Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation

APPROVED
Vice-Rector for Academic Affairs
_____ E.S. Bogomolova
31 August 2021

WORKING PROGRAM

Name of the academic discipline: **BIOLOGICAL CHEMISTRY – BIOCHEMISTRY OF ORAL CAVITY**

Specialty: **31.05.03 DENTISTRY**

Qualification: **DENTIST**

Department: **BIOCHEMISTRY NAMED AFTER G.YA.GORODISSKAYA**

Mode of study: **FULL-TIME**

Labor intensity of the academic discipline: **216 academic hours**

Nizhny Novgorod
2021

The working program has been developed in accordance with the Federal State Educational Standard for the specialty 31.05.03 Dentistry approved by Order of the Ministry of Education and Science and Higher Education of the Russian Federation No. 984 dated August 12, 2020.

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The program was reviewed and approved at the department meeting (protocol No.12 on August 30, 2021)

Head of the Department of Biochemistry named after G.Ya.Gorodisskaya
PhD, Professor
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30 August 2021

AGREED
Deputy Head of EMA ph.d. of biology _____ Lovtsova L.V.
(signature)

30 August 2021

1. The purpose and objectives of mastering the academic discipline "Biological chemistry - biochemistry of the oral cavity" (hereinafter - the discipline).

The purpose of mastering the discipline: participation in forming the relevant competencies: professional (GPC-2) and universal (UC-1) competencies:
Tasks of the discipline is to form knowledge about the molecular mechanisms of the physiological functions of the human body and their disturbances in pathological conditions, about the main patterns of metabolic processes that determine the state of health and human adaptation to changes in the conditions of the external and internal environment; substantiate biochemical mechanisms for prevention and treatment, biochemical methods for diagnosing and monitoring the effectiveness of treating diseases of various organs and tissues, especially organs and tissues of the oral cavity.

Requirements to the deliverables of mastering the discipline.
As a result of completing the discipline, the student should
know: • structure and properties of the main classes of biologically important compounds, the main metabolic pathways of their transformation, the role of hereditary factors in the development of diseases,
• chemical and biological essence of the processes occurring in a living human body at the molecular and cellular levels, their changes under the influence of adverse factors,
• basic principles of biochemical processes of human life activity in their integrity and interconnection.

Be able to: • use the basics of biochemical knowledge about the composition and metabolism of organs and tissues to analyze their functions at the molecular level and the state of the body as a whole,
• analyze the state of the human body, using knowledge of the biochemical processes; interpret the results of the most common methods of laboratory diagnostics, obtain information in global computer networks,
• determine the state of the human body, identify signs of pathological processes based on the interpretation of biochemical studies,
• navigate in educational, scientific, reference literature, information resources.

Possess: • the ability to abstractly think, analyze, synthesize the information received,
• basic information transformation technologies, medical and functional conceptual apparatus,
• methods of forming a healthy lifestyle of a person, using knowledge of the molecular mechanisms that underlie life processes;
• skills of analytical work with information obtained from various sources.

2. Position of the academic discipline in the structure of the General Educational Program of Higher Education (GEP HE) of the organization.

2.1 The discipline "BIOLOGICAL CHEMISTRY - BIOCHEMISTRY OF THE ORAL CAVITY" refers to the core part of Block 1 of GEP HE (31.05.03 "Dentistry", specialist level). In the general system of training doctors, biochemistry occupies a special position - it is a science that, on the one hand, gives fundamental knowledge about the molecular mechanisms of the functioning of the human body, and on the other hand, is an applied medical discipline, the knowledge of which is necessary for every dentist.
The discipline is taught in 2 and 3 semesters/ first and second years of study.

2.2. The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline: general and bioorganic chemistry, biology, physics.

2.3. Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines: propaedeutic and prevention of dental diseases, therapeutic dentistry, pathophysiology - pathophysiology of the head and neck, immunology - clinical immunology.

3. Deliverables of mastering the academic discipline and metrics of competence acquisition:

Mastering the discipline aims at acquiring the following universal (UC) and general professional (GPC) competencies:

	Competence code	The content of the competence (or its part)	As a result of mastering the discipline, the students should:		
			know	be able to	possess
1.	GPC-2.	Capable analyze results own activities to prevent professional mistakes	IGPC 2.1: orders rendering medical help, clinical recommenda-tions with taking into account standards of medical care; analysis technique results of own activity	IGPC 2.2: analyze the results examination and treatment of patients with dental diseases; compose action plan to prevent professional mistakes based on analysis results of own activity	IGPC 2.3: participation in clinical (clinico-anatomical) conferences on parsing mistakes professional activity
2.	UC-1.	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy.	IUC 1.1: methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis.	IUC 1.2: gain new knowledge based on analysis, synthesis, etc.; collect data on complex scientific problems related to the professional field; search for information and solutions based on action, experiment and experience.	IUC 1.3: researching the problem of professional activity using analysis, synthesis and other methods of intellectual activity; developing an action strategy to solve professional problems.

