University of Gdańsk

Subject card

Subject name and code	Molecular methods of nucleic acid amplification, PG_00154267		
Field of study	Medical Biology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	undergraduate studies	Subject group	Obligatory subject group in the field of study 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	Pracownia Biochemii Mikroorganizmów -> Katedra Biochemii Ogólnej i Medycznej -> Faculty of Biology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Karolina Stojowska-Swędrzyńska	
	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	2.0	33.0	50

Subject objectives	The aim of the lecture is to provide students with the various techniques of nucleic acid amplification in vitro, 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
[BIOLMEDL3_U06] reads with understanding scientific texts in Polish and simple texts in English in the field of medical biology; independently searches and uses available sources of information, including electronic sources	The student reads and understands simple scientific and biological texts and watches scientific presentations in English in the field of molecular biology, genetic engineering, molecular diagnostics and medicine, in particular regarding nucleic acid amplification methods.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[BIOLMEDL3_W12] is oriented in the development and current state of knowledge and the latest trends in medical biology; indicates their relationship with other disciplines of natural or medical sciences	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, genetic engineering and molecular diagnostics.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[BIOLMEDL3_W16] explains the theoretical basis of experimental methods and lists the most important techniques of biological sciences that can be applied to medical biology and diagnostics	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
[BIOLMEDL3_K01] understands the need for lifelong learning and to update his/her knowledge of medical biology and related disciplines	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
[BIOLMEDL3_U15] learns independently, in a focused manner	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 and medicine.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[BIOLMEDL3_K03] is aware of his/ her own limitations and knows when to seek expert assistance	The student performs a critical self-assessment of own competences and updates knowledge and improves skills	[SK1] oral statement/conversation/ discussion [SK5] implementation of a problem task

Subject contents

- 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 negativeresults, 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, restrictionenzymes, DNA ligases and DNA and RNA polymerases.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	problem task	50.1%	20.0%
	written or oral colloqium	50.1%	80.0%
Recommended reading	Basic literature	• Scientific articles and multimedia presentations handed out during course	
	Supplementary literature	• Rahman et al. Polymerase Chain Reaction (PCR): A Short Review, AKMMC J 2013: 4(1): 30-36, doi: 10.3329/akmmcj.v4i1.13682 • Carrino, Lee, Nucleic acid amplification methods, Journal of Microbiological Methods 23 (1995) 3-20, doi: 10.1016/0167-7012(95)00024-F • Fakruddin et al, Nucleic acid amplification: Alternative methods of polymerase chain reaction . J Pharm Bioallied Sci. 2013 Oct-Dec; 5(4): 245252. doi: 10.4103/0975-7406.120066 • Mullis, Faloona, Specific synthesis of DNA in vitro via a polymerase-catalyzed chain reaction. Methods Enzymol. 1987;155:335-50. doi: 10.1016/0076-6879(87)55023-6.	
	eResources addresses	Uzupełniające 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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