University of Gdańsk

Subject card

Subject name and code	Cytogenetics and Epigenetic Control, PG_00193535		
Field of study	Bioinformatics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	Bachelor's studies	Subject group	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	3.0
Learning profile	academic	Assessment form	credit
Conducting unit	Faculty of Biology -> Rector		
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	0.0	0.0	30.0	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	0.0	45.0	75

Subject objectives

Understand the principles of cytogenetics, the structure of the nuclear genome of the plant cell, and issues concerning the molecular mechanisms of vegetative and generative development of angiosperm plants.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOINL3_U02] Graduate is able to apply knowledge of natural sciences and science to formulate, analyze and solve problems related to bioinformatics	The graduate uses knowledge of cytogenetics to interpret known data empirical data. The graduate critically inspects information on epigenetic control mechanisms from a variety of sources, including English-language sources.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU3] text preparation/written work
[BIOINL3_W02] Has advanced scientific knowledge necessary to understand the basic processes in living organisms.	Graduate 1. knows the organization and structure of the plant genome. 2. Knows the structure and division of chromosomes. 3. understands the mechanisms of epigenetic control. 4. Knows the differences of the epigenome of plants and animals. 5. Knows the mechanisms of response to environmental stress.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW3] text preparation/written work

Subject contents	1. Review of basic issues of plant cytogenetics.2. karyotype analysis: karyotype, karyogram, ideogram.3. organization and structure of the genome.4. cell cycle, mitosis meiosis.5. Mechanisms regulating the amount of DNA in a plant cell.6. Variations in chromosome number and chromosome arrangements and their importance in microevolution and speciation.7. Cytosine methylation and its changes in ontogeny.8. Molecular analysis of karyotype.9. Issues of cytogenetics in selected groups of plants.10. Comparison of the epigenome of plants and animals - basic components of epigenetic regulation.11. Epigenetic mechanisms controlling sexual, apomictic and vegetative reproduction.12. Genetic and epigenetic control of responses to environmental stress - apomictic mechanisms;13. Biotechnological techniques in interspecies, intergeneric crossing.14. use of apomixis in breeding of crop plants.
Prerequisites and co-requisites	- Completed cell biology and metabolism.- Completed molecular biology and genetics.The student, after completing the compulsory subjects in the first three semesters, has the knowledge and skills to qualify him to participate and pass the course.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Determination of the passing grade on the basis of partial grades received during the semester - colloquium	51.0%	100.0%

Recommended reading

Basic literature	Podstawy cytogenetyki roślin. PWN, Warszawa 1999 Malepszy S. Biotechnologia roślin. PWN, Warszawa 2009- Scientific publications provided by the teacher.- Paro R, Grossniklaus U, Santoro R, Wutz A. Introduction to Epigenetics. Cham (CH): Springer; 2021.
Supplementary literature	- Scientific publications provided by the teacher.- Paro R, Grossniklaus U, Santoro R, Wutz A. Introduction to Epigenetics. Cham (CH): Springer; 2021.
eResources addresses	

Example issues/ example questions/ tasks being completed	Project 1Analyze the work and respond to the authors' final statement about obtaining a doubled maternal haploid. Based on the results and diagnostics obtained, was the mode of origin confirmed?- Fu, S., Yin, L., Xu, M. et al. Maternal doubled haploid production in interploidy hybridization between Brassica napus and Brassica allooctaploids. Planta247, 113-125 (2018). https://doi.org/10.1007/s00425-017-2772-y Background of the problem- The authors claim to have found a new in vivo pathway for the production of a maternal Brassica napus double haploid. The pollen donor, allooctaploid rapeseed, acts as a DH inducer.- created a new artificial Brassica hybrid, allooctaploid Brassica (AAA ACC CC, 2n = 8 × = 76), through interspecific crossing and genome doubling. - They described a homozygous line at the third autogeneration of the synthesized Brassica allohexaploid (AAA ACC, 2n = 6 × = 58). - Crosses were made between B. napus as the mother and Brassica allohexaploid as the pollen donor, and a maternal doubled B. napus haploid was obtained, which was identified by phenotype, ploidy and molecular analysis. Issues:- A. Plant material for the study and obtained in the experiment. Which Brassica lines were the starting ones, and what was crossed with what, and still added to finally obtain octoploid DH genotypes?- B. Morphological evaluation of the starting plants once obtained and the ability to pollinate. What methods were used. Were there differences? What kind of differences?- C. Evaluation of the degree of ploidy and number of chromosomes. What methods were used, what did the methods consist of. What was the result?- D. Assessment of homozygosity/heterozygosity. Description of the method and the result. Was it possible with this method to prove the identity of DH with one of the parents?General guidelines for project preparation: - The project should be prepared in text form (plus photos/schemes; Word file up to 4 A4 pages) and in presentation form.- The presentation is a graphic form of the described project to be rearranged at the last credit exercises (presentation time 15 min). - Both forms are evaluated (description: 75% of the grade, presentation of the project at the last class: 25%). - Each member of the team is to participate in the presentation- the text form is given to the instructor no later than 24 hours before class
Work placement	Not applicable

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