4. Sections of the academic discipline and competencies that are formed when mastering them.

№	Competence code	Section name of the discipline	The content of the section in teaching units
1.	UC-1, GPC -2	Structural organization of proteins. Features of the functioning of oligomeric proteins. Enzymes - structural organization and functioning.	The primary structure of proteins and its informational role. Protein conformation: stages of formation, features of the influence of environmental conditions. conformational lability of proteins. Formation of the active center and its interaction with the ligand as the basis for the functioning of proteins. The structure and functions of oligomeric proteins on the example of hemoglobin in comparison with myoglobin. Physico-chemical properties of proteins. Specificity of the action of enzymes. The main parameters characterizing the dependence of the enzymatic reaction rate on the substrate concentration (maximal velocity and Michaelis constant). Factors affecting the activity of enzymes. Classification of enzymes. Cofactors of enzymes, characteristics of the main coenzymes and their functions. Regulation of enzyme activity. Enzyme inhibitors and their use as therapeutic drugs. The concept of enzymopathies. Enzymes are drugs. Principles of enzymodiagnostics.
2.	UC-1, GPC-2	Energy metabolism	Catabolism of nutrients (carbohydrates, lipids, proteins) as the main source of energy necessary for vital processes. Specific and general pathways of catabolism. The tricarboxylic acid cycle as the main source of tissue respiration substrates. Relationship between reactions of the general pathway of catabolism and ETC. Mechanisms of regulation of these processes. Hypoenergetic states. Endergonic and exergonic reactions in a living cell. High energy compounds. ADP-ATP cycle. Dehydrogenation of substrates and oxidation of hydrogen to form water (tissue respiration) as an energy source for ATP synthesis. Thermoregulatory function of tissue respiration. Regulation of the tissue respiration by endogenous and exogenous substances.

3.	UC-1, GPC-2	Amino acid metabolism	Digestion of proteins, absorption of amino acids. Peptidases of the stomach and pancreas. Essential and nonessential amino acids. Transamination and deamination of amino acids. The biological significance of these processes. The end products of nitrogen metabolism: ammonium salts and urea. The role of glutamine and alanine in the neutralization and transport of ammonia. Synthesis of urea in the liver. Violations of the processes of synthesis and excretion of urea, as the main cause of various types of hyperammonemia. Use of nitrogen-free amino acid residues. The metabolic transformations of serine and glycine. The role of H4-folate. Mechanism of action of sulfa drugs. Methionine and transmethylation reactions. Synthesis of creatine and its importance for providing energy for muscle work. Metabolism of phenylalanine and tyrosine in different tissues. Synthesis of catecholamines and their biological role. Causes and consequences of amino acid metabolism disorders (phenylketonuria, alkaptonuria, Parkinson's disease).
4.	UC-1, GPC-2	Biosynthesis of nucleic acids and proteins. Fundamentals of molecular genetics.	Structure and functions of DNA and different types of RNA. Synthesis of DNA, ensuring the transfer of genetic signs from generation to generation. Relation of replication to the cell cycle. DNA repair as the basis of genome stability. Synthesis of RNA and post-transcriptional modifications of various types of RNA. Process features. Biological code as a way to translate a four-digit nucleotide record into a twenty-digit amino acid sequence. Protein synthesizing system. The sequence of events during the formation of a polypeptide chain on a ribosome. Post-translational modifications of proteins. Matrix synthesis inhibitors. Regulation of gene expression: stable repression and adaptive changes. Molecular mutations and recombinations as a source of genetic variability. Genotypic heterogeneity as the cause of protein polymorphism. Hereditary diseases. The use of DNA technology in medicine.
5.	UC-1, GPC-2.	Nucleotide metabolism.	Pathways for the synthesis of purine and pyrimidine nucleotides, enzymes, regulation. Catabolism of purine and pyrimidine nucleotides. Uric acid. Pathology of purine nucleotide metabolism: gout.
6.	UC-1, GPC-2	Hormonal regulation of metabolism and body functions.	The main systems of intercellular communication: endocrine, paracrine, autocrine. Classification of hormones by chemical structure, mechanism of action and biological functions. The role of hormones in the metabolic regulation system, target cells and cellular hormone receptors. The role of insulin and glucagon in the regulation of energy metabolism during normal nutrition. Changes in metabolism in hypo- and hypercortisolism.
7.	UC-1, GPC-2	Carbohydrate metabolism	The main carbohydrates in food. Digestion. Glucose as the most important metabolite of carbohydrate metabolism. Mechanism of transmembrane transfer of glucose and other monosaccharides into cells. Glycogen is a reserve form of

