presentations in Polish on specific issues in the field of genetic engineering	[SU1] oral statement/conversation/ discussion
[BIOLL3_U07] The graduate is able to independently search for and use available sources of biological information, including electronic sources	the student independently searches and uses available sources of biological information, including electronic sources, especially when preparing a cloning project of a selected gene	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task
[BIOLL3_W14] The graduate has an advanced understanding of experimental methods and the most important techniques used in the biological sciences	the student explains the theoretical basis of experimental methods and lists the most important methods and techniques used in genetic engineering, biotechnology and molecular biology	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[BIOLL3_W16] The graduate knows and understands the relationship between the achievements of a 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	the student explains the connections between the achievements of genetic engineering and the possibilities of their use in socio-economic life, taking into account the sustainable use of biological diversity	[SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[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	the student is familiar with the development and current state of knowledge and the latest research trends in the fields of molecular genetics, molecular biology, medical biology and biotechnology and indicates their relationship with other	[SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[BIOLL3_K01] The graduate is prepared to evaluate his/her own knowledge, understand the need for continuous learning and development, and is open to new ideas	the student knows the limits of his or her own knowledge and understands the need for constant learning and development and is open to new ideas	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[BIOLL3_U08] The graduate is able to learn independently, in a focused manner	the student has the ability to give oral presentations in Polish on specific issues in the field of genetic engineering	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[BIOLL3_U06] The graduate can read with comprehension scientific biological texts in Polish and simple texts in English	the student reads and understands simple scientific biological texts in the field of molecular genetics, molecular biology, biotechnology and medical biology in Polish and simple texts in English	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task
[BIOLL3_K08] The graduate is ready to be honest, reliable and apply the principles of savoir-vivre in academic and professional work	the student understands the need for honesty and reliability in scientific and professional work	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work

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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