

**Thematic plan of seminar-type classes
in discipline «Molecular biology»
for students of 2024 year of admission
under the educational programme
cipher 35.05.01 Pharmacy,
specialisation (profile) Pharmacy
(Specialist's degree),
form of study full-time
for the 2025-2026 academic year**

№	Thematic blocks	Practical training (PT) ³	Hours (academic) ⁴
Semester 3			
1.	Introduction to molecular biology. ¹ Historical aspects of the development of science. Main classes of biomolecules. Transformation of Energy and Information in Cell ²	-	2
2.	Nucleic acids: structure and biological functions. Levels of DNA compaction	PT	2
3.	Replication and Repair of DNA: Mechanisms and Biomedical Significance. ¹ Stages of the implementation of genetic information. ²	PT	2
4.	Transcription. ¹ Stages of implementation. Post-transcriptional modifications of RNA. ²	PT	2
5.	Translation and its stages ¹ . Genetic code and its properties. Regulation of gene expression in prokaryotes. Drugs that regulate gene expression.	PT	2
6.	Regulation of gene expression in prokaryotes and eukaryotes. ¹ The "operon" theory. Drugs – replication inhibitors, gene expression modulators ²	PT	2
7.	Methods for studying the structure and function of nucleic acids. ¹ Polymerase chain reaction (PCR). Sequencing. Prospects for the use of gene therapy in the treatment of diseases. ²	PT	2
8.	Midterm tests 1 "Matrix biosyntheses". ¹	PT	2
9.	Classification and functions of proteins. ¹ Peptides and proteins. Levels of structural organization and classification of proteins. Enzymes: classification and	PT	2

	biological role. Classification of cofactors. Role of vitamins. ²		
10.	Mechanisms of enzymatic catalysis. ¹ Fundamentals of enzyme kinetics. ²	PT	2
11.	Coordination of metabolic pathways. ¹ Regulation of enzymatic activity. Mechanisms of induction and inhibition of enzymes. ²	PT	2
12.	Post-translational modifications of protein. ¹ Protein folding and its disorders. Molecular mechanisms of proteinopathies. Proteins and enzymes as biomarkers. ²	PT	2
13.	Methods for determining enzymatic activity. ¹ Enzyme-linked immunosorbent assay (ELISA). Application and diagnostic value of ELISA. ²	PT	2
14.	The use of enzymes in molecular genetic research. Methods for studying the structure of proteins. ¹	PT	2
15.	Proteins and enzymes as targets for drugs. ¹	PT	2
16.	Midterm tests 2 "Proteins and Enzymes: Principles of Structure and Functioning".¹	PT	2
17.	Methods of protein isolation of animal cells. Methods of protein purification and fractionation. Methods of protein identification. ¹ Methods of destruction of animal cells. Salting of proteins; dialysis. Isoelectric point. Chromatographic separation of proteins (types and principles of chromatography). Methods of gel filtration, electrophoresis of proteins in polyacrylamide gel. Western blot (the principle of recognition of proteins by antibodies). ²	PT	2
Semester 4			
18.	Structure and functions of biological membranes. ¹ Membrane proteins. Mechanisms of transport of substances across the membrane. Intercellular contacts. ²	PT	2
19.	Mechanisms of transport of substances across the membrane. ¹	PT	2
20.	Receptor function of biological membranes. ¹ Receptor signal transduction pathways. Metabotropic and ionotropic receptors. ²	PT	2

21.	^v Catalytic receptors. ¹ Molecular mechanisms of signal transduction. Nuclear and cytoplasmic receptors, regulation of its activity. ²	PT	2
22.	Midterm tests 3 "Biological membranes. Transduction of the receptor signal". 1	PT	2
23.	The cell cycle and its regulation. (Part 1) ¹ Phase of mitosis. Proteins and enzymes in the regulation of cell proliferation. ²	PT	2
24.	The cell cycle and its regulation. (Part 2) ¹ Phase of mitosis. Proteins and enzymes in the regulation of cell proliferation. ²	PT	2
25.	Cell damage. The role of necrosis and apoptosis in health and pathology. (Part 1) ¹	PT	2
26.	Cell damage. The role of necrosis and apoptosis in health and pathology. (Part 2) ¹	PT	2
27.	Molecular genetic mechanisms of tumor transformation of cells and metastasis. (Part 1) ¹	PT	2
28.	Molecular genetic mechanisms of tumor transformation of cells and metastasis. (Part 2) ¹	PT	2
29.	Principles of development and study of antitumor drugs ¹	PT	2
30.	Midterm tests 3 "Regulation of proliferative activity of cells. Mechanisms of cell death. Oncogenesis". 1	PT	2
31.	Methods of molecular and cell biology. (Part 1). ¹ Visible light microscopy, fluorescence, confocal scanning. ²	PT	2
32.	Methods of molecular and cell biology. (Part 2). ¹ Staining methods: dyes, antibodies conjugated to fluorescent groups, recombinant proteins coupled to fluorescent proteins, fluorescent probe hybridization (FISH)	PT	2
33.	Methods of molecular and cell biology. (Part 3). ¹ Precipitation of nucleic acids, proteins. Gel - electrophoresis of DNA and RNA: agarose and polyacrylamide. ²	PT	2
34.	Methods of molecular and cell biology. (Part 4). ¹ DNA and RNA detection. Southern and Northern blot detection. Protein separation by PAAG (polyacrylamide gel) electrophoresis. Detection of proteins by Coomassie staining, silver staining, and immunoblotting	PT	2
Total			68

¹ – Topic

² – Essential content

³ – PT (Practical training)

⁴ – one thematic block includes several classes, the duration of one class is 45 minutes, with a break between classes of at least 5 minutes

Considered at the department of Fundamental Medicine and Biology meeting, protocol of «22» May 2025. № 10

Head of the Department



A.V. Strygin