			glucose. Structure, properties and distribution of glycogen. The biosynthesis and breakdown (mobilization) of glycogen as processes that maintain the constancy of the glucose level in the blood. Differences in glycogen mobilization in the liver and muscles. Regulation of glycogen synthesis and breakdown by hormones. Aerobic breakdown is the main pathway of glucose catabolism in the body. Energy effect of aerobic glycolysis and aerobic breakdown of glucose. Anaerobic breakdown (anaerobic glycolysis). Differences in terminal proton acceptors in aerobic and anaerobic glycolysis. Regeneration of NAD+ as a reaction that ensures the continuous flow of the glycolytic process in tissues with a limited supply of oxygen or the absence of mitochondria in cells. Regulation of glucose catabolism. Biosynthesis of glucose (gluconeogenesis) from non-carbohydrate substances. Substrates of gluconeogenesis in various physiological states: during fasting and hard work states. Ways of lactate metabolism (Cori cycle). Regulation of glycolysis and gluconeogenesis. The role of insulin and glucagon. Importance of glycolysis in the liver for fat synthesis. Regulation of blood glucose in various physiological states of the body. Pentose phosphate pathway for glucose conversion. Distribution and physiological significance of the process.
8.	UC-1, GPC-2	Lipid metabolism.	Structure and functions of human tissue lipids, essential fatty acids. Digestion, absorption and transport of lipids with blood and possible violations of these processes: steatorrhoea, hyperchylomicronemia. The function of lipoprotein lipase. Mobilization of neutral fat in adipose tissue. The role of insulin, glucagon, adrenaline in the regulation of fat metabolism. β-oxidation of fatty acids, its regulation. Biosynthesis and oxidation of ketone bodies. The role of fatty acids and ketone bodies as energy sources during physical work, starvation, diabetes mellitus. Eicosanoids, biological effects. The use in dentistry of drugs that inhibit the synthesis of eicosanoids. Stages of fatty acid biosynthesis, synthesis of fats from carbohydrates in the liver, packaging into VLDL and transport. Deposition of fats in adipose tissue. The role of insulin in the regulation of the synthesis of fatty acids and fats. Functions of cholesterol, stages of its biosynthesis and regulation. Role of lipoproteins in cholesterol transport. Synthesis and conjugation of bile acids, enterohepatic circulation. Hypercholesterolemia, biochemical basis for the development of atherosclerosis and its treatment. The role of ω-3 acids in the prevention of complications of atherosclerosis. Cholelithiasis and principles of its treatment. The main cell membranes and their functions. The lipid composition of membranes is phospholipids, glycolipids, cholesterol. Mechanisms for the transport of substances through membranes. The main components and stages of transmembrane signaling of hormones, mediators, cytokines, eicosanoids. lipid

			peroxidation.
9.	UC-1, GPC-2	Biochemistry of the liver. Inactivation of foreign substances in the body.	The system of microsomal oxidation and the role of cytochrome P450 in this process in the inactivation of xenobiotics. Conjugation reactions. Neutralization of products formed from amino acids under the action of intestinal microorganisms. Biotransformation of drugs in the liver. Molecular mechanisms of phagocytosis. Heme structure and biosynthesis, regulation. Violations of the biosynthesis of heme - porphyria. Iron metabolism: absorption, transport, entry into cells. Iron metabolism disorders. Heme catabolism. The metabolism of bilirubin. Jaundice and their differential diagnosis. Hereditary disorders of bilirubin metabolism.
10.	UC-1, GPC-2	Biochemistry of connective tissue.	Features of synthesis, intracellular and extracellular post-translational modifications of proteins of the extracellular matrix. Structure and functions of glycosaminoglycans. Hereditary and acquired metabolic disorders of connective tissue proteins.
11.	UC-1, GPC-2	Biochemistry of mineralized tissues.	Osteoblasts, osteocytes and osteoclasts - their role in bone metabolism. Hydroxyapatites, possible options for changing their structure. Non-collagen bone proteins: osteonectin, osteocalcin, osteopontin; features of their structure and metabolism. The role of hormones in the regulation of calcium and phosphate metabolism (parathyroid hormone, calcitonin and calcitriol). Structure, biosynthesis and mechanism of action of calcitriol. Causes and manifestations of rickets, hypo- and hyperparathyroidism. Bone remodeling. The role of RANKL proteins and osteoprotegerin in the regulation of resorption and bone formation. Formation and structure of membrane vesicles; their participation in mineralization. Involvement of hormones in the regulation of remodeling. The structure and function of osteocalcin, the main marker of bone metabolism. Tooth tissues, difference in the degree of mineralization and protein composition. The main features of the metabolism of tooth tissues. The role of Ca2+-binding proteins in the formation of the organic basis of tissues. Genetic disorders of tooth tissues - hereditary disorders of amelogenesis and dentinogenesis.
12.	UC-1, GPC-2	Biochemistry of the oral fluid.	Mixed saliva, the origin of its mineral organic constituents. Flowing saliva, volume of secretion, regulation of secretory function. Metabolism of acinar cells of the salivary glands. The mineral composition of mixed saliva, the structure of calcium phosphate micelles, changes in their structure when the saliva pH deviates from the optimum. Structure and functions of mixed saliva proteins. Synthesis of mucins, features of their amino acid composition and oligosaccharide chains. The role of mucins in the construction of the pellicle. Polyfunctional proteins of saliva, features of their structure and functioning. Antigen-specific glycoproteins of saliva and their use in forensics. Protective systems of the oral cavity. Proteins and electrolytes of the gingival fluid. Stages

			and mechanism of activation of proteins of the complement system. The presence in the gingival fluid, bacterial enzymes of aggression. Low molecular weight substances and the mechanism of their toxic effect on the cells of the oral mucosa. The formation of plaque, the causes of caries. Formation of tartar (supragingival, subgingival). Influence of subgingival calculus on the development of inflammation of periodontal tissues. The use of saliva for diagnostic purposes.

