

## Thematic plan lecture of biochemistry for the autumn semester 2020-2021 of academic year

№	Topic of lecture	Content
1.	Introduction The structure and functions of simple and complex proteins	<p><b>The subject and objectives of biochemistry.</b> Objects of biochemical research. Levels of structural organization of the living. The main sections and directions of biochemistry. Biochemistry and medicine.</p> <p><b>Protein molecules are the basis of life.</b> Amino acids as a structural element of protein molecules. The molecular weight of proteins. The size and shape of protein molecules, physico-chemical properties of proteins.</p> <p><b>Structural organization of protein molecules.</b> Types of bonds between amino acids in a protein: covalent and non-covalent, a brief description of the bonds. The primary structure of proteins. The dependence of the biological properties of proteins on the primary structure.</p>
2	The structure and functions of simple and complex proteins	<p><b>Structural organization of protein molecules.</b> Conformation of peptide chains in proteins. The secondary structure, its most important options, the role of hydrogen bonds in its maintenance. The tertiary structure of the protein, globular and fibrillar proteins. The concept of the domain organization of protein molecules. Families and superfamilies of proteins. The dependence of the biological properties of proteins on the secondary and tertiary structure.</p> <p><b>Protein denaturation.</b> Quaternary structure, self-assembly of multimolecular protein molecules. Biological functions of proteins. Ability for specific interactions. Methods for fractionation and purification of individual proteins</p> <p><b>Classification of proteins by biological functions.</b> Differences in the protein composition of organs and tissues in accordance with various functions of organs. Change in protein composition in ontogenesis and in diseases.</p>
3.	Vitamins	<p><b>History of the discovery and study of vitamins. Classification, biological functions.</b> Alimentary and secondary hypovitaminosis. Hypervitaminosis. General characteristics of water- and fat-soluble vitamins. Vitamin-dependent and vitamin-resistant conditions. Biochemical characteristics of the pathogenesis of rickets. Biochemical characteristics of hypervitaminosis A and D</p>
4	Enzymes. General properties	<p><b>Enzymes,</b> concept, role in metabolism. Features of enzymatic catalysis: high efficiency, dependence on physicochemical environmental conditions (temperature, pH), high selectivity (specificity of action and substrate specificity). Activators and inhibitors of enzymes, types of inhibition. The use of inhibitors as drugs.</p> <p><b>The structure of enzymes.</b> The active center, the theory of its conformation. Cofactors of enzymes. Coenzyme functions of vitamins. The main stages of enzymatic catalysis, the kinetics of enzymatic catalysis, the dependence of the rate of enzymatic catalysis on the concentration of the substrate. <b>Classification and nomenclature of enzymes. Isoenzymes</b></p>
5.	Enzymes. Specific properties. Activity regulation	<p><b>Regulation of the action of enzymes.</b> Allosteric centers of enzymes, their regulatory functions: allosteric activators and inhibitors. Regulation of the activity of enzymes by phosphorylation and dephosphorylation, specific proteolysis of the proenzyme, release of the active center from the complex with the inhibitor. The difference in</p>

		the enzymatic composition of organs and tissues, tissue-specific enzymes. Changes in the enzyme spectrum in ontogenesis and in diseases. Enzyme diagnostics and enzyme therapy. Hereditary and secondary enzymopathies. Measurement of enzyme activity in order to diagnose diseases. The use of enzymes to treat diseases. Immobilized enzymes.
6.	Regulation of metabolic processes. Hormones.	<p><b>The role of hormones in the metabolic regulation system</b>, the main mechanisms of intercellular communication: endocrine, paracrine, autocrine. The role of hormones in the regulation of metabolism. The hierarchy of regulatory systems. Neurohormonal regulation. Mediators and hormones. Hormone classification. Target cells and cellular hormone receptors. The mechanism of transmission of the hormonal signal to the cell. Cyclic 3.5-AMP and other secondary intermediaries. The effect of cytokines. Regulation of the synthesis and secretion of hormones according to the feedback principle. Synthesis and secretion of peptide hormones. The role of liberins, statins, tropic hormones of the hypophysis in the regulation of metabolism and physiological functions of the organism. Eicosanoids, their role in the regulation of metabolism and physiological functions in a living cell.</p> <p><b>Disruption of hormonal regulation.</b></p>
7.	Introduction to metabolism. Biochemistry of nutrition.	<p><b>The concept of metabolism:</b> nutrition, transport, metabolism, the allocation of metabolic products. The composition of human food, organic and mineral components, basic and minor nutrition, metabolism, the allocation of metabolic products. The composition of human food, organic and mineral components, major and minor The concept of metabolism and metabolic pathways. Anabolism and catabolism. The scheme of catabolism of basic nutrients. The concept of specific and general ways of catabolism. The relationship between anabolism and catabolism. Regulation of metabolism. Methods for the study of metabolism.</p>
8.	Energy metabolism	<p><b>Energy metabolism.</b> Biological oxidation. Endergonic and exergonic reactions. Macroergic compounds. Cyclic ATP, ADP. Substrate dehydrogenation and hydrogen oxidation as an energy source for ATP synthesis. Structural organization of the mitochondrial respiratory chain. Oxidative phosphorylation, chemosmotic theory of conjugation. Dissociation of oxidation and phosphorylation. Ter-regulatory roller of tissue respiration. Regulation of electron transfer chains. Violation of energy metabolism. The scheme of catabolism of basic nutrients. The concept of specific and general ways of catabolism. Oxidative decarboxylation of pyruvic acid. The sequence of reactions. The structure of the pyruvate dehydrogenase complex.</p> <p><b>The cycle of citric acid.</b> Allosteric mechanisms of regulation of CTK. Anabolic functions of the CTK. Reactions replenishing the citrate cycle. The mechanisms of regulation of the citrate cycle.</p>
9.	Carbohydrate metabolism and function	<p><b>The main carbohydrates of animals</b>, their content in tissues, biological role. The main carbohydrates of human food, the digestion of carbohydrates. Glucose as the main metabolite of carbohydrate metabolism. Scheme of sources and ways of spending glucose. Glucose catabolism. Anaerobic breakdown of glucose, stages, distribution, regulation, physiological significance.</p> <p><b>Glyconeogenesis</b>, the relationship of glycolysis and glyconeogenesis (Kori cycle). Aerobic decomposition of carbohydrates, stages, sig-</p>

		nificance. Pentose phosphate glucose conversion pathway. Oxidative and non-oxidative stages of the formation of pentoses.
10.	Metabolism and function of carbohydrates.	<p><b>Metabolism of fructose and galactose, metabolism of disaccharides.</b> Hereditary metabolic disorders of mono and disaccharides. Properties and distribution of glycogen. Biosynthesis and breakdown of glycogen in the liver and muscles, features and regulation of processes. Violation of glycogen exchange. The structure and functions of the carbohydrate part of glycoproteins.</p> <p><b>Glycosaminoglycans and proteoglycans, structure, properties, functions.</b></p>
11.	The metabolism and function of amino acids	<p><b>General scheme of sources and ways</b> of spending amino acids. The dynamic state of proteins in the body. Digestion of proteins in the gastrointestinal tract.</p> <p><b>Proteinases of the gastrointestinal tract,</b> proteinase proenzymes, the mechanism of their transformation into enzymes, substrate specificity of proteinases. The absorption of amino acids, the intake of amino acids in tissue cells. Regulation of the processes of digestion and absorption of amino acids</p>

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