UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN
Faculty of Medicine

Course sylabus – part A

USOS Code: 48SJO-MOLBIOL
ECTS: 3.00
Cycle: 2026

Molecular Biology
Molecular Biology

SUBJECT MATTER CONTENT:

Classes – Principles of work in a molecular biology laboratory. Principles of operation of basic laboratory equipment. Methods of isolating nucleic acids. Quantitative and qualitative analysis of nucleic acids. Enzymes used in molecular biology. Application possibilities and types of polymerase chain reaction. Gene therapy. Human genome project. Genetic databases. Use of quantitative polymerase chain reaction (qPCR) in medical diagnostics. Biological properties of stem cells. Application of stem cells in medicine.

Lecture – The structure of RNA, DNA, and chromatin. DNA replication, repair, and recombination, and the regulation of DNA and RNA degradation. Transcription, translation, and the regulation of gene expression. Characterization of the primary, secondary, tertiary, and quaternary structure of proteins. Protein modifications and their function, and the regulation of protein degradation. The function of the human genome, transcriptome, and proteome, and methods for their analysis. The molecular basis of neoplastic transformation. An outline of the molecular biology of cancer. The causes of cancer development – the relationship between external factors and molecular predispositions.

TEACHING OBJECTIVE:

The aim of the course is to provide students with knowledge of the primary and secondary structures of DNA and RNA and the organization of chromatin; DNA replication, repair and recombination, and the regulation of DNA degradation; transcription, transcriptional regulation of gene expression, and the regulation of RNA degradation; translation and translational regulation of gene expression; and the primary, secondary, tertiary and quaternary structures of proteins, their post-translational modifications and functional significance, and the regulation of protein degradation. The course also aims to introduce the characteristics and significance of the human genome, transcriptome and proteome, and the methods used to analyse them, as well as the causes of cancer, including the interplay between external factors and molecular predispositions, the molecular basis of neoplastic transformation, and the fundamentals of cancer molecular biology. During the course, students will acquire knowledge and practical skills in basic molecular biology methods, including nucleic acid isolation, amplification and electrophoresis, as well as more advanced methods, such as quantitative polymerase chain reaction (qPCR). Students will also develop skills in planning simple research studies,

Legal acts specifying learning outcomes: 467/2024;
Discipline: Medical Sciences
Course status: Obligatory
Group of courses: A - basic course
ISCED Code: 0912
Field of studies: Medicine
Field: Medicine
Learning profile: -
Form of studies: full-time
Level of studies: uniform master's studies
Year/Semester: 1st year, Medicine in English

Classes types: Classes; Lecture;
Classes: Classes (25h); Lecture (5h);
Language: ANG
Introductory subject: no requirements
Prerequisites: Basic knowledge from biology.

Organized by the unit:
Coordinators responsible for the course:
Izabela Małysz-Cymborska, i.malysz-cymborska@uwm.edu.pl

Additional notes:

interpreting results, drawing conclusions, and using online databases as sources of scientific information.

DESCRIPTION OF THE LEARNING OUTCOMES OF THE COURSE IN RELATION TO THE DESCRIPTION OF THE CHARACTERISTICS OF THE SECOND LEVEL LEARNING OUTCOMES FOR QUALIFICATIONS AT LEVELS 6-8 OF THE POLISH QUALIFICATION FRAMEWORK IN RELATION TO THE SCIENTIFIC DISCIPLINES AND THE EFFECTS FOR FIELDS OF STUDY

Symbols for outcomes related to the discipline:
M/NMA_P7S_KO+++, M/NMA_P7S_ UW+++, M/NMA_P7S_WG++++++

Symbols for outcomes related to the field of study:
K.5+, K.7.+, K.8.+, B.U12.+, B.U8.+, B.U11.+, B.W15.+, B.W10.+, B.W11.+, B.W12.+, B.W14.+, B.W18.+, B.W26.+

LEARNING OUTCOMES:

Knowledge (W1) – The student knows and understands the molecular mechanisms of regulation of cellular processes and the importance of disorders of gene expression and protein function in the development of diseases and mechanisms of therapy.

Knowledge (W2) – The student characterizes the primary, secondary, tertiary and quaternary structures of proteins, knows post-translational and functional modifications of proteins and their importance.

Knowledge (W3) – The student knows the function of nucleotides in the cell, the primary and secondary structure of nucleic acids (DNA, RNA) and the structure of chromatin.

