



Subject card

Subject name and code	Gene Expression Systems, PG_00048908						
Field of study	Biotechnology						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
Education level	second-cycle 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	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			4.0		
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. Hubert Cieśliński					
	Teachers	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	0.0	0.0	15.0	45
	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	45		10.0		45.0	100
Subject objectives	Gaining knowledge on the possibilities of use of existing expression systems for recombinant protein production.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
Subject contents	<p>Course content: Lectures - topics:</p> <p>A brief presentation of the most important information on gene expression in living organisms in terms of the practical use of this knowledge in the functioning of gene expression systems.</p> <p>Sources of information about the heterologous gene: a) when the sequence of the gene is known, b) when the sequence of the gene is unknown.</p> <p>Definition of expression system, expression vector, gene expression host. Overview of the most important types of expression vectors (discussion of the role of the special role of plasmids as the most frequently used platform for the construction of expression vectors).</p> <p>Escherichia coli - as a host for heterogeneous gene expression - advantages and disadvantages. Examples of known expression systems based on selected expression vectors, gene expression promoters used in them, E. coli strains. E. coli - as a model illustrating the most common problems with heterologous expression of genes - discussion of strategies to solve them.</p> <p>Bacillus subtilis and Bacillus megaterium - as host of heterogeneous gene expression - advantages and disadvantages. Examples of known expression systems based on selected expression vectors, gene expression promoters (including promoters used in E. coli expression systems) of Bacillus sp.</p> <p>Lactococcus lactis as host for expression of genes with GRASS status - examples of expression systems based on this host. Expression of genes in L. lactis in order to obtain strains of GMO bacteria for in vivo use - controversy over the possibilities of such systems.</p> <p>Yeast expression systems: Saccharomyces cerevisiae and Pichia pastoris - as hosts for heterogeneous gene expression - advantages and disadvantages. Examples of known expression systems based on selected expression vectors, gene expression promoters used therein (e.g. constitutive and inducible expression).</p> <p>Leishmania tarentolae - a protozoan as a gene expression host that combines the advantages of both Prokaryotic and Eukaryotic hosts. Expression system based on this host.</p> <p>Expression in eukaryotic (mammalian and insect) cells - expression vectors based on DNA and RNA viruses</p> <p>Seminars:</p> <p>The use of modern gene expression systems for the production of selected bioproducts in the pharmaceutical and food industries, in the processing industry, in agriculture, in the fuel and energy industry, in the utilization industry, or in production of bioproducts used in scientific research.</p>						
Prerequisites and co-requisites	Finished courses: General microbiology. Basics of genetic engineering, Molecular biology						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Presentation os expression system applied for particular recombinant protein production	60.0%	40.0%
	Short test evaluating the knowledge gained during previous lectures	60.0%	60.0%
Recommended reading	Basic literature	Ch. Hardin, J. Edwards "Cloning, Gene Expression, and Protein Purification: Experimental Procedures and Process Rationale" Villey-VCH M. Dyson "Expression systems" Scion Publishing B. Alberts "Molecular Biology of the Cell" 4th Edition, Garland Science	
	Supplementary literature	J. Fernandez, J. Hoeffler "Gene expression systems" Elsevier S. Higgins, B. Hames "Protein expression: A practical approach" Oxford University Press	
	eResources addresses	Adresy na platformie eNauczanie: Systemy Ekspresji Genów 2023/2024 - Moodle ID: 37542 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=37542	
Example issues/ example questions/ tasks being completed	Advanteges and disadvanteges of bacterial expression systems for the production of biopharmaceuticals		
Work placement	Not applicable		