Annex No. 1.5 to the Rector's Order of the UR No. 61/2025

SYLLABUS

Concerning the cycle of education **2025- 2031**

Academic year 2026/2027

1. BASIC INFORMATION CONCERNING THIS SUBJECT

Subject name	**Molecular Biology**
Course code *	**B**
Faculty (name of the leading direction)	**Faculty of Medicine, University of Rzeszow**
Department Name	**Department of Biology** **Laboratory Diagnostics and Clinical Epigenetics**
Field of study	**Medicine**
Level of education	**Uniform master studies**
Profile	**General academic**
Form of study	**Stationary / non-stationary**
Year and semester	**Year II, semester 3**
Type of course	**Obligatory**
Language of instruction	**English**
Coordinator	**Dr Aleksander Myszka, PhD**
Name(s) of the instructor(s)	**Dr Aleksander Myszka, PhD** **Karolina Maternia-Dudzik, MSc**

*** -** *according to the resolutions of the Faculty of Medicine*

1.1. Forms of classes, number of hours and ECTS points

Semester (no.)	Lecture	Exercise	Conversation	Laboratory	Seminar	Practical	Number of points ECTS
3	20	20	-	-	-	-	**3**

1.2.The form of class activities

☒ Classes are conducted in a traditional format
☒ Classes are implemented using methods and techniques of distance learning

1.3. Examination Forms: (exam, credit with grade or credit without grade); **credit with grade**

2. BASIC REQUIREMENTS

The students should know the basics of cell biochemistry and biology.

3. OBJECTIVES, LEARNING OUTCOMES, AND PROGRAM CONTENT USED IN TEACHING METHODS

3.1. Objectives of this course

C1	Understanding the molecular mechanisms of cell functioning
C2	Understanding the structure and principles of the functioning of the human genome and genes
C3	Understanding the process of cell division, disturbances in cell division, aging, and the processes leading to cancer development
C4	Understanding molecular methods of gene analysis, their applications, and limitations
C5	Understanding the principles of conducting molecular scientific research and selecting appropriate methods
C6	Understanding the possibilities of using molecular techniques in various aspects of medicine
C7	Ability to perform basic molecular research and database analyses

3.2. Outcomes for the course

EK (the effect of education)	The content of the learning effect defined for the subject	Reference to directional effects [1]
EK_01	The graduate knows and understands the basic catabolic and anabolic pathways, the mechanisms of their regulation, and the influence of genetic and environmental factors on them	B. W13.
EK_02	The graduate knows and understands the basic methods used in laboratory diagnostics, including protein and nucleic acid electrophoresis	B. W14.
EK_03	The graduate knows and understands the processes of the cell cycle, proliferation, differentiation and aging of cells,	B. W17.

[1] *In the case of an educational path leading to teaching qualifications, also include the learning outcomes from the standards for teacher training.*

	apoptosis, and necrosis, as well as their significance for the functioning of the organism	
EK_04	The graduate is able to predict the direction of biochemical processes depending on the energetic state of the cells	B. U6.
EK_05	The graduate is able to use medical databases and accurately interpret the information contained in them to solve problems in basic and clinical sciences	B. U8.
EK_06	The graduate is able to use basic laboratory and molecular techniques	B. U12.
EK_07	The graduate is prepared to recognise and acknowledge their own limitations, as well as to self-assess deficits and educational needs	K.05.
EK_08	The graduate is prepared to utilise objective sources of information	K.07.
EK_09	The graduate is prepared to draw conclusions from their own measurements or observations.	K.08.

3.3. Programme content

A. Problems of the lecture

Course contents
1. Introduction to molecular biology. The structure of nucleic acids and DNA replication. Cell cycle.
2. Genome organisation and gene expression. The structure of eukaryotic chromosomes
3. Overview of the epigenome, transcriptome, and proteome. Protein synthesis and post-translational modifications of proteins.
4. Molecular basis of cancer transformation. Mutagenesis, DNA damage and DNA repair.
5. Molecular biology techniques are used in the routine diagnosis of human diseases.
6. Overview of next-generation sequencing and introduction to databases. Assessment of pathogenicity of genetic variants.
7. Basics of genetic engineering. DNA cloning and its applications. The application of genetic engineering in gene therapy.