5. Volume of the academic discipline and types of academic work.

Type of educational work	Labor intensity		Labor intensity (AH) in semesters		
	volume in credit units (CU)	volume in academic hours (AH)	2nd semester	3rd semester	
Classroom work, including			54	54	
Lectures (L)		24	12	12	
Laboratory practicum (LP)*					
Practicals (P)		84	42	42	
Seminars (S)					
Student's individual work (SIW)		72	36	36	
exam		36		36	
TOTAL LABOR INTENSITY		216	90	126	

*- relevant for both full-time and distance learning

6. Content of the academic discipline

6.1. Sections of the discipline and types of academic work*:

№	Se-me-ster num-ber	Name of the section of the academic discipline	Types of academic work** (in AH)					
			L	LP	P	S	SIW	total
1	2	Structural organization of proteins. Features of the functioning of oligomeric proteins. Enzymes. Structural organization and functioning.	2		12		12	26
2	2	Energy metabolism.	2		9		4	15
3	2	Amino acid metabolism.	2		12		6	20
4	2	Biosynthesis of nucleic acids and proteins. Fundamentals of molecular genetics.			3		4	7
5	2	Nucleotide metabolism.	2		3		4	9
6	2	Hormonal regulation of	2		3		4	9

		metabolism and body functions.						
7	3	Carbohydrate metabolism.	2		12		6	20
8	3	Lipid metabolism.	4		12		6	22
9	3	Biochemistry of the liver. Inactivation of foreign substances in the body.	2		3		4	9
10	3	Biochemistry of connective tissue.	2		3		8	13
11	3	Biochemistry of mineralized tissues.	2		3		8	13
12	3	Biochemistry of the oral fluid. Biochemistry of the oral cavity	2		9		6	17
		TOTAL	24		84		72	180

*- relevant for both full-time and distance learning

** - L – lectures; LP – laboratory practicum; P – practicals; S – seminars; SIW – student's individual work.

6.2. Thematic schedule of lectures*:

№	Name of lecture topics	Volume in AH	
		semester 2	semester 3
1	INTRODUCTION. SUBJECT AND OBJECTIVES OF BIOLOGICAL CHEMISTRY. ENZYMES. STRUCTURE, PROPERTIES, REGULATION OF ENZYME ACTIVITY.	2	
2	MITOCHONDRIAL ELECTRON TRANSFER CHAIN. OXIDATIVE PHOSPHORYLATION.	2	
3	AMINO ACID METABOLISM. PROTEIN ASSIMILATION. TRANSAMINATION, OXIDATIVE DEAMINATION AND DECARBOXYLATION OF AMINO ACIDS. METABOLISM OF CYCLIC AMINO ACIDS. END PRODUCTS OF NITROGEN METABOLISM. THE ROLE OF GLUTAMINE IN THE NEUTRALIZATION OF AMMONIA. BIOSYNTHESIS OF UREA. SYNTHESIS OF CREATINE AND CREATIN PHOSPHATE.	2	
4	NUCLEOTIDE METABOLISM.	2	
5	HORMONES.	2	
6	CARBOHYDRATE METABOLISM. SYNTHESIS AND DECOMPOSITION OF GLYCOGEN. GLUCOSE CATABOLISM. ANAEROBIC AND AEROBIC GLYCOLYSIS. GLUCONEOGENESIS. REGULATION OF CARBOHYDRATE METABOLISM.	2	

7	LIPID METABOLISM. LIPID DIGESTION. LIPOPROTEINS. FATTY ACIDS CATABOLISM.		2
8	BIOSYNTHESIS OF LIPID.MEMBRANES. LPO.		2
9	BIOCHEMISTRY OF THE LIVER.		2
10	BIOCHEMISTRY OF CONNECTIVE TISSUE.		2
11	BIOCHEMISTRY OF MINERALIZED TISSUES.		2
12	BIOCHEMISTRY OF THE ORAL CAVITY.		2
	TOTAL (total - 24 AH)		

