

**Subject card**

<b>Subject name and code</b>	Basis of genetic engineering, PG_00048688						
<b>Field of study</b>	Podstawy inżynierii genetycznej (Wykład)						
<b>Date of commencement of studies</b>	October 2023	<b>Academic year of realisation of subject</b>			2025/2026		
<b>Education level</b>	Bachelor's studies	<b>Subject group</b>			Optional subject group Subject group related to scientific research in the field of study		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	3	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	5	<b>ECTS credits</b>			1.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>	Laboratory of Microbial Biochemistry -> Department of General and Medical Biochemistry -> Faculty of Biology -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		prof. dr hab. Sabina Kędzierska-Mieszkowska				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	15.0	0.0	0.0	0.0	0.0	15
	E-learning hours included: 0.0						
	Additional information:  Dodatkowe informacje: Metody dydaktyczne: Wykład z prezentacją multimedialną, metoda projektów (teoretyczny projekt badawczy), dyskusja, praca w grupach, konsultacje organizowane w indywidualnych przypadkach.						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	15		0.0		0.0	15
<b>Subject objectives</b>	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 our lives. Participants will have the opportunity to acquire skills in: (1) designing experiments related to gene cloning, studying their expression, and identifying their protein products; (2) using publicly available sequence and structure databases; (3) preparing multimedia presentations.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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_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 able to deliver oral presentations in Polish on specialized topics in the field of genetic engineering.	[SU1] wypowiedź ustna/rozmowa/ dyskusja
	[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.	[SW2] prezentacja/projekt/referat/ raport [SW5] realizacja zadania problemowego
	[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 project on cloning a selected gene.	[SU2] prezentacja/projekt/referat/ raport [SU5] realizacja zadania problemowego
	[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.	[SU2] prezentacja/projekt/referat/ raport [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_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 [SW5] realizacja zadania problemowego
	[BIOLL3_K08] the graduate is ready to be honest, reliable and apply the principles of savoir-vivre in his/her academic and professional work	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_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.	[SW2] prezentacja/projekt/referat/ raport [SW5] realizacja zadania problemowego
<b>Subject contents</b>	The main topic of the lecture is the process of gene cloning from both prokaryotic and eukaryotic sources in various expression systems. The course covers selected prokaryotic vectors (plasmid, phage, cosmid) and eukaryotic vectors; enzymology of genetic engineering; stages of the gene cloning process (including mRNA purification, cDNA synthesis, and 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 T7 RNA polymerase-based expression system; and identification of protein products of cloned genes (immunodetection and protein microsequencing). Lecture topics are selected to provide a coherent experimental and thematic sequence from gene cloning to obtaining purified protein, i.e., the product of the cloned gene.		
<b>Prerequisites and co-requisites</b>	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
	Carrying out a credit project: preparing a cloning project for a selected gene, or A written assessment consisting of multiple-choice questions and open-ended tasks.	51.0%	
Recommended reading	Basic literature	<p><b>A.1. Materials used during classes</b> The course is an original design based on many years of study of primary sources and the instructors own research work.</p> <p><b>A.2. Materials studied independently by the student</b> 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:</p> <ul style="list-style-type: none"> <li>• Buchnowicz J. (ed.). 2012. <i>Molecular Biotechnology: Genetic Modifications, Advances, Problems</i>. PWN, Warsaw.</li> <li>• Brown T. A. 2009. <i>Genomes</i>. PWN, Warsaw.</li> </ul>	
	Supplementary literature	<p><b>Supplementary literature:</b></p> <ul style="list-style-type: none"> <li>• Ledakowicz S. (ed.). 2014. <i>Biochemical Engineering</i>. WNT, Warsaw.</li> <li>• Berg J. M., Tymoczko J. L., Stryer L. 2009. <i>Biochemistry</i>. PWN, Warsaw.</li> <li>• Watson J. D. et al. 2006. <i>Recombinant DNA: Genes and Genomes A Short Course</i>. Baskerville Beucher.</li> <li>• Węgleński P. (ed.). 2007. <i>Molecular Genetics</i>. PWN, Warsaw.</li> <li>• 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. <i>Gene</i>, 129: 18.</li> <li>• Kędzierska S., Wawrzynów A., Taylor A. 1996. The Rz1 gene product of bacteriophage lambda is a lipoprotein localized in the outer membrane of <i>Escherichia coli</i>. <i>Gene</i>, 168: 18.</li> </ul>	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<p><b>Example problem tasks:</b></p> <ol style="list-style-type: none"> <li>1. Propose a bacterial expression system that could be used for efficient overproduction of a protein well tolerated by the host cells (complete experimental workflow from cloning to obtaining purified protein).</li> <li>2. Propose a bacterial expression system that could be used for efficient overproduction of a protein poorly tolerated by the host cells (complete experimental workflow from cloning to obtaining purified protein).</li> <li>3. Design experiments that would allow investigation of the activity of a potential promoter of a selected gene.</li> </ol>		
Work placement	Not applicable		