



Subject card

Subject name and code	Basic Genetic Engineering, PG_00054716						
Field of study	Biotechnology						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Obligatory subject group 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		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Microbiology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marta Wanarska				
	Teachers		dr hab. inż. Marta Wanarska				
			Aleksandra Rosińska				
			dr hab. inż. Hubert Cieśliński				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		8.0		57.0	125
Subject objectives	Preparing students for work in the laboratory of genetic engineering, including documentation of activities and results, application of the basic techniques and tools with particular emphasis on methods of isolation, modification, selection and analysis of organisms, cells and molecules.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U04		Student is able to prepare bacteriological media. Student is able to grow bacteria, including genetically modified ones. Student is able to transform Escherichia coli cells with plasmid DNA.		[SU4] Assessment of ability to use methods and tools		
	K6_U07		Student is able to isolate genomic and plasmid DNA from bacteria. Student is able to amplify the selected gene using the PCR technique. Student knows how to clone the PCR product into a plasmid vector. Student is able to perform a restriction analysis of the recombinant plasmid. Student is able to analyze the results of DNA sequencing.		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		
	K6_W08		Student acquires the knowledge about the basic tools used for the construction of genetically modified microorganisms, and about the development of new biotechnological processes using GMM.		[SW1] Assessment of factual knowledge		
	K6_U06		Student is able to perform agarose gel electrophoresis of genomic and plasmid DNA, and PCR products. Student is able to analyze the results of electrophoresis.		[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information		

Subject contents	Definition and scope of genetic engineering. Basic glossary. Isolation and preparation of nucleic acids. Electrophoresis of nucleic acids. Enzymes used in genetic engineering: restriction endonucleases, DNA ligases, DNA polymerases, nucleases, enzymes modifying of DNA fragments termini (kinases, phosphatases). Plasmids, classification and encoded features. Plasmid vector systems: classification and characterization. Characterization of bacteriophage lambda: phage vector systems. Characterization of bacteriophage M13 and derived vectors. Hosts for cloning vectors. Recombinant clones selection. Construction of genomic, metagenomic and cDNA libraries. Methods of transformation: chemical transformation, transformation by electroporation, transduction. DNA sequencing methods. Polymerase chain reaction description, PCR variants, application of PCR. Site-specific mutagenesis. Expression of heterologous genes in bacteria (<i>Escherichia coli</i>) and yeast (<i>Pichia pastoris</i>). Practical application of genetic engineering: production of recombinant drugs, vaccines and industrial enzymes or production of biofuels.		
Prerequisites and co-requisites	The exams passed: General microbiology, Industrial microbiology, Molecular biology.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	60.0%	50.0%
	Written exam	60.0%	50.0%
Recommended reading	Basic literature	1. Węgleński P. (Ed.): Molecular genetics. PWN, Warsaw, 1995 (1996, 1998, 2000, 2002, 2012). 2. Brown T.A.: Genomes, PWN, Warsaw, 2001 (2009). 3. Buchowicz J.: Molecular biotechnology, PWN, Warsaw, 2006 (2012). 4. Brillowska-Dąbrowska A., Wanarska M., Zalewska-Piątek B., Piątek R., Kur J.: Principles of genetic engineering, PG, 2014.	
	Supplementary literature	1. Kur J.: Principles of genetic engineering, PG, 1994. 2. Stryer L.: Biochemistry, PWN Press, Warsaw, 1997 (1999, 2000, 2003). 3. Glick B.R., Pasternak J.J.: Molecular biotechnology: principles and applications of recombinant DNA, ASM Press, Washington, D.C., 1998 (2010). 4. Hill W.E.: Genetic engineering, Taylor and Francis, London, 2002.	
	eResources addresses	Adresy na platformie eNauczanie: Podstawy inżynierii genetycznej 2023/2024 - Moodle ID: 31201 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31201	
Example issues/ example questions/ tasks being completed	Isolation of genomic and plasmid DNA from bacteria. Agarose gel electrophoresis of genomic and plasmid DNA. Gene amplification by PCR. Cloning of PCR product into pUC19 plasmid. Chemical transformation of <i>Escherichia coli</i> cells with plasmid DNA. Analysis of recombinant plasmids by digestion with restriction enzymes. Analysis of gene sequence - comparison with NCBI database.		
Work placement	Not applicable		