*- relevant for both full-time and distance learning

6.3. Thematic plan of laboratory practicum (LP)* (this type of activity is not provided in the curriculum).

6.4. Thematic plan of practicals (P) *:

№	Name of topics of practicals	Volume in AH	
		semester 2	semester 3
1	Structure and properties of proteins.	3	
2	Enzymes. properties of enzymes. Vitamins as enzyme cofactors.	3	
3	Regulation of enzyme activity.	3	
4	Credit test topic: “Proteins. Enzymes.»	3	
5	Energy metabolism. TCA cycle.	3	
6	Biological oxidation. Oxidative phosphorylation.	3	
7	Credit test topic: «Energy metabolism»	3	
8	Protein metabolism. Digestion of proteins.	3	
9	Intracellular transformations of amino acids.	3	
10	End products of protein metabolism.	3	
11	Credit test topic: « Protein metabolism »	3	
12	Nucleotide metabolim and protein synthesis	6	
13	Hormonal regulation of metabolism and body functions.	3	
14	Carbohydrate metabolism. Assimilation of dietary carbohydrates. Synthesis and mobilization of glycogen.		3
15	Aerobic and anaerobic glycolysis. Gluconeogenesis		3
16	The pentose phosphate pathway for glucose conversion. Regulation of carbohydrate metabolism.		3
17	Credit test topic: « Carbohydrate metabolism».		3
18	The most important lipids in the body. Assimilation of dietary lipids. Lipid transport.		3
19	Mobilization of triacylglycerols. Oxidation of fatty acids and ketone bodies		3
20	Synthesis of fatty acids, phospholipids and cholesterol. Biological membranes. Membrane metabolism.		3
21	Credit test topic: « Lipid metabolism».		3
22	Biochemistry of the liver.		3
23	Biochemistry of connective tissue.		3
24	Biochemistry of mineralized tissues.		3

25	Biochemistry of the oral cavity. Organic components of saliva.		3
26	Biochemistry of the oral cavity. Inorganic components of saliva.		3
27	Credit test topic: « Biochemistry of oral cavity».		3
	TOTAL (total - 84 AH)		

*- relevant for both full-time and distance learning

6.5. Thematic plan of seminars (this type of activity is not provided in the curriculum).

6.6. Types and topics of student's individual work (SIW) *:

№	Types and topics of student's individual work (SIW)	Volume in AH	
		semester 2	semester 3
1	1. Fulfillment of case-tasks. 2. Preparation of abstracts on topics: - Suprasecondary protein structure. Domains and clusters. - The role of proteomics in the assessment of pathological conditions.	6	
2	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: - Protein enzyme inhibitors. Enzyme inhibitors as drugs, - Hereditary enzymopathies. 3. Business game "Vitamins".	6	
3	1. Fulfillment of case tasks 2. Preparation of abstracts on topics: -Biochemical bases for the use of drugs based on B vitamins and succinic acid. - The value of citrate for bone tissue. - The role of mitochondria in the development of programmed cell death and apoptosis. - Hypoenergetic states.	4	
4	1 Fulfillment of case tasks. 2. Preparation of abstracts on topics: - Nitrogen balance as a general indicator of protein metabolism. - Intracellular protein proteolysis. The role of ubiquitin. - Biogenic amines: formation, metabolism, functions. - Hyperammonemia. - Nitrogen monoxide, its physiological role - the discovery of the 20th century.	6	
5	1. Fulfillment of case tasks. 2. Preparation of abstracts on the topic: -Regulation of gene expression. -Use of DNA technology in medicine.	4	
6	1. Fulfillment of case tasks 2. Preparation of abstracts on topics: - Violations of purine metabolism. -Enzymes for the synthesis of nucleotides as targets for the action of antiviral and antitumor drugs.	4	
7	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics:	4	

	- Regulation of water-salt metabolism. -Regulation of calcium and phosphate metabolism.		
8	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: - Disorders of digestion and absorption of carbohydrates. - Regulation of glycolysis. Pasteur effect. - Relationship between glycolysis and gluconeogenesis. -Hyperglycemia and hypoglycemia - causes, biochemical indicators, effects on the body. -Glycation of proteins. Amadori products. 3. Role-playing game "Patient with diabetes at the dentist"		6
9	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: -Essential fatty acids and phospholipids. Their role and importance in human metabolism. -Bile acids; formation and their role in lipid digestion. - Relationship between lipid and carbohydrate metabolism. The ketogenic diet and ketosis. - The role of ω-3-acids in the prevention of atherosclerosis. - Pro - and - antioxidant systems of the cell. 3. Round table "LPO".		4
10	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: - Microsomal and non-microsomal oxidation, role in the neutralization of endogenous toxic substances and xenobiotics. -Mechanism of addiction to drugs. -Inducers of cytochrome P450 synthesis.		4
11	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: - The role of ascorbic acid in the metabolism of connective tissue. - Connective tissue polymorphism		8
12	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: -Biochemical mechanisms of bone tissue remodeling. -GLA proteins, their role in bone and tooth mineralization		8
13	1. Fulfillment of case tasks. 2. Preparation of abstracts on topics: - Proteins of the oral fluid that perform a protective function. - Enzymes of saliva, their physiological role, diagnostic value.		6
	TOTAL (total - 72 AH)		

*- relevant for both full-time and distance learning

7. Types of assessment formats for ongoing monitoring and mid-term assessment.

№	Seme-ster	Types of a control	Name of section of academic discipline	Assessment formats		
				types	number of test questions	number of test task options

