GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Molecular Biology, PG_00037496		
Field of study	Biotechnology		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-cycle 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	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Microbiology -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Lucyna Holec-Gąsior	
	Teachers	dr hab. inż. Lucyna Holec-Gąsior	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

E-learning hours included: 0.0

Biologia molekularna 2022/2023 - Moodle ID: 26427
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26427

Biologia molekularna_laboratorium 2022/2023 - Moodle ID: 26429
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26429

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	60	4.0	11.0	75

Subject objectives

The aim of the course is to provide knowledge in the field of molecular genetic mechanisms and basic research techniques used in molecular biology. Knowledge and understanding of the processes related to the replication and expression of genetic material. Knowledge of various techniques of molecular biology and the ability to use them in practice. Ability to work in a molecular biology laboratory with the use of appropriate research tools as well as the analysis and processing of results.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W06	The student defines the basic concepts of molecular biology. It explains the central dogma of biology. Understands the basic processes taking place in the cell: replication, transcription, and translation. The student has knowledge of the structure of nucleic acids (DNA and RNA). Understands the mechanism of action of the following cellular enzymes: DNA polymerases, RNA polymerases, topoisomerases, ligases, restriction enzymes, phosphatases, and kinases. The student has knowledge of the regulation of gene expression, DNA damage, and repair.	[SW1] Assessment of factual knowledge
K6_U06	The student is able to choose the appropriate technique to perform a specific task. The student is able to prepare a laboratory stand. The student uses the basic techniques and methods used in the molecular biology laboratory.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	**LECTURE:** Introduction to molecular biology. The dogma of molecular biology. Basic concepts (gene, genotype, phenotype, nucleic acids, replication, transcription, translation). Characteristics of nucleic acids (DNA and RNA). Three-dimensional structure of DNA in a prokaryotic and eukaryotic cell. DNA replication (basic rules of the replication process: initiation, elongation, and termination; proteins participating in the replication process; characteristics of DNA polymerases). DNA damage and repair (types of mutations, the molecular basis of mutations; mutagens, DNA repair mechanism). DNA recombination (Holliday homologous recombination model; localized recombination; transposition; gene conversion). Transcription in Prokaryotes and Eukaryotes (basic rules of transcription, initiation, elongation, termination, characteristics of RNA polymerases). RNA maturation processes. Regulation of transcription in bacteria (lactose operon, tryptophan operon, catabolic repression mechanism, attenuation). Regulation of transcription in eukaryotes (chromatin modifications, protein activators and repressors of the transcription process, structural motifs responsible for interactions with nucleic acids). Differentiation of RNA structure and function (types of RNA acid; ribosome structure, transfer RNA, messenger RNA). RNA maturation processes. Translation and its regulation (molecular mechanism of translation: initiation, elongation, termination). Genetic code. Proteins - structure and properties. Post-translational protein modifications: protein folding, chaperones, signal sequences; chemical modifications of proteins (acetylation, glycosylation, phosphorylation, proteolytic cleavage, controlled protein degradation, the role of ubiquitin). Basic techniques for the study of nucleic acids and proteins. **LABORATORY:** Basic techniques and methods used in the molecular biology laboratory. Isolation of plasmid and genomic DNA. Agarose electrophoresis of nucleic acids. Chemical transformation of Escherichia coli cells with plasmid DNA. Chromatographic methods in the purification of proteins. Metal Affinity Chromatography. Protein polyacrylamide electrophoresis under denaturing conditions (SDS-PAGE) and staining of gels using the Coomassie Brilliant Blue method.
Prerequisites and co-requisites	Knowledge of the basics of cell biology and microbiology.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory - short written tests	60.0%	40.0%
lecture - written exam	60.0%	60.0%

Recommended reading	Basic literature	1. Baj J., Markiewicz Z. Molecular biology of bacteria. PWN, Warsaw, 2012. 2. Węgleński P. Molecular genetics. PWN, Warsaw, 2012. 3. Brown T.A. Genomes. PWN, Warsaw, 2018. 4. Turner P.C., McLennan A.G., Bates A.D., White M.R.H., Short Lectures. Molecular biology. PWN, Warsaw, 2011. 5. Matthews. H.R., Freedland R.A., Miesfeld R.L., Biochemistry and Molecular Biology in Outline. Prószyński i S-ka, Warsaw, 2000.
	Supplementary literature	Scientific publications on the presented issues.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. What is the dogma of molecular biology? 2. Characteristics of nucleic acids. 3. What is the three-dimensional structure of DNA in a prokaryotic and eukaryotic cell? 4. What is the molecular mechanism of DNA replication? 5. What are the types of DNA damage? 6. Models of recombination DNA. 7. What is the molecular mechanism of transcription? 8. What are the types of RNA polymerases? 9. How does RNA mature in a eukaryotic cell? 10. Diversity of RNA structure and function. 11. What is the molecular mechanism of the translation process? 12. What are the post-translational modifications of proteins. 13. Methods of testing nucleic acids. 14. Properties and application of restriction enzymes as tools in the study of nucleic acids.	
Work placement	Not applicable	