Załącznik nr 5 do zarządzenia nr 189/2025

COURSE SPECIFICATION

Course code: 0912.7.LEK.B.MB

Course title in Polish: Biologia molekularna
Course title in English: Molecular Biology

1. Placement of the course within the study programme

1.1. Field of study	Medicine
1.2. Mode of study	Full-time
1.3. Level of study	Uniform Master's study
1.4. Profile of study	General academic
1.5. Course specification author	dr hab. prof. UJK Wioletta Adamus-Białek
1.6. Contact	wioletta.adamus-bialek@ujk.edu.pl

2. Generał characteristics of the course

2.1. Language of instruction	English
2.2. Entry requirements	Biology

3. Detailed characteristics of the course

3.1. Type of classes	Lectures – 20h, classes – 15h, laboratories – 15h
3.2. Place of course delivery	Courses in the teaching rooms of UJK
3.3. Form of assessment	Credit with grade; exam (3rd semester)
3.4. Teaching methods	Lecture: informative lecture, interactive lecture, problem-based lecture Exercises: subject-specific exercises, case studies Laboratory: laboratory exercises, practical classes, measurement, demonstration with explanation, demonstration with instruction
3.5.a. Basic reading list	1. Clinical Molecular Medicine, Principles and Practice, Edited by: Dhavendra Kumar, ISBN: 978-0-12-809356-6, DOI: 10.1016/C2015-0-05912-3, 2020 2. Molecular Biology, 3rd Edition, Academic Cell, David P. Clark, Nanette J. Pazdernik, Michelle R. McGehee, ISBN: 9780128132883 eBook ISBN: 9780128132890, 2018
3.5.b. Supplementary reading list	1. Principles of Genetics and Molecular Epidemiology, Juan Carlos Gomez-Verjan, Nadia Alejandra Rivero-Segura, Springer Cham, DOI https://doi.org/10.1007/978-3-030-89601-0, 2022

4. Objectives, content and learning outcomes

4.1. Course objectives (taking into account the form of classes)

Lectures:

- **CO1.** Introduction to the structure and function of the human genome, including DNA and RNA
- **CO2.** Introduction to the mechanisms of nucleic acid metabolism, specifically replication, transcription, and translation
- **CO3.** Introduction to the mechanisms of gene expression regulation

Classes:

- **CO1.** Understanding the significance of proteomics in medical sciences, including protein structure and post-translational modifications, and an overview of research methods used in proteomics
- **CO2.** Understanding the significance of transcriptomics and genomics in medical sciences and an overview of research methods used for nucleic acids
- **CO3.** Introduction to methods used in molecular laboratory diagnostics, including protein and nucleic acid electrophoresis
- **CO4.** Introduction to the metabolic transformations of nucleic acids and proteins occurring in organs, as well as the metabolic, biochemical, and molecular basis of diseases and therapies; the direction of biochemical processes depending on the cellular energy state
- **CO5.** Introduction to medical databases and developing the skills to correctly interpret the information contained therein to solve problems in basic and clinical sciences

Laboratories:

- **CO1.** Overview of laboratory organization, work principles, and the operation of equipment used in molecular research
- **CO2.** Developing skills in performing basic molecular techniques and interpreting the obtained research results
- **CO3.** Developing skills in selecting appropriate laboratory procedures based on the specific case being discussed

4.2. Course content (taking into count the form of classes)

Lectures

Structure and functions of the human genome, including DNA and RNA. Replication, transcription, and translation. Epigenetics. Mechanisms of gene expression regulation.

Exercises

Genomics, transcriptomics, and proteomics – significance, research methods, and practical applications in medical sciences. Proteins – structure, post-translational modifications, and functions. Genetic variants, including germline and somatic variants, and factors influencing genetic variation. Overview of methods used in molecular laboratory diagnostics. Analysis of clinical cases in genetic diagnostics, with particular emphasis on the limitations of diagnostic methods—including prenatal diagnostics—depending on the research technique employed. Metabolic pathways of nucleic acids and proteins in organs; metabolic, biochemical, and molecular bases of diseases and therapies; direction of biochemical processes depending on the cellular energy state. Medical databases and the interpretation of information contained therein for solving problems in basic and clinical sciences.

Laboratories

Organization and principles of laboratory work; procedures for collecting and storing samples for genetic testing; operation of equipment used in molecular research. Isolation of genetic material using manual and automated methods, accounting for pre-analytical and laboratory errors affecting sample quality and test results; qualitative and quantitative DNA analysis. PCR techniques and reaction types, with a focus on Real-Time PCR (qPCR/RT-PCR)—principles of operation, result interpretation, and applications in molecular diagnostics. Application of gel and automated electrophoresis in nucleic acid analysis and the principles of Sanger sequencing in molecular diagnostics. Fundamentals of next-generation sequencing (NGS) technology, sample preparation steps, and a comparison between NGS and Sanger sequencing. Diagnostic capabilities, clinical applications, and use cases for NGS—including the diagnosis of genetic diseases and cancers as well as microbiome analysis—along with the limitations of high-throughput sequencing techniques.

