

Subject card

Subject name and code	Molecular biology of a eukaryotic cell, PG_00147177						
Field of study	Genetics and Experimental Biology						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2026/2027		
Education level	undergraduate studies	Subject group			Obligatory subject group 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			2.0		
Learning profile	academic	Assessment form					
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Anna Herman-Antosiewicz				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	<p>1. Understanding the main mechanisms of protein transport in the cell</p> <p>2. Acquaintance with the mechanisms of quality control of protein folding in the endoplasmic reticulum</p> <p>3. Learning and understanding the processes related to the expression of genetic material, its variability and its consequences</p> <p>4. Familiarization with the most important intracellular signaling pathways</p> <p>5. Acquiring the ability to use laboratory methods and techniques for studying the biology of eukaryotic cells - concerns laboratory</p>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[GBEL3_W01] Understanding the structure and properties of basic types of biological macromolecules, molecular mechanisms of metabolic pathways and genetic information flow, as well as sources of genetic variability in organisms and mechanisms of evolution; explaining the rules of inheritance, elucidating differences in the structure and functioning of prokaryotic and eukaryotic cells, and understanding the structure and functional relationships at the cellular and tissue levels.	- describes the molecular mechanisms of expression and variability of genetic information, as well as intracellular protein transport pathways and the importance of these processes in the functioning of cells and entire eukaryotic organisms - sees the relationship between protein folding in the endoplasmic reticulum and the proper functioning of the eukaryotic cell	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report
	[GBEL3_W03] The molecular mechanisms of genetic information transmission and gene expression, as well as the molecular and genetic basis of human physiology and diseases, including infectious diseases.	- describes the molecular mechanisms of expression and variability of genetic information, as well as intracellular protein transport pathways and the importance of these processes in the functioning of cells and entire eukaryotic organisms - sees the relationship between protein folding in the endoplasmic reticulum and the proper functioning of the eukaryotic cell	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report
	[GBEL3_K08] Responsibility for entrusted equipment/materials and respect for the work of others.	is responsible for the entrusted equipment/materials and his/her work and respects the work of others - applies to laboratory	[SK8] observation of student's independent or team work
	[GBEL3_U03] Proficient in using research equipment and tools, while following the correct sequence of procedures, to conduct basic physical, biological, or chemical observations and measurements in laboratory work within the field of biological sciences.	uses basic research equipment and tools in the manipulation of mammalian cells and, maintaining the correct sequence of activities, performs simple experiments using them - applies to laboratory	[SU2] presentation/project/paper/report [SU8] observation of student's independent or team work
	[GBEL3_K07] Lifelong learning and updating knowledge in the field of molecular genetics and other disciplines.	understands the need for lifelong learning and updating knowledge regarding the molecular basis of the functioning of eukaryotic cells	[SK8] observation of student's independent or team work
	[GBEL3_W05] the principles of research planning based on achievements in biological sciences and related fields, the potential application of their results in practice, the principles of 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 and practical activities, with consideration for sustainable use of biological diversity.	has knowledge of the most important techniques used to study the response of a eukaryotic cell to factors damaging the genetic material or cytoskeleton	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report
	[GBEL3_W06] the development and current state of knowledge, as well as the latest trends in molecular genetics and related fields; indicating their relationship with other disciplines in the natural or medical sciences and the possibilities of their practical application.	is aware of 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 [SW2] presentation/project/paper/report
	[GBEL3_K05] Responsibility for the safety of one's own work and others.	is responsible for the safety of his/her own and others' work	[SK8] observation of student's independent or team work

Subject contents	<p>General mechanisms of intracellular transport. Transmembrane transport: between the nucleus and cytoplasm, to mitochondria, chloroplasts, peroxisomes, endoplasmic reticulum. Main classes of membrane proteins synthesized in the ER. Protein modifications and folding in the endoplasmic reticulum: the role of reticular chaperones, protein folding control system, mechanism of response to incorrectly folded proteins. Vesicular intracellular transport: general routes of protein secretion and endocytosis in the cell. Mechanisms of protein transport between the Golgi apparatus and the endoplasmic reticulum and from the Golgi apparatus to lysosomes. Endocytosis and exocytosis.</p> <p>Stages of gene expression in eukaryotic cells. Control of the frequency of initiation of replication and transfer of DNA to daughter cells in connection with the division cycle of eukaryotic cells. Cell aging, the role of telomeres. Transmission of DNA damage signals in eukaryotic cells. Gene expression and chromatin structure. Variability of genetic material: mutagenesis and DNA repair processes, mobile genetic elements, genome rearrangements.</p>		
Prerequisites and co-requisites	Basic knowledge of cell biology, molecular biology, biochemistry, genetics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam (closed and open questions) - covers material from lectures and selected English-language scientific articles	51.0%	100.0%
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, 2000 2. Molecular Biology of the Cell, Alberts B., Johnson A., Lewis J., Raff M., Roberts K., Walter P.; 2002 3. Genes VIII, Lewin B., Benjamin Cummings, 2004 4. Biochemia, Berg J.M., Stryer L., Tymoczko J.L., wydanie polskie, PWN, 2007 	
	Supplementary literature	<p>- Cytobiochemia, Kłyszewko-Stefanowicz L., PWN 1998</p> <p>- Zdrowowicz M, Spisz P, Hać A, Herman-Antosiewicz A, Rak J. (2022) Influence of Hypoxia on Radiosensitization of Cancer Cells by 5-Bromo-2'- deoxyuridine. Int J Mol Sci. 23(3):1429;</p> <p>- Hać A., Brokowska J., Rintz E., Bartkowski M., Węgrzyn G., Herman-Antosiewicz A. (2019) Mechanism of selective anticancer activity of isothiocyanates relies on differences in DNA damage repair between cancer and healthy cells. Eur J Nutr. 59(4):1421-1432;</p> <p>- Herman-Antosiewicz A, Lew KL, Xiao H, Singh SV. (2007) Induction of p21 protein protects against sulforaphane-induced mitotic arrest in LNCaP human prostate cancer cell line. Mol Cancer Ther. 6: 1673-81;</p> <p>- Herman-Antosiewicz A, Stan SD, Hahm ER, Xiao D, Singh SV. (2007) Activation of a novel ataxia-telangiectasia mutated and Rad3 related/ checkpoint kinase 1-dependent prometaphase checkpoint in cancer cells by diallyl trisulfide, a promising cancer chemopreventive constituent of processed garlic. Mol Cancer 6:1249-61;</p> <p>- Słominska-Wojewodzka M, Gregers TF, Walchli S, Sandvig, K. (2006) EDEM Is Involved in Retrotranslocation of Ricin From the Endoplasmic Reticulum to the Cytosol. Mol Biol Cell. 17: 1664-75.</p> <p>- Słominska-Wojewodzka M, Sandvig, K. (2015) The Role of Lectin-Carbohydrate Interactions in the Regulation of ER-Associated Protein Degradation. Molecules 20: 9816-46.</p> <p>- Nowakowska-Gołacka J, Sominka H, Sowa-Rogozińska N, Słomińska-Wojewódzka M. (2019) Toxins Utilize the Endoplasmic Reticulum-Associated Protein Degradation Pathway in Their Intoxication Process. Int J Mol Sci, 20 (6).</p>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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