1	2	3	4	5	6	7
1.	2	Control of mastering the topic. Monitoring the student's individual work.	Structure and function of proteins and amino acids	Test tasks	6-10	unlimited
				Test questions	2	8
2.	2	Control of mastering the topic. Monitoring the student's individual work.	Enzymes	Test tasks	6-12	unlimited
				Test questions	2	7
				Situational tasks	1	23
3.	2	Control of mastering the topic. Monitoring the student's individual work.	Energy metabolism	Test questions	6-12	unlimited
				Abstract	2	7
4.	2	Control of mastering the topic. Monitoring the student's individual work.	Amino acid metabolism	Test tasks	5-10	unlimited
				Test questions	2	7
5.	2	Control of mastering the topic. Monitoring the student's individual work.	Biosynthesis of nucleic acids and proteins. Fundamentals of Molecular Genetics.	Test tasks	2	10
				Test questions	1	10
6.	2	Control of mastering the topic. Monitoring the student's individual work.	Nucleotide metabolism	Test tasks	5-10	unlimited
				Test questions	2	7
7.	2	Control of mastering	Hormonal regulation of metabolism and body	Test tasks	5-10	unlimited

		the topic. Monitoring the student's individual work.	functions.	Test questions	2	7
8.	3	Control of mastering the topic. Monitoring the student's individual work.	Carbohydrate metabolism	Test tasks	6-12	unlimited
				Test questions	2	8
9.	3	Control of mastering the topic. Monitoring the student's individual work.	Lipid metabolism	Test tasks	6-12	unlimited
				Test questions	2	10
10.	3	Control of mastering the topic. Monitoring the student's individual work.	Biochemistry of the liver. Inactivation of xenobiotics in the body.	Test tasks	6-12	unlimited
				Test questions	2	7
11.	3	Control of mastering the topic. Monitoring the student's individual work.	Biochemistry of connective tissue	Test tasks	5-10	unlimited
				Test questions	2	8
12.	3	Control of mastering the topic. Monitoring the student's individual work.	Biochemistry of mineralized tissues (bones and teeth)	Test tasks	6-12	unlimited
				Test questions	2	7
13.	3	Control of mastering the topic. Monitoring the student's	Biochemistry of oral cavity	Test tasks	5-10	unlimited
				Test questions	2	7

		individual work.				
14.	3	Exam	All sections of the subject	Test questions	3	35

Examples of evaluation tools:

Examples of assessment tools for ongoing monitoring of progress and intermediate certification:

TEST CONTROL ON THE TOPIC "PROTEINS, ENZYMES"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. What is the chemical origin of enzymes?

1 – complex proteins 2 – derivatives of vitamins
3 – derivatives of amino acids 4 – simple and complex proteins

2. Define the term apoenzyme:

1 -complex of protein and coenzyme 2 – protein part of a complex enzyme
3 -unprotein part of a complex enzyme 4 – simple ezyme

TEST CONTROL ON THE TOPIC: "BIOLOGICAL OXIDATION"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. From the list below, select the author of the peroxide theory of biological oxidation:

1 - Lauvazier 2 - Bach 3 - Warburg 4 - Wieland 5 - Paladin 6 - Chance 7 - Mitchell 8 - Lehninger 9 - Knoop 10 - Kennedy

2. From the list below, select the name of the subclass of enzymes that supply electrons to molecular oxygen in biological oxidation reactions: (2 answers)

1 - dehydrogenases 2 - oxidases 3 - oxygenases

3. From the list below, select the products of the first stage of nutrient catabolism: (3 answers)

1 - fatty acids 2 - glucose 3 - amino acids 4 - urea 5 - water 6 - uric acid 7 - pyruvate 8 - lactate 9 - carbon dioxide 10 - acetyl-SCoA

TEST CONTROL ON THE TOPIC "CARBOHYDRATE METABOLISM"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. From the list below, select tissues in which reactions pentose phosphate pathway proceed at the highest speed: (3 answers)

1 - fatty 2 - hepatic 3 - adrenal cortex
4 - muscular 5 - nervous 6 - cardiac

2. Select an NADP-dependent enzyme from the list below pentose phosphate pathway: (2 answers)

1 - glucose-6-phosphate dehydrogenase 2 - gluconolactone hydrolase
3 - 6-osphogluconate dehydrogenase 4 - epimerase

3. From the list below, select a TPP-dependent enzyme pentose phosphate pathway: (2 answers)

1 - glucose-6-phosphate dehydrogenase 2 - gluconolactone hydrolase
3 - 6-phosphogluconate dehydrogenase 4 - transketolase 5 - transaldolase

TEST CONTROL ON THE TOPIC "Lipid Metabolism"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. Indicate which of the following amino acids are involved in the formation of paired bile acids: (2 answers)

1 - alanine 2 - glycine 3 - serine 4 - taurine 5 - cysteine

2. From the list below, select the chemicals that are formed during hydrolysis TAG in the gut: (2 answers)

1 - fatty acids 2 - monoacylglyceride 3 - phosphoric acid 4 - sphingosine

3. From the list below, select the substances involved in the resynthesis of triacylglycerides (TAG) in the cells of the small intestine mucosa: (2 answers)

1 - monoacylglycerides 2 - fatty acids 3 - Acyl-SkoA 4 - α-glycerophosphate

TEST CONTROL ON THE TOPIC "PROTEIN METABOLISM"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. From the list below, select the parameter that determines the nutritional value of the protein: (2 answers)

1 - a set of essential amino acids 2 - completeness of assimilation of amino acids
3 - the physiological state of the body 4 - body weight and age of the body.

