University of Gdańsk

Subject card

Subject name and code	Molecular methods of nucleic acid amplification, PG_00154479		
Field of study	Biology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	undergraduate 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	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
[BIOLL3_W16] The graduate knows and understands the relationship between the achievements of the chosen field of science and discipline of natural sciences and the possibilities of their use in socio-economic life, taking into account the sustainable use of biodiversity	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 graduate knows the theoretical basis of experimental methods and the most important techniques of the biological sciences	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
[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_U06] The graduate can read with comprehension simple scientific biological texts in Polish and simple texts in English	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_K01] The graduate is prepared to evaluate their own knowledge, understand the need for continuous learning and development, and is open to new ideas	The student recognizes the boundaries of their own knowledge, conducts a critical self-assessment 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 graduate is able to learn 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.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[BIOLL3_U07] The graduate should be able to independently search for and use available sources of biological information, including electronic sources	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

<table>
<tr><td>Subject contents</td><td>• 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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>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.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>problem task</td><td>50.1%</td><td>20.0%</td></tr>
<tr><td>written or oral colloqium</td><td>50.1%</td><td>80.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>• Scientific articles and multimedia presentations handed out during course</td></tr>
<tr><td>Supplementary literature</td><td>• 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.</td></tr>
<tr><td>eResources addresses</td><td>Uzupełniające
Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Topics and sample tasks required for the exam are provided throughout the course.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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