GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	GENE EXPRESSION SYSTEMS, PG_00065566		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	blended-learning
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department Of Biotechnology And Microbiology -> Faculty Of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Hubert Cieśliński	
	Teachers		

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: 30.0

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	35.0	90

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
[K7_W05] identifies crucial developments in research, apparatus and technology in biotechnology and related fields	the student has knowledge of key biotechnologies developed for the construction of gene expression systems	[SW1] Assessment of factual knowledge
[K7_W01] defines the phenomena, processes and laws of living nature applied to the production of useful goods and the carrying out of services	the student has knowledge of technologies used to construct gene expression systems used to produce consumer goods and conduct scientific research (also as part of commercial services)	[SW1] Assessment of factual knowledge
[K7_K02] is aware of the potential risks and opportunities associated with the development of science and technology for the natural environment and society	the student has knowledge of the basic risks resulting from the use of gene expression systems in industrial-scale cultures	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U01] designs experiments in accordance with the state of the art and the latest scientific literature, using computer methods of data analysis, computer simulations	the student is able to use knowledge of gene expression systems to select the appropriate biotechnological solution taking into account the biological properties and the need for recombinant protein production	[SU3] Assessment of ability to use knowledge gained from the subject

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<tr><td>Subject contents</td><td>Course content: Lectures - topics:
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.
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.
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).
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.
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.
Lactococcus lactus as host for expression of genes with GRASS status - examples of expression systems based on this host. Expression of genes in L. lactus in order to obtain strains of GMO bacteria for in vivo use - controversy over the possibilities of such systems.
Yeast expression systems: Sacharomyces 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).
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.
Expression in eukaryotic (mammalian and insect) cells - expression vectors based on DNA and RNA viruses

Seminars:
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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Finished corses: General microbiology. Basics of genetic engineering, Molecular biology</td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Short test evaluating the knowledge gained during previous lectures</td><td>60.0%</td><td>60.0%</td></tr>
<tr><td>Presentation os expression system applied for particular recombinant protein production</td><td>60.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>J. Fernandez, J. Hoeffler "Gene expression systems" Elsevier S. Higgins, B. Hames "Protein expression: A practical approach" Oxford University Press</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Advanteges and disadvanteges of bacterial expression systems for the production of biopharmaceuticals</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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