

**Thematic lesson plan of lectures  
in the discipline " Medical Biochemistry "  
for students of the educational program  
specialist degree  
in the specialty of training 33.05.01 Pharmacy,  
direction (profile) Pharmacy,  
form of study full - time  
for the 2023-2024 academic year**

№	Topics of lectures	Hours (academic)
1.	<b>Introduction. The subject and objectives of medical biochemistry<sup>1</sup>. The place of biochemistry among other biological sciences. Structural organization and functionality of biological macromolecules: metabolism and energy, the ability to extract and transform environmental energy; self-reproduction as the quintessence of a living state. Classification of organisms by carbon and energy sources. Levels of the structural organization of the living organisms. The biochemical unity of all forms of life. The main stages of the development of biochemistry. Methodological approaches and levels of biochemical research. Applied sections of biochemistry. The relationship of biochemistry with pharmacy, its role in the preparation of pharmacists<sup>2</sup>.</b>	2
2.	<b>Enzymes<sup>1</sup>. Classification and nomenclature. Factors affecting enzyme activity. Enzyme cofactors: metal ions and coenzymes. The mechanism of enzymes action. Enzyme inhibition, types of inhibition. Medicinal substances as enzyme inhibitors. Regulation of enzyme activity in the living system. Methods of regulation of enzyme activity: allosteric regulation and allosteric inhibition, feedback regulation, covalent modification. Isoenzymes. Applications of enzymes: the use of enzymes in medicine and pharmacy. Enzymopathology. Hereditary enzymopathies. Enzyme pattern in diseases: diagnostic importance of enzymes. enzyme therapy <sup>2</sup>.</b>	2
3	<b>Part 1. Bioenergetics<sup>1</sup>. Biological oxidation. The structure of mitochondria. Redox reactions are sources of energy in the body. Redox potential. Structural organization of respiratory chain <sup>2</sup>.</b>	2
	<b>Part 2. Hypotheses of ATP synthesis: Leninger's and Mitchell's. Uncoupling of oxidation and phosphorylation. Significance of uncoupling. Sources and generation of free radicals. Oxygen toxicity. Antioxidants in biological system: the antioxidant enzyme system, nutrient antioxidants, metabolic antioxidants. Photosynthesis <sup>2</sup>.</b>	2
4	<b>Part 1. Functions and metabolism of carbohydrates<sup>1</sup>. The main carbohydrates that are part of animal and plant organisms. Classification and nomenclature. Monosaccharides and their derivatives. Oligosaccharides are food and antigenic determinants. Polysaccharides, biological role. Digestion and absorption of carbohydrates. "Sugar" of blood<sup>2</sup>.</b>	2
	<b>Part 2. The main ways of glucose catabolism<sup>1</sup>. Regulation of glycogen synthesis and degradation. Glycolysis. Biological role. Regulation.</b>	2

