

Subject card

Subject name and code	Biochemical basis of gene expression, PG_00048682						
Field of study	Biology						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2025/2026	
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		dr hab. Monika Słomińska-Wojewódzka				
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		0.0		0.0	20
Subject objectives	<ol style="list-style-type: none"> 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_U08] the graduate is able to learn independently, in a focused manner	The graduate demonstrates focused, independent learning.	[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 is able to independently search and use available sources of biological information, including electronic sources	Independently searches and uses available biological information sources, including electronic ones, especially when preparing presentations.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report [SU3] text preparation/written work [SU5] implementation of a problem task [SU8] observation of student's independent or team work
	[BIOLL3_U10] the graduate is able to prepare oral presentations in Polish and in a foreign language on specific topics in the field of biology	The graduate has the ability to give oral presentations in Polish on specific issues related to protein synthesis and folding.	[SU1] oral statement/conversation/discussion [SU2] presentation/project/paper/report
	[BIOLL3_K08] the graduate is ready to be honest, reliable and apply the principles of savoir-vivre in his/her 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 ready to evaluate his/her own knowledge and understands the need for continuous learning and development and is open to new ideas	Knows the limitations of his own knowledge, 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 [SK5] implementation of a problem task [SK8] observation of student's independent or team work
	[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	The graduate is familiar with the development, current state of knowledge, and latest trends in the functioning and regulation of protein translation, and understands their relationship to other natural sciences.	[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_W14] the graduate knows the theoretical basis of experimental methods and the most important techniques of the biological sciences	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_U06] the graduate can read with comprehension simple scientific biological texts in Polish and simple texts in English	Reads and understands scientific biological texts in Polish and 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

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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Biochemistry, Berg J.M., Stryer L., Tymoczko J.L., Polish edition, PWN, 2019 2. Cytobiochemistry, Kłyszajko-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-Rogozicka 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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