GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Supramolecular Chemistry and Medicine, PG_00050125						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2022		Academic year of realisation of subject	2022/2023			
Education level	second-cycle studies		Subject group	Optional subject group 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	3		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Microbiology -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Beata Krawczyk				
	Teachers		dr hab. Beata Krawczyk				
Lesson type and method of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	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	45		6.0	24.0		75
Subject objectives	The aim of the course is to acquaint the student with molecular methods, applied for medical diagnosis.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U53] can apply advanced equipment used in biomedical diagnostics	The student can isolate the genetic material. The student acquires the ability to prepare the PCR reaction. The student knows how a thermal cycler works and he can use it. The student can choose and apply diagnostic and analytical methods in the field of his specialty, with particular emphasis on molecular diagnostics.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
	K7_K02	Knowledge of the organization of the laboratory where molecular methods are used, advantages and disadvantages of molecular methods. The student can understand the necessity of applying new solutions in molecular diagnostics.	[SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work
	[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	The student can analyze the results of the experiment. The student knows what equipment to use for a given method.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	[K7_W53] Knows and understands, to an increased extent, selected aspects of biomedical diagnostics.	The student can answer the question: who can become a diagnostician and with what tools can work.	[SW1] Assessment of factual knowledge
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student can use IT (bioinformatic programs) for data analysis	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents	**Lecture:** Range of applications of molecular diagnostics in medicine. Discoveries in molecular diagnostics. Standarization of molecular diagnostics and verification of molecular assays. Genetic material from nuclear region and mitochondrion (Prokaryotic and Eukaryotic Genomes). Genetic polymorphism and evolutionary conservation of DNA regions. DNA amplification by Polymerase Chain Reaction (PCR). Advantages of PCR. Pitffals in PCR. The problem of DNA contamination. Detection of bacteria in clinical samples by PCR. Variations on the basic PCR technique and applications: multiplex PCR, nested-PCR, RT-PCR. Real-time PCR and application. Alternative methods for amplified nucleic acid testing. Molecular epidemiology the basics (short- term epidemic and epidemiological surveillance. REA-PFGE and PCR fingerprinting methods for differentiation of microorganisms. Ribotyping. Interpretation of gel electrophoresis patterns for molecular typing. Application of molecular typing methods in epidemiology. Molecular diagnostics in virology. An overview of new and traditional methods of DNA sequencing. Methodology of hybridization methods. Blotting Methods and applications (Southern and northern blot). Microarray cDNA and Chip DNA. Karyotype. Cytogenetic methods. Fluorescence in situ hybridization and CGH. **Exercise:** 1. Principles of organization of the laboratory (laboratory) of molecular diagnostics. The rules of moving around the molecular diagnostics laboratory and working with nucleic acid amplification techniques. The problem of contamination, principles of preventing and combating contamination. 2. Comparative analysis of the nucleotide sequence in the study of genetic relationship on the example of Enterococci. The role of tuf, sodA, ddl, groESL genes. Comparison of gene sequences of bacteria of the genus Enterococcus (nucleotide sequence alignment) - generic identification (tuff gene); species identification sodA, ddl, groESL. Generating relatedness between species based on sodA, ddl, and groESL gene sequences (alignment). Free MEGA SOFTWARE (MEGA7.0; MEGA11) http:// www.megasoftware.net); Verify specificity using tools such as the Basic Local Alignment SearchTool (BLAST) (http://www.ncbi.nlm.nih.gov/blast/) (online). 3. Principles of primer design - designing generic and species primers for tuf, ddl, sodA gene amplification 4. Analysis of restriction fragment length polymorphism in species differentiation: PCR-RFLP for *recA* gene; *16S; rpoD / Acinetobacter sp.(Acinetobacter lwoffii, Acinetobacter baumannii, Acinetobacter calcoaceticus, Acinetobacter junii, Acinetobacter haemolyticus, A. johnsonii*); universal PCR primers/selection of restriction enzyme for species differentiation; Programme: CLC sequence viewer 6 or 7.6 5. Genotyping in epidemiology and phylogenetic analysis (study of genetic relationship; determination of genetic diversity), e.g. E.coli; PyELPH 1.4 program. Task based on a photo of polyacrylamide gel from laboratories. 6. Biosensors project Paper + Project: Description of the problem, epidemiology - meaning, statistics, selection of the type of biosensor: part. receptor, receiving, detector; Presentation **Laboratory:** 1. Identification of *E. faecium and E. faecalis* species by PCR. 2. Application of multiplex PCR for identification of *Staphylococcus aureus*, and the -lactam antibiotics resistance. 3. Amplification of the human CCR5 gene - the detection of deletions 32pz-resistance to HIV infection. 4. Identification of the human sex by analysis of amelogenin gene (AMGXY). 5. Genotyping of bacterial strains based on PCR MP method. Philogenetic analysis of bacterial strains. .
Prerequisites and co-requisites	General Microbiology, Molecular biology

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory - written report, test	60.0%	25.0%
presentation, report	60.0%	25.0%
written exam	60.0%	50.0%

Recommended reading

Basic literature	Diagnostyka molekularna w mikrobiologii. B.Krawczyk, J.Kur. Wydawnictwo PG.2008. Biologia molekularna w medycynie. Elementy genetyki medycznej. Pod red. Jerzy Bal; PWN W-wa 2008. Genetyka medyczna. L.B. Jorde, J.C. Carey, M.J. Bamshad, R.L. White. Redakcja naukowa wydania polskiego Jacek Wojcierowski. Lublin 2002. Genomy. T.A. Brown. Przekład P. Węgleński. PWN W-wa 2001. PCR Application Manual. 2006. Roche Diagnostics GmbH, Mannheim (www.roche-applied-science.com) Analiza DNA - teoria i praktyka pod red. Ryszarda Słomskiego Wydawnictwo Uniwersytetu Przyrodniczego w Poznaniu. 2008. Diagnostyka molekularna z zastosowaniem techniki PCR. Krawczyk B. i in. Wyd. PG-2012 Podstawy techniki PCR ćwiczenia laboratoryjne. Wyd. PG 2012..Genetyka medyczna" G. Drewa, T. Ferenc, wyd. ELSEVIER 2012.
Supplementary literature	articles from web. http://www.ncbi.nlm.nih.gov/pubmed/

	eResources addresses	Uzupełniające https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27399 - PDF lectures links to support pages program links publications
Example issues/ example questions/ tasks being completed	The student knows what equipment to use for a given method.? What determines the efficiency of the PCR? Molecular epidemiology - methods	
Work placement	Not applicable	