University of Gdańsk

Subject card

Subject name and code	Biochemical basis of gene expression, PG_00196850		
Field of study	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 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	3	Language of instruction	Polish
Semester of study	5	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	0.0	20.0	0.0	0.0	0.0	20

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	20	1.0	4.0	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 in preparing scientific presentations.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOLL3_W07] The graduate knows the development of biology as a science, its connections with other disciplines and the principles of using biological knowledge in the economy and social life, including ways that are entrepreneurial		
	[BIOLL3_U09] The graduate is able to learn independently and plan her/his own development in an organized and controlled manner		
	[BIOLL3_U05] The graduate is able to prepare written papers and oral presentations on biological issues, using specialized terminology		
	[BIOLL3_U03] The graduate is able to search for, select and critically analyze information from various sources, including scientific literature and electronic databases, as well as read and understand scientific texts in Polish and English		
	[BIOLL3_K04] The graduate is ready to apply the principles of bioethics, scientific integrity and honesty, including the proper handling of biological material and respect for intellectual property		
	[BIOLL3_K01] The graduate is ready to critically evaluate her/his biological knowledge and continuously update and develop it, taking into account scientific advances and the needs of practice		
	[BIOLL3_W05] The graduate has advanced knowledge of experimental methods, laboratory and field techniques, and the principles of planning and conducting biological research		
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
	oral multimedia presentation - the evaluation includes the extent of exhaustion of the topic, correctness of the content, attractiveness of the presentation	51.0%	30.0%
	tests - include the degree of mastery of the material applicable to the given exercises in written form	51.0%	60.0%
	spontaneous oral statements and oral tests with access to materials - are the students' answers to the problem tasks posed, in case of comprehensive statements points are awarded	80.0%	2.0%
	group work - correctness of task completion is assessed, but also discussion and cooperation skills	80.0%	8.0%

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. Richter JD. Breaking the code of polyadenylation-induced translation. Cell. 2008, 8;132, 335-337. 4. Cochella L, Green R. Wobble during decoding: more than third-position promiscuity Nat. Struc. Mol. Biol. 2004, 11, 1160-1162 5.Francklyn CS. Charging two for the price of one. Nat Struct Biol. 2001, 8, 189-191. 6. Sherlin LD, Uhlenbeck OC. Hasty decisions on the ribosome. Nat Struct Mol Biol. 2004, 11,206-208. 7. Slominska-Wojewodzka M, Sandvig, K. The Role of Lectin-Carbohydrate Interactions in the Regulation of ER-Associated Protein Degradation. Molecules, 2015, 20: 9816-9846. 8. 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	
	Regulation of mRNA polyadenylation process. What is the degeneration and wobble of the genetic code.

Work placement	
	Not applicable

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