

Subject card

Subject name and code	Introduction to epigenetics, PG_00207259						
Field of study	Biology						
Date of commencement of studies	October 2026		Academic year of realisation of subject			2026/2027	
Education level	Master'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	1		Language of instruction			Polish	
Semester of study	2		ECTS credits			3.0	
Learning profile	academic		Assessment form			exam	
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Joanna Rojek				
	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		43.0	75
Subject objectives	Learning objectives1 To acquire knowledge of the biology and dynamics of chromatin2. knowledge of the mechanisms that regulate chromatin activity at the epigenetic level3. ability to correlate the knowledge of epigenetic control with the development of organisms and the importance of epigenetics in plant biology,biotechnology and medicine.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[BIOLMU2_W04] has in-depth knowledge of the chosen specialization in the biological sciences		- The graduate has an in-depth knowledge of epigenetic control in the development of organisms (B2_W04)			[SW4] test/exam - oral or written	
	[BIOLMU2_W01] has a deep knowledge and understanding of natural phenomena and processes at various levels of complexity		- The graduate has an in-depth understanding of cellular and cellular phenomena at the level of epigenetic (B2_W01)			[SW4] test/exam - oral or written	
	[BIOLMU2_U06] is able to use the acquired specialist knowledge in the field of biological sciences to interpret the collected empirical data and draw conclusions		- uses the acquired expertise in epigenetics to interpret the collected empirical data and make inferences (B2_U06)			[SU4] test/exam - oral or written	
	[BIOLMU2_U02] is able to proficiently use the scientific literature of the biological speciality studied		- The graduate is proficient in the use of scientific literature in the field of epigenetics (both in Polish and English) (B2_U02)			[SU4] test/exam - oral or written	
	[BIOLMU2_K07] is ready to systematically update biological knowledge and information on its practical applications		- The graduate systematically updates the knowledge of epigenetics and information on its practical applications (B2_K07)			[SK4] test/exam - oral or written	

Subject contents	1. chromatin biology: histone variants and modifications, heterochromatin, correlation between gene activity and histone modifications;DNA methylation and its modifications; interactions between histone modifications and DNA; organization and compartmentalization of chromatin;nuclear; structural maintenance of chromosome complexes2. chromatin dynamics: basic nuclear processes; formation and remodeling of nucleosomes, chromatin remodeling complexes3. cellular memory: PcG and TrxG complexes; mechanism of targeting chromatin domains by PCG / TrxG; memory switching and role of non-coding RNAs; erasure of epigenetic memory4. "dosage compensation" systems: compensation of gene expression levels; chromosome dosage compensation.5. genomic imprinting in mammals and flowering plants: characteristics and mechanism of differential expression of alleles depending on their parental origin; parental origin effect ("parent-of-origin effect"), paternally and maternally imprinted genes, maternal effect.6. RNA-based gene silencing system: source and classes of small RNAs; Dicer and Argonaute (AGO) proteins; RNA interference phenomenon;transcriptional and post-transcriptional gene silencing.7. Regeneration and reprogramming (plant and animal stem cells; chromatin dynamics during reprogramming).8. epigenetic control and tumorigenesis: DNA hyper- and hypomethylation in tumorigenesis; changes in histone modifications and PcG activity in tumorigenesis9. epigenetics and metabolism: intermediates of cellular metabolism as cofactors of chromatin-modifying enzymes.		
Prerequisites and co-requisites	Credit for subjects in cell biology, genetics and molecular biology		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written test	51.0%	100.0%
Recommended reading	Basic literature	- Paro R et al. 2021. Introduction to epigenetics. Springer International Publishing- Williams ME. 2016 epigenetics. Teaching Tools in Plant Biology: Lecture Notes. The Plant Cell (online)- Tollefsbol T. 2017. Handbook of Epigenetics. The New Molecular and Medical Genetics. Academic Press, 2nd edition- lecture materials in Polish prepared by the instructor	
	Supplementary literature	- recent scientific publications in epigenetics- Rojek J, Tucker MR, Rychłowski M, Nowakowska J, Gutkowska M. 2021. The Rab Geranylgeranyl Transferase Beta Subunit Is Essential for Embryo and Seed Development in Arabidopsis thaliana. International Journal of Molecular Sciences. 22(15):7907. https://doi.org/10.3390/ijms22157907 - Rojek J, Tucker MR, Pinto SC, et al. 2021. Rab-dependent vesicular traffic affects female gametophyte development in Arabidopsis. Journal of Experimental Botany- Kuta E, Rojek J. 2004. Imprinting genomowy u roślin. Postępy Biologii Komórki 31: 353-371.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	18. trxG and PcG components and role, antagonism of action19. epigenetic silencing of FLC gene (mechanism)-control of flowering process20. genomic imprinting in plants and animals, mechanism, examples of imprinted genes and clusters in plants and animals, where this control takes place (note sexual processes vs. imprinting)		
Work placement	Not applicable		

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