	<b>Aerobic (complete) degradation of glucose. Energy yield. Pyruvate oxidation and the tricarboxylic acid cycle, their connection with specific pathways. The pentose cycle. Gluconeogenesis. Biological role. Regulation<sup>2</sup>.</b>	
5	<b>Metabolism of lipids.</b> <b>Part 1. Chemistry of lipids<sup>1</sup>. Classification. Essential fatty acids. Physico-chemical properties of lipids. Digestion and absorption of lipids. The chemical composition and role of bile. Resynthesis of triglycerides in the intestine. Transport of lipids in the body, lipoproteins<sup>2</sup>.</b>	2
	<b>Part 2. Metabolism of lipids<sup>1</sup>. Intracellular lipolysis. <math>\beta</math>-oxidation of fatty acids and glycerol oxidation. Localization and regulation. Synthesis and utilization of ketone bodies. Biochemical bases of ketonemia. Cholesterol and its biological role. Synthesis of cholesterol and its regulation. Cholesterol level as a risk factor for atherosclerosis<sup>2</sup>.</b>	2
6	<b>Protein and amino acid metabolism.</b> <b>Part 1. Protein digestion<sup>1</sup>. Characteristics of proteases. Pool of amino acids. Common pathways of amino acid catabolism: deamination, transamination, decarboxylation. Glutamate dehydrogenase. The role of glutamic acid in indirect deamination. Aminotransferases, their biological and medical significance. Ammonia is the final product of decomposition amino acids<sup>2</sup>.</b>	2
	<b>Part 2. Transport and utilization of ammonia for urea synthesis<sup>1</sup>. Decarboxylation of amino acids. Biogenic amines and polyamines. Metabolism of individual amino acids. Degradative pathway of phenylalanine and tyrosine. Amino acids and their derivatives as medical substances<sup>2</sup>.</b>	2
7	<b>Metabolism of porphyrins<sup>1</sup>. Biosynthesis of heme. Regulation of heme synthesis. Porphyrrias. Degradation of heme to bile pigments. "Direct" and "indirect" bilirubin. Jaundice<sup>2</sup>.</b>	2
8	<b>Metabolism of nucleotides<sup>1</sup>. Catabolism of nucleic acids, purine and pyrimidine nucleotides. The final products of the transformation of nitrogenous bases, infringements of their metabolism. Hyperuricemia and gout, allopurinol as a competitive inhibitor of xanthine oxidase. Xanthinuria. Orotaciduria. Anabolism of nucleotides. Biosynthesis of uridylic acid. Biosynthesis of purine nucleotides, features of deoxyribonucleotide synthesis. Regulation of nucleotide anabolism processes<sup>2</sup>.</b>	2
9	<b>Nucleic acids<sup>1</sup>. Structure and functions. Template biosynthesis of nucleic acids and proteins. Nucleotides are structural units of polynucleotides, their structure. The primary structure of DNA and RNA, their secondary and tertiary organization. Watson and Crick's DNA model. The role of nucleic acids in the storage and transfer of genetic information. Physico-chemical properties of nucleic acids<sup>2</sup>.</b>	2
10	<b>Template biosynthesis of nucleic acids and proteins.</b> <b>Part 1. DNA replication, its mechanism and biological significance<sup>1</sup>. DNA damage and repair.</b>	2

	<b>Transcription, its main stages. The role of tRNA in protein synthesis. Regulation of protein synthesis at the level of transcription and translation<sup>2</sup>.</b>	
	<b>Part 2. Posttranslational modification of proteins 1. Medicinal substances as mutagens. Genetic engineering, application in medicine and pharmacy<sup>2</sup>.</b>	2
11	<b>Part 1. The relationship of metabolism of proteins, nucleic acids, carbohydrates and lipids<sup>1</sup>. Biochemical bases of the relationship. Hierarchy of regulatory systems. Classification of hormones<sup>2</sup>.</b>	2
	<b>Part 2. Mechanism of transmission of hormonal signals to cells<sup>1</sup>. Hormones of energy supply of homeostasis. Pathogenesis of diabetes mellitus. The role of hormones in the regulation of calcium and phosphate metabolism (parathyroid hormone, calcitonin and calcitriol). Regulation of mineral metabolism. Aldosterone. Hormones of the sex glands. Prostaglandins<sup>2</sup>.</b>	2
12	<b>Pharmaceutical biochemistry. Biochemistry and Pharmacy<sup>1</sup>. Enzymes as analytical reagents. Biochemical foundations of genetic engineering. Liposomes as drug carriers. Biotransformation of medicinal substances in the body. Biochemical bases of pharmacokinetics and pharmacodynamics<sup>2</sup>.</b>	2
	<b>Total</b>	<b>36</b>

<sup>1</sup> -Subject

<sup>2</sup> - essential content (if necessary)

Considered at the meeting of the department of Theoretical biochemistry with a course of clinical biochemistry "10" May 2023, protocol № 16

Head of the Department

O.V. Ostrovskij.