University of Gdańsk

Subject card

Subject name and code	Biochemical basis of gene expression, PG_00147783						
Field of study	Genetics and Experimental 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 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	6		ECTS credits		1.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Laboratory of Intracellular Signalling -> Department of Medical Biology and Genetics -> Faculty of Biology -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Monika Słomińska-Wojewódzka				
	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		3.0		7.0	25
Subject objectives	1. Familiarization with the structure of mRNA and tRNA molecules, as well as the function of aminoacyl-tRNA synthetases and ribosomes. 2. To learn in detail the mechanisms of protein synthesis in prokaryotic and eukaryotic cells, and to discuss how this process is regulated at different stages. 3. To learn about the general issues of protein folding and degradation. 4. To be able to use available sources of biological information.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[GBEL3_W06] A graduate has an advanced knowledge and understanding of: the development and current state of knowledge and the latest trends in molecular genetics and related fields; indicates their relationship to other disciplines in the life sciences or medical sciences and their potential for use in practice	Is oriented to the current state of knowledge and the latest trends in molecular biology indicates their relationship with other disciplines of natural or medical sciences.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[GBEL3_W05] A graduate has an advanced knowledge and understanding of: principles for planning research based on the achievements of biological sciences and related disciplines and the possibility of putting their results into practice, principles for the operation of equipment and apparatus used in molecular genetics research, and the principle of interpreting biological phenomena and processes based on empirical data in research work and practical action, taking into account the sustainable use of biodiversity.	Knows the principles of planning research based on the achievements of biological sciences related to the process of protein translation and the possibility of using their results in practice.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[GBEL3_W03] A graduate has an advanced knowledge and understanding of: molecular mechanisms of genetic information transfer and gene expression and the molecular and genetic basis of human physiology and disease, including infectious diseases.	Knows the molecular mechanisms of expression of genetic information.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[GBEL3_W01] A graduate has an advanced knowledge and understanding of: the structure and properties of the main types of biological macromolecules; the molecular mechanisms of basic metabolic pathways and genetic information flow; the sources of genetic variation in organisms and the mechanisms of evolution. They can explain the principles of inheritance, the differences in structure and function between prokaryotic and eukaryotic cells, as well as the structure and functional relationships at the cellular and tissue levels.	Describes the structure and properties of the basic types of RNA, mechanisms of the translation process, explains the differences in the structure and functioning of the prokaryotic and eukaryotic cell.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[GBEL3_U04] The graduate is able to: read scientific texts in English and Polish with comprehension, synthesise the knowledge they contain, prepare well-documented papers on biological problems and on the commercialisation of research.	Can read with understanding scientific texts in English and Polish, synthesizes the knowledge contained therein, prepares well-documented studies of biological problems concerning the process of translation, folding and properties of proteins.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[GBEL3_K07] The graduate is prepared to: lifelong learning and updating of knowledge in molecular genetics and other fields.	Understands the need for lifelong learning and updating knowledge of molecular biology.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written
[GBEL3_K02] The graduate is prepared to: critically evaluate their own knowledge and methods in molecular biology and related fields and commercialise their research.	Is ready to critically evaluate his own knowledge and methods in the field of molecular biology.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written

Subject contents	mRNA: differences in structure of prokaryotic and eukaryotic mRNA, structure of 5' and 3' ends of mRNA, stability and degradation of mRNA. tRNA: structure, modifications of bases in tRNA, maturation of tRNA, isoacceptor tRNA. Genetic code: historical outline, properties, principle of code vacillation, deviations from code universality. Aminoacyl-tRNA synthetases: structure, classification, mechanism of action. Ribosomes: structure of prokaryotic and eukaryotic ribosomes, arrangement of active sites, characteristics of rRNA. Regulation of gene expression at the level of the translational process. Translation initiation in prokaryotic and eukaryotic cells: stages of translation initiation process, role of initiation factors (IFs), structure and role of initiator tRNAs. Elongation of translation: role of elongation factors (EFs), stages of elongation process, effect of antibiotics that inhibit elongation, mechanism of peptide bond formation. Termination of translation: mechanism of termination, role of termination factors (RF). Mechanism of selenocysteine coding. Systems of mRNA quality control. Suppressor mutations: mechanism of suppression of missense nonsense and insertion mutations. Programmable shift of the mRNA reading frame. General principles of protein folding. Selected post-translational modifications of proteins. General issues of protein degradation.
Prerequisites and co-requisites	Basic knowledge of cell biology, molecular biology, biochemistry. Good knowledge of English.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test - includes the degree of mastery of the material covered in the lectures in written form	51.0%	100.0%

Recommended reading

Basic literature	1. Molecular Cell Biology, Lodish H., Berk A., Zipursky S.L., Matsudaira P., Baltimore D., Darnell J.E.; W.H. Freeman and Company, 2016 2. Molecular Biology of the Cell, Alberts B., Johnson A., Lewis J., Raff M., Roberts K., Walter P.; 2022 3. Genes VIII, Lewin B., Benjamin Cummings, 2014
Supplementary literature	1. Biochemistry, Berg J.M., Stryer L., Tymoczko J.L., Polish edition, PWN, 2019 2. Cytobiochemistry, Kłyszejko-Stefanowicz L., PWN 2022 3. Słomińska-Wojewódzka M, Sandvig, K. The Role of Lectin-Carbohydrate Interactions in the Regulation of ER-Associated Protein Degradation. Molecules, 2015, 20: 9816-9846 4. Nowakowska-Gołacka J, Sominka H, Sowa-Rogozińska N, Słomińska-Wojewódzka M. Toxins Utilize the Endoplasmic Reticulum-Associated Protein Degradation Pathway in Their Intoxication Process. 2019, Int J Mol Sci, 20 (6)
eResources addresses	

Example issues/ example questions/ tasks being completed	Differences in the course of translation between prokaryotic and eukaryotic cells. Mechanisms of regulation of translation initiation.
Work placement	Not applicable

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