University of Gdańsk

Subject card

Subject name and code	Molecular biology of a eukaryotic cell, PG_00198353		
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	5	ECTS credits	2.0
Learning profile	academic	Assessment form	exam
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

1. Understanding the main mechanisms of protein transport in the cell

2. Acquaintance with the mechanisms of quality control of protein folding in the endoplasmic reticulum

3. Learning and understanding the processes related to the expression of genetic material, its variability and its consequences

4. Familiarization with the most important intracellular signaling pathways

5. Acquiring the ability to use laboratory methods and techniques for studying the biology of eukaryotic cells - concerns laboratory

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 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_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.	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_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.	- 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_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 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_K05] The graduate is prepared to: responsibility for their own and others' safety at work	is responsible for the safety of his/her own and others' work	[SK8] observation of student's independent or team work
[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 regarding the molecular basis of the functioning of eukaryotic cells	[SK8] observation of student's independent or team work
[GBEL3_K08] The graduate is prepared to: takes responsibility for equipment/materials entrusted to it and respects 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] The graduate is able to: use research apparatus and tools and, following the correct sequence of operations, carry out simple physical, biological or chemical observations and measurements in laboratory work in the 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

Subject contents	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. 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.
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	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	- Cytobiochemia, Kłyszejko-Stefanowicz L., PWN 1998 - 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; - 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; - 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; - 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; - Slominska-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. - Slominska-Wojewodzka M, Sandvig, K. (2015) The Role of Lectin-Carbohydrate Interactions in the Regulation of ER-Associated Protein Degradation. Molecules 20: 9816-46. - 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).
eResources addresses	
Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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