2. From the list below, select the state of the body in which a negative nitrogen balance develops: (2 answers)

1 - healthy adult 2 - severe disease
3 - growing body 4 - aging body 5 - pregnancy

3. From the list of enzymes, select gastrointestinal endopeptidases: (6 answers)

1 - amyopeptidase 2 - dipeptidase 3 - carboxypeptidase 4 - collagenase
5 - pepsin 6 - trypsin 7 - chymotrypsin 8 - enteropeptidase 9 - elastase

4. From the list below, select an enzyme that activates collagenase:

1 - amyopeptidase 2 - dipeptidase 3 - carboxypeptidase 4 - pepsin
5 - trypsin 6 - chymotrypsin 7 - enteropeptidase 8 - elastase

TEST CONTROL ON THE TOPIC "BIOCHEMISTRY OF HORMONES"

Instruction.

Without additional instructions in the test item, select the one most correct answer.

1. The hormone somatostatin is secreted by the neurons of the hypothalamus, but it can perform the functions neurotransmitter at synapses. From the list below, select the name of this type of action:

1 - autocrine 2 - paracrine 3 - hemocrine 4 - neurocrine

2. Match the hormones (1 - 4) and the place of their formation (5 - 8): (4 pairs of answers)

1 - insulin 2 - glucagon 3 - progesterone 4 - aldosterone
5 - α-cells of the islets of Langerhans 6 - β-cells of the islets of Langerhans
7 - adrenal cortex 8 - corpus luteum

3. From the list below, select a hormone of protein nature:

1 - thyroxine 2 - adrenaline 3 - parathyroid hormone 4 - corticosterone
5 - testosterone

8. Educational, methodological and informational support for mastering the academic discipline (printed, electronic publications, the Internet and other network resources).

8.1. Key literature references

№	Name according to bibliographic requirements	Number of copies	
		at the department	at the library

1	**Biochemistry with exercises and tasks: a textbook for universities + 1 electron. disk (CD-Rom) / Severin E.S., A.I. Glukhov, V.A. Golenchenko, O.V. Korlyakova and others; - M. : GEOTAR-Media, 2010. - 384 p. : ill. soft - ISBN 978-5-9704173-6-2.**	4	92
2	**Biochemistry of tissues and fluids of the oral cavity: textbook / T. P. Vavilova; Vavilova Tatyana Pavlovna - 2nd ed., corrected. and additional - M. : GEOTAR-Media, 2012. - 208 p. : ill. - ISBN 9785970418611.**	2	10
3	**Biochemistry of the oral cavity: textbook / P. P. Zagoskin, E. I. Erlykina; Volga Research Medical University. - N. Novgorod: PIMU Publishing House, 2021. - 104 p. : ill. - ISBN 978-5-7032-1418-3.**	5	105
4	**Biochemistry of tissues and fluids of the oral cavity: textbook / T.P. Vavilov; Vavilova T.P. - Moscow: GEOTAR-Media, 2019. - 208 p. - ISBN 978-5-9704-5006-2. - Text : electronic. - URL: https://www.studentlibrary.ru/book/ISBN9785970450062.html (date of access: 11/14/2021). - Access mode: by subscription.**	Electronic resource	Electronic resource
5	**Lippincott Illustrated Reviews: Biochemistry / E. E. Abali, S. D. Cline, D. S. Franklin, S. M. Viselli. – 8th ed. – Philadelphia : Wolters Kluwer, 2022. – XI, 625 p. : ill. – ISBN 978-1-975155-11-7.**	1	59
6	**Biochemistry with exercises and tasks : monograph / b. ed, V. V. ; ed. by A. I. Glukhov ; V. V. Garin. – Moscow: GEOTAR-Media, 2022. – 296 c. – ISBN 978-5-9704-7069-5. – Text : electronic. – URL: https://www.studentlibrary.ru/book/ISBN9785970470695.html (date of access: 20.11.2022). – Access mode: by subscription.**	Electronic resource	Electronic resource

8.2. Further reading*:

№	Name according to bibliographic requirements	Number of copies	
		at the department	at the library
1	**Biological chemistry and biochemistry of the oral cavity. Situational tasks and tasks: textbook / A.I. Glukhov; Glukhov A.I. - Moscow: GEOTAR-Media, 2019. - 240 p. - ISBN 978-5-9704-5096-3. - Text : electronic. - URL: https://www.studentlibrary.ru/book/ISBN9785970450963.html (date of access: 11/14/2021). - Access mode: by subscription.**	Electronic resource	Electronic resource
2	**Biochemistry: textbook / ed. E. S. Severin. - 5th ed., Rev. and additional - M. : GEOTAR-Media, 2016. - 768 p. – ISBN 9785970437629.**	1	2