B. Problems of auditorium, seminar, laboratory and practical classes

Course contents
1. Principles of work in a molecular laboratory. Organisation and work safety. Basic molecular biology procedures and laboratory organisation.
2. Isolation of genomic DNA from peripheral blood. Measurement of isolate concentration using a spectrophotometer.
3. Polymerase chain reaction (PCR). Principle of the method and assay performance.
4. Preparation of agarose gels. Agarose electrophoresis of PCR products. Overview of the principles of Sanger and Next Generation sequencing.
5. Real-time PCR (qPCR). Principle of the method and reaction performance. Overview of electrophoresis results.
6. Overview of qPCR results.

7. Introduction to databases. Assessment of the pathogenicity of genetic variants. Working with databases – searching for information in the ClinVar and OMIM databases.
8. Final test + discussion of sample molecular test results – clinical examples.

3.4. Didactic methods

Lecture: problem lecture, lecture with multimedia presentation, distance learning methods

Exercises: project method (research project, implementation, practical / group work / problem solving / discussion / experiment execution, experience design)

4. ASSESSMENT METHODS AND CRITERIA

4.1. Methods of assessing learning outcomes

Symbol of effect	Methods of assessing learning outcomes (e.g., test; colloquium; oral exam; written exam; project; report; observation during classes)	Form of classes (Exercises, Seminar…)
EK_ 01	colloquium	lecture
Ek_ 02	colloquium	lecture
Ek_ 03	colloquium	lecture
Ek_ 04	report, observations during classes	exercises
Ek_ 05	colloquium, observations during classes, report	lecture, exercises
Ek_ 06	observations during classes, report	lecture, exercises
Ek_ 07	observations during classes	lecture, exercises
Ek_ 08	observations during classes	lecture, exercises
Ek_ 09	observations during classes	lecture, exercises

4.2. Course completion requirements (evaluation criteria)

Lectures, classes (EK_01 - EK_09)

Positive assessment of the tests, positive assessment of the report, positive assessment of the students' work during classes, 100% attendance.

Final colloquium – single-choice test.

Assessment criteria:

5.0 - has knowledge of the education content at the level of 93% -100%

4.5 - shows knowledge of the content of education at the level of 85% -92%

4.0 - shows knowledge of the content of education at the level of 77% -84%

3.5 - shows knowledge of the content of education at the level of 69% -76%

3.0 - shows knowledge of the content of education at the level of 60% -68%

2.0 - shows knowledge of the educational content below 60%

Positive evaluation of the subject can be obtained only on condition of obtaining a positive assessment for each of the established learning outcomes.

5. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE THE INTENDED LEARNING OUTCOMES IN HOURS AND ECTS CREDITS

Form of activity	Average number of hours required to complete the activity
Contact hours according to the study schedule	40
Other activities involving academic staff (participation in consultations, exams)	3
Non-contact hours – student's independent work (preparation for classes, exam, etc.)	32
SUM OF HOURS	75
TOTAL NUMBER OF ECTS	**3**

** Please note that 1 ECTS point corresponds to 25–30 hours of total student workload.*

6. PRACTICAL TRAINING IN THIS SUBJECT

Number of hours	-
Rules and forms of internships	-

7. LITERATURE

Basic literature: Lippincott Illustrated Reviews: Cell and Molecular Biology. Nalini Chandar, Susan M. Viselli; Wolters Kluwer Health,2019
Additional literature: 1. Biochemistry, molecular biology and genetics. Lieberman, Michael A. Ricer, Rick E,: Wolters Kluwer Health/Lippincott Williams & Wilkins, copyright 2020 2. Introduction to molecular biology and molecular genetics., Wilczok, Tadeusz Tkacz, Magdalena A., Institute of Computer Science. University of Silesia, 2009 3. Advanced lab practices in biochemistry and molecular biology., Agarwal, Swati Khan, Suphiyal, . K., International Publishing House Pvt. Ltd, 2018 4. Molecular cell biology., Lodish, Harvey F. Berk, Arnold Kaiser, Chris A, Krieger, Monty Bretscher, AnthonyPloegh, Hidde Amon, Angelika Martin, Kelsey C., W. H. Freeman and Company. cop. 2016

Approved by the Head of the Department or an authorised person