Knowledge (W4) – The student knows the functions of the human genome, transcriptome and proteome and the basic methods used to learn and study them; describes the processes of DNA replication, repair and recombination, transcription and translation, and degradation of DNA, RNA and proteins; knows the concepts of gene expression regulation.

Knowledge (W5) – The student knows the basic methods used in laboratory diagnosis, including protein and nucleic acid electrophoresis.

Knowledge (W6) – Student knows the functions and applications of stem cells in medicine.

Knowledge (W7) – Student knows principles of conducting scientific research for the development of medicine.

Skills (U1) – The student is able to use basic laboratory techniques such as isolation of nucleic acids, setting up PCR reactions, and electrophoresis of nucleic acids in agarose gel.

Skills (U2) – The student uses databases, including online ones, and searches for the necessary information using available tools.

Skills (U3) – The student is able to plan and carry out simple scientific research, interpret its results and draw conclusions.

Social competences (K1) – The student is ready to notice, recognize and self-assess educational deficits and needs.

Social competences (K2) – The student is ready to use objective sources of information.

Social competences (K3) – The student is ready to formulate conclusions based on his/her own measurements and observations.

Symbols for outcomes related to the field of study:

Classes – ['K1', 'K2', 'K3', 'U1', 'U2', 'U3', 'W2', 'W3', 'W4', 'W5', 'W6', 'W7'] – Multimedia presentations constituting a theoretical introduction to the topic being implemented (W4;W5;W6;W7;U1;U2;U3;U4;K1;K2;K3). Laboratory classes- Carrying out basic laboratory analyses related to the topic of the classes, under observation and after prior training by the exercise instructor (U1;U2;U3;K1;K2;K3).

Lecture – ['K2', 'K3', 'W1', 'W2', 'W3', 'W4'] – Lecture (W1;W2;W3;W4;K1;K2;K3;): informative with multimedia presentation.

FORM AND CONDITIONS OF VERIFYING LEARNING OUTCOMES:

Classes (Written test) – ['K1', 'K2', 'K3', 'U1', 'U2', 'U3', 'W5', 'W6', 'W7'] – Written tests with closed questions to check preparation for current exercises (W4;W5;W6;W7;U1;U2;U3;K1;K2;K3).

Lecture (Written exam) – ['K1', 'K2', 'W1', 'W2', 'W3', 'W4', 'W5'] – Written test with single-choice closed questions. The condition for passing is to obtain at least 60% of all possible points (W1;W2;W3;W4;W5;W6;K1;K2;K3).

Classes (Colloquium test) – ['K1', 'K2', 'K3', 'U1', 'U2', 'U3', 'W3', 'W4', 'W5'] – Written test with closed questions. The condition for passing is to obtain at least 60% of all possible points (W4;W5;W6;W7;U1;U2;U3;K1;K2;K3).

REQUIRED LITERATURE:

1. **Fundamental molecular biology**

   Allison L.A.; Blackwell Publishing; 2007; Pages: ; Tome: ;

2. **Molecular Biology: Principles of Genome Function**

   Nancy L Craig, Rachel Green, Carol Greider, Gisela Storz, Cynthia W; Oxford University Press; 2021; Pages: ; Tome: ;

COMPLIMENTARY LITERATURE:

1. **Williams Hematology, Chapter 9**

   Kenneth Kaushansky, Josef T. Prchal, Linda J. Burns, Marshall A. Lichtman, Marcel Levi, David C. Lin; McGraw Hill / Medical; 2010; Pages: ; Tome: ;

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Detailed description of ECTS credits awarded - part B

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ECTS: 3.00
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Molecular Biology
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1. Contact hours with the academic teacher:

- participation in: Classes	25 h
- participation in: Lecture	5 h
- consultation	4 h
	Total: 34 h

Independent work of a student:

- Preparation for tests, colloquiums, and exams.	41.00 h
	Total: 41.00 h

contact hours + independent work of a student Total: 75.00 h

1 ECTS credit = 25-30 h of an average student's work, number of ECTS

ECTS Points = 75.00 h : 25 h/ECTS = 3.00 ECTS

Average: 3.00 ECTS

- including the number of ECTS credits for contact hours with the direct participation of an academic teacher - 1.36 ECTS pts

- including the number of ECTS credits for hours of independent work of a student - 1.64 ECTS pts