University of Gdańsk

Subject card

Subject name and code	Multicellular organisms - Genetics Foundation (M04_B1), PG_00197041		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Intercollegiate Faculty of Biotechnology Office -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Michał Obuchowski	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	46.0	0.0	0.0	0.0	0.0	46
	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	46	5.0	24.0	75

Subject objectives	Program block 1 in Module 04 is intended to provide detailed knowledge about the basic biological phenomena occurring in the cells of higher organisms at the level of genes and genomes (BIOTECHL3_W01), including the course of gene expression and modification of biomolecules, mechanisms of regulation of these processes and the basis of inheritance. The program block will also enable you to gain detailed knowledge about the transport of biomolecules in a eukaryotic cell, including vesicular transport (BIOTECHL3_W02).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHL3_W02] The graduate knows and understands at an advanced level selected processes at the cell, tissue and organism level, important from the biological point of view	The student understands the mechanism of selected biological processes occurring at the molecular level and is able to scale them to a cell, tissue or organism.	[SW4] test/exam - oral or written
[BIOTECHL3_W01] The graduate possesses structured and advanced knowledge of biological phenomena at the molecular level and understands their importance for biotechnology.	The student understands the basic life processes occurring in cells at the molecular level, which can be used in biotechnology.	[SW4] test/exam - oral or written
[BIOTECHL3_K05] The graduate is willing to understand the need to inform the society about the achievements of biotechnology important for the improvement of health and quality of life.	The student understands the need to disseminate information about the role of biotechnology to improve health and quality of life.	[SK4] test/exam - oral or written

Subject contents	F1. Mechanisms of regulation of gene expression in higher organisms: - Transcription in Eukaryota (basic differences from Prokaryotes). - Tissue diversity of gene expression. - Eukaryotic RNA polymerases. Construction of the regulatory region in eukaryotes. - Transcription regulators. Combinatorics of transcription regulators and their interactions. - Assembly of the RNApol II complex. - Mediator. - Regulation of haploid phase gene expression in yeast. Type change in yeast. - Spatio-temporal regulation of gene expression. Regulation at the body level (hormones, simple signaling cascades). - Regulation of gene expression at the chromosome level (X silencing). Regulation of gene expression by methylation. - RNA transport and processing (capping, polyadenylation, gene splicing, editing). - Riboswitches. - Alternative splicing of mRNA, transsplicing. - Transport to and from the nucleus. - Antisense RNA, RNA interference. - Diversity of the mRNA translation site in the eukaryotic cell. - mRNA degradation. - Regulation at the translation level (ferritin, ferritin receptor, NMD system). - rRNA processing and ribosome formation. - Translation and protein degradation in eukaryotic cells. F2. Genetics of higher organisms - the role of genes in the development of tissues/organs and the basis of inheritance: - Basics of Mendelian genetics. Genetic crossbreeds. Mendel's laws. Deviations from the 3:1 phenotypic ratio (incomplete dominance, codominance, lethal alleles, multiple alleles, epistasis). - Autosomal dominant and recessive inheritance. Inheritance of sex-linked traits. Single-gene diseases. Chromosome aberrations. - Phenotypic, environmental and genetic variability (mutational and recombination variability), mutation, mutagens, genetic diversity, polymorphism. - Genetic and molecular markers, their types, characteristics, analysis methods and applications. - Genetic counseling. Screening tests. Prenatal testing. - Genetic linkage and mapping, recombination of genes on the chromosome, meiosis and crossing-over, genetic maps and physical maps. - Conducting linkage analysis in various types of organisms. Pedigree analysis. Planned breeding experiments. - Inheritance of quantitative traits, quantitative traits, threshold traits, genotype-environment interaction, heritability, twin studies, parent-offspring regression coefficient. - Mapping quantitative trait loci (QTL). Genome-scale association studies (GWAS). - Quantitative traits in humans, genetic factors and the influence of the environment in lifestyle diseases. - Genomics. Genome learning projects. Sequencing techniques (traditional and NGS). - Personalized (precision) medicine. Application of structural and functional genomics in modern genetics. - Epigenetics. Chromatin modifications/DN modifications and genome expression. Genomic imprinting. X chromosome inactivation. - Ethical aspects of genetic research.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Part F1 (20 points)	0.0%	20.0%
Integration egzam	50.0%	40.0%
Part F2 (40 points)	0.0%	40.0%

Recommended reading

Basic literature	1. Molecular Cell Biology, 9th edition, 2021, Freemann 2. Molecular Biology of the Cell, Alberts B et al (editors), 7th edition or later, 2022, Garland Science 3. Genomes 4 T.A. Brown, 2018, Garland Science 4. Molecular Biology of the Gene, 7th edition, 2014, Pearson 5. Winter P.C., Hickey G.I., Fletcher H.L. "Genetics - short lectures", ed. III, collective translation edited by W. Prus-Głowacki, Wydawnictwo Naukowe PWN, Warsaw 2010. 6. Węgleński P. (scientific editor) "Molecular genetics", ed. VI, PWN Scientific Publishing House, 2007.
Supplementary literature	1. Principles of Biochemistry, Lehninger, edition, 7th edition 2017, Freeman 2. Concepts of Genetics, 10th edition, 2012, Pearson 3. Molecular Cloning, 2012, 4th edition, Cold Spring Harbor Laboratory Press
eResources addresses	

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable