

Subject card

Subject name and code	Molecular methods of nucleic acid amplification, PG_00146043						
Field of study	Biology						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
Education level	Bachelor's studies	Subject group			Optional subject group		
Mode of study	full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish English		
Semester of study	6	ECTS credits			2.0		
Learning profile	academic	Assessment form					
Conducting unit	Laboratory of Microbial Biochemistry -> Department of General and Medical Biochemistry -> Faculty of Biology -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Karolina Stojowska-Swędryńska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		10.0		25.0	50
Subject objectives	The aim of the lecture is to provide students with the various techniques of nucleic acid amplification <i>in vitro</i> , including target, probe and signal amplification systems and their application in molecular biology, biotechnology and medicine.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOLL3_W10] the graduate is familiar with the development and current state of knowledge and the latest trends in biology, as well as their relationship with other natural disciplines	The student is aware of the development and current state of knowledge and the latest research trends using nucleic acid amplification techniques. Moreover, he/she can demonstrate the relationship between these techniques and the possibilities of their application in molecular biology, biotechnology and genetic engineering.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
	BIOLL3_U07	The student independently searches for and uses available sources of biological information, including scientific textbooks, electronic sources (publications, multimedia presentations), and online programs for the analysis of nucleic acid sequences and the design of primers.	[SU1] oral statement/conversation/ discussion [SU5] implementation of a problem task
	BIOLL3_K01	The student recognizes the boundaries of their own knowledge, conducts a critical selfassessment of their competencies, understands the importance of continuous learning and development, and actively updates their knowledge and enhances their skills.	[SK1] oral statement/conversation/ discussion [SK5] implementation of a problem task
	BIOLL3_U08	The student independently learns in a focused manner, aiming to expand their knowledge in the field of nucleic acid amplification as applied in molecular biology, genetic engineering, biotechnology, and molecular diagnostics.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
	BIOLL3_U06	The student reads and understands simple scientific and biological texts and watches scientific presentations in English in the field of molecular biology, genetic engineering and molecular diagnostics, in particular regarding nucleic acid amplification methods.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
	BIOLL3_W16	The student explains the relationship between the achievements of molecular biology and genetic engineering and the methods of amplification and analysis of nucleic acids and the possibilities of their use in scientific work, socio-economic life and commercial purposes.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
	BIOLL3_W14	The student lists the most important experimental methods and techniques based on the analysis and amplification of nucleic acids, used in molecular biology, genetic engineering, molecular diagnostics and biotechnology, with particular emphasis on the methods discussed during classes. He can also explain their theoretical basis and application.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion

Subject contents	<ul style="list-style-type: none"> • The basic principles of the Polymerase Chain Reaction (PCR) • Methods for detection of amplified fragments (hybridization and electrophoretic techniques, labeling, probes). • Controls in the experiment, weight DNA marker, interpretation of the results (positive and negative results, contamination). • Qualitative, quantitative and semi-quantitative analysis, Real Time PCR • Simplex and multiplex PCR, Nested PCR, Touch down PCR • Application of PCR for the analysis of unknown sequences (RAPD - Random Amplified Polymorphic DNA, LM PCR - Ligation Mediated PCR, inverse PCR, semi-LM PCR, semi-RAPD, Target Gene Walking, panhandle PCR) • Review of other target amplification methods (eg. TMA - Transcription Mediated Amplification, SDA - Strand Displacement Amplification) • Review of probe amplification methods (e.g. LCR - Ligase Chain Reaction, Gap-LCR) ·Review of signal amplification methods (e.g. bDNA Branched DNA) • Post-amplification analysis of the PCR product (SSCP, DGGE, TGGE, melting point analysis, restriction analysis, sequencing). • Criteria for selecting an appropriate method of nucleic acid amplification method depending on the purpose and laboratory capabilities and equipment. 		
Prerequisites and co-requisites	Knowledge of the basics of molecular biology, biochemistry and genetic engineering, and in particular, knowledge of the structure, properties and functions of basic macromolecules such as DNA, RNA, restriction enzymes, DNA ligases and DNA and RNA polymerases.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written or oral colloquium	50.1%	80.0%
	problem task	50.1%	20.0%
Recommended reading	Basic literature	<ul style="list-style-type: none"> • Scientific articles and multimedia presentations handed out during course 	
	Supplementary literature	<ul style="list-style-type: none"> • Rahman et al. <i>Polymerase Chain Reaction (PCR): A Short Review</i>, AKMMC J 2013; 4(1): 30-36, doi: 10.3329/akmmcj.v4i1.13682 • Carrino, Lee, <i>Nucleic acid amplification methods</i>, Journal of Microbiological Methods 23 (1995) 3-20, doi: 10.1016/0167-7012(95)00024-F • Fakruddin et al, <i>Nucleic acid amplification: Alternative methods of polymerase chain reaction</i> . J Pharm Bioallied Sci. 2013 Oct-Dec; 5(4): 245252. doi: 10.4103/0975-7406.120066 • Mullis, Faloona, <i>Specific synthesis of DNA in vitro via a polymerase-catalyzed chain reaction</i>. Methods Enzymol. 1987;155:335-50. doi: 10.1016/0076-6879(87)55023-6. 	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Topics and sample tasks required for the exam are provided throughout the course.		
Work placement	Not applicable		

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