8.3. List of guidelines for independent work of students:

№	Name according to bibliographic requirements	Number of copies	
		at the department	at the library

1	**Biochemistry for dental students / D. Puri. – Delhi : Elsevier, 2016. – XV, 332 p. – ISBN 978-81-312-4444-9.**	Electronic resource	Electronic resource
2	**Biochemistry with exercises and tasks: monograph / b. ed, V. V. ; ed. by A. I. Glukhov; V. V. Garin. – Moscow: GEOTAR-Media, 2022. – 296 c. – ISBN 978-5-9704-7069-5. – Text: electronic.. – URL: https://www.studentlibrary.ru/book/ISBN9785970470695.html (date of access: 20.11.2022). – Access mode: by subscription.**	Electronic resource	Electronic resource
3	**Training material in biochemestry** : **Training material** / **E. Erlykina, A. A. Anashkina, O. V. Barinova [et al.] ; – N. Novgorod : Publishing House of Privolzhskiy Research Medical University, 2019.**	Electronic resource	Electronic resource
4	**Hormones. Textbook / ed. prof. E.I. Yerlykina. - N. Novgorod: 2018. - 39 p.**	Electronic resource	Electronic resource
5	**Biochemical aspects of matrix syntheses. Textbook / ed. prof. E.I. Yerlykina. - N. Novgorod: 2019**	Electronic resource	Electronic resource

8.4. Electronic educational resources for teaching academic subjects

8.4.1. Internal Electronic Library System of the University (IELSU)***.**

Name of the electronic resource	*Brief description (content*	*Access conditions*	*Number of users*
Internal electronic library system (IELS)	Proceedings of the teaching staff of the Academy: textbooks and teaching aids, monographs, collections of scientific papers, scientific articles, dissertations, abstracts of dissertations, patents.	From any computer on the Internet, using an individual login and password [Electronic resource] - Access mode: http://95.79.46.206/login.php	unlimited

8.4.2. Electronic educational resources acquired by the University.

Name of the electronic resource	*Brief description (content)*	*Access conditions*	*Number of users*
Electronic database "Student Advisor"	Educational literature + additional materials (audio, video, interactive materials, test tasks) for higher medical and pharmaceutical education. Editions are structured by specialties and disciplines in	From any computer on the Internet, using an individual login and password [Electronic resource] - Access mode: http://www.studmedlib.ru/	General subscription of PIMU

	accordance with the current Federal State Educational Standards of Higher Professional Education.		
Electronic library system "Bukap"	Educational and scientific medical literature of Russian publishing houses, incl. translations of foreign publications.	From any computer located on the Internet by login and password, from the computers of the academy. Subscribed editions are available for reading. [Electronic resource] - Access mode: http://www.books-up.ru/	General subscription of PIMU
"Bibliopoisk"	Integrated search service "single window" for electronic catalogs, ELS and full-text databases. The results of a single search in the demo version include documents from domestic and foreign electronic libraries and databases available to the university as part of a subscription, as well as from open access databases.	For PIMU, access to the demo version of the Bibliopoisk search engine is open: http://bibliosearch.ru/pimu.	General subscription of PIMU
Russian electronic periodicals	Periodicals on medical topics and higher education	From the computers of the academy on the platform of the electronic library eLIBRARY.RU -magazines publishing house "Mediasphere" - from the computers of the library or	

		provided library at the request of the user [Electronic resource] - Access mode: https://elibrary.ru/	
International scientometric database "Web of Science Core Collection"	Web of Science covers materials on natural, technical, social, humanities; takes into account the mutual citation of publications developed and provided by Thomson Reuters; has built-in search, analysis and management of bibliographic information.	Free access from PIMU computers [Electronic resource] - Access to the resource at: http://apps.webofknowledge.com	Free access from PIMU computers

8.4.3 Open access resources

Name of the electronic resource	*Brief description (content)*	*Access conditions*
Federal Electronic Medical Library (FEML)	Includes electronic analogues of printed publications and original electronic publications that have no analogues recorded on other media (dissertations, abstracts, books, magazines, etc.). [Electronic resource] - Access mode: http://neb.rf/	from any computer on the Internet
Scientific electronic library eLIBRARY.RU	The largest Russian information portal in the field of science, technology, medicine and education, containing abstracts and full texts of scientific articles and publications. [Electronic resource] - Access mode: https://elibrary.ru/	from any computer on the Internet
Scientific electronic library of open access CyberLeninka	Full texts of scientific articles with annotations published in scientific journals in Russia and neighboring countries. [Electronic resource] - Access mode: https://cyberleninka.ru/	from any computer on the Internet
Russian State Library (RSL)	Abstracts for which there are copyright agreements with permission for their open publication [Electronic resource] - Access mode: http://www.rsl.ru/	from any computer on the Internet
Reference and legal system "Consultant Plus"	Federal and regional legislation, judicial practