

Subject card

Subject name and code	Biochemical basis of gene expression, PG_00145158						
Field of study	Biology						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2027/2028		
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_W14] The graduate knows the theoretical basis of experimental methods and the most important techniques of the biological sciences	1. Is oriented to the development and current state of knowledge and the latest trends in the functioning and regulation of the process of protein translation, and indicates their relationship with other natural disciplines. 2. Explains the theoretical basis of experimental methods and the most important techniques used in the study of the various stages of the translation process	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion [SW2] presentation/project/paper/report [SW3] text preparation/written work [SW5] implementation of a problem task
	[BIOLL3_W10] The graduate is familiar with the development and current state of knowledge and the latest trends in biology, as well as their relationship with other natural disciplines	Explains the theoretical basis of experimental methods and the most important techniques used in the study of the various stages of the translation process.	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion [SW2] presentation/project/paper/report [SW3] text preparation/written work [SW5] implementation of a problem task
	[BIOLL3_U10] The graduate will be able to prepare oral presentations in Polish and a foreign language on specific topics in the field of biology	Has the ability to give oral presentations in Polish on specific issues in protein synthesis and folding.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report
	[BIOLL3_U08] The graduate is able to learn independently, in a focused manner	He learns independently in a focused manner.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written [SU5] implementation of a problem task [SU8] observation of student's independent or team work
	[BIOLL3_U07] The graduate should be able to independently search for and use available sources of biological information, including electronic sources	Independently searches for and uses available sources of biological information, including electronic sources, especially when preparing presentations.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU4] test/exam - oral or written [SU8] observation of student's independent or team work
	[BIOLL3_U06] The graduate can read with comprehension scientific biological texts in Polish and simple texts in English	Reads with understanding scientific biological texts in Polish and texts in English.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU3] text preparation/written work [SU4] test/exam - oral or written [SU5] implementation of a problem task [SU8] observation of student's independent or team work
	[BIOLL3_K08] The graduate is ready to be honest, reliable and apply the principles of savoir-vivre in academic and professional work	Understands the need for scientific integrity and honesty.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK8] observation of student's independent or team work
	[BIOLL3_K01] The graduate is prepared to evaluate their own knowledge, understand the need for continuous learning and development, and is open to new ideas	Knows the limitations of his own knowledge and understands the need for continuous learning and development and is open to new ideas.	[SK1] oral statement/conversation/discussion [SK2] presentation/project/paper/report [SK3] text preparation/written work [SK4] test/exam - oral or written [SK8] observation of student's independent or team work

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%
	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%
	tests - include the degree of mastery of the material applicable to the given exercises in written form	51.0%	60.0%
	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, Kłyszewko-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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