4.3. Course learning outcomes

Course learning outcomes (code)	Upon completion of the course, the student	Alignment with programme learning outcomes
in the area of knowledge knows and understands:		
W01	The protein primary, secondary, tertiary and quaternary structures as well as the post-translational and functional protein modifications and their significance;	B.W10.
W02	The functions of nucleotides in the cell, RNA and DNA primary and secondary structure as well as chromatin structure;	B.W11.
W03	The functions of the human genome, transcriptome and proteome and basic methods used in their study, the processes of replication, repair and recombination of DNA, transcription and translation and degradation of DNA, RNA and proteins as well as the concept of the regulation of gene expression;	B.W12.
W04	Basic methods used in laboratory diagnostics, including electrophoresis of proteins and nucleic acids;	B.W14.
W05	Metabolic changes taking place in organs as well as metabolic, biochemical and molecular basis of diseases and therapies;	B.W15.
in the area of skills knows how to:		
U01	Envisage the development of biochemical processes depending on the state of the cells' energy;	B.U6.
U02	Use medical databases and properly interpret the information contained therein necessary to solve problems in the field of basic and clinical sciences;	B.U8.
U03	Use basic laboratory and molecular techniques;	B.U12.
in the area of social competences is able to:		
K01	Recognize his/her own limitations and self-evaluate educational deficiencies and needs;	K.S5.
K02	Use reliable information sources;	K.S7.
K03	Conclude on the basis of own surveys and observations;	K.S8.
K04	Introduce rules of social conduct and teamwork to the group of specialists, including specialists form other medical professions also in the multicultural and multinational environment;	K.S9.
K05	Give opinions concerning various aspects of professional activity;	K.S10.
K06	Take responsibility for own decisions made during professional activities including own safety and safety of other people.	K.S11.

4.4. Assessment methods for learning outcomes

Assessment method (+/-)

Course learning outcomes (code)	Oral/written/ practical examinaion /other (specify)*	Test*	Project*	In-class activity*	Independent study*	Group work*	Other (specify)*
Type of classes							

1:	L	C	Lab	L	C	Lab	L	C	Lab	L	C	Lab	L	C	Lab	L	C	Lab	L	C	Lab

2:																					
W01	+	+			+																
W02	+																				
W03	+	+			+																
W04			+									+									
W05		+			+																
U01		+	+		+							+									
U02		+	+		+							+									
U03			+									+									
K01		+			+																
K02		+			+																
K03			+									+									
K04			+									+									
K05		+			+																
K06		+			+																

Annotation. 1: form of classes; 2: learning outcomes

4.5. Assessment criteria for learning outcomes

Type of classes:

LECTURE (L) (including classes conducted with the use of distance learning methods and techniques)

Grade	Assessment criteria
3,0	Obtaining 61-68% score on the test verifying the knowledge and skills provided for in the curriculum
3,5	Obtaining 69-76% score on the test verifying the knowledge and skills provided for in the curriculum
4,0	Obtaining 77-84% score on the test verifying the knowledge and skills provided for in the curriculum
4,5	Obtaining 85-92% score on the test verifying the knowledge and skills provided for in the curriculum
5,0	Obtaining 93-100% score on the test verifying the knowledge and skills provided for in the curriculum

Type of classes:

CLASSES (C) (including classes conducted with the use of distance learning methods and techniques)

Grade	Assessment criteria
3,0	Obtaining 61-68% score on the test verifying the knowledge and skills provided for in the curriculum
3,5	Obtaining 69-76% score on the test verifying the knowledge and skills provided for in the curriculum
4,0	Obtaining 77-84% score on the test verifying the knowledge and skills provided for in the curriculum
4,5	Obtaining 85-92% score on the test verifying the knowledge and skills provided for in the curriculum
5,0	Obtaining 93-100% score on the test verifying the knowledge and skills provided for in the curriculum

Type of classes:

LABORATORIES (LAB) (including classes conducted with the use of distance learning methods and techniques)

Grade	Assessment criteria
3,0	Passing 61-68% of the requirements specified by the tutor related to the preparation of the laboratory report
3,5	Passing 69-76% of the requirements specified by the tutor related to the preparation of the laboratory report
4,0	Passing 77-84% of the requirements specified by the tutor related to the preparation of the laboratory report
4,5	Passing 85-92% of the requirements specified by the tutor related to the preparation of the laboratory report

5,0	Passing 93-100% of the requirements specified by the tutor related to the preparation of the laboratory report

The condition for admission to the exam is 100% attendance at all forms of education.

5. ECTS credit allocation – student workload

Category	Student workload (full-time mode)	Student workload (part-time mode)
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER (CONTACT HOURS)	**50**	
Participation in lectures*	20	
Participation in seminars/laboratories*	30	
Other (specify) e.g. classes conducted with the use of distance learning methods and techniques*		
INDEPENDENT STUDY (NON-CONTACT HOURS)	**50**	
Preparation for lectures*	20	
Preparation for seminars/laboratories*	30	
Preparation for examination/test*		
Gathering materials for project, online research*		
Preparation of a multimedia presentation*		
Other (specify)*		
TOTAL HOURS	**100**	
ECTS CREDITS for the course	**4**	

*** delete as appropriate**

Approved for implementation (date and legible signatures of course instructors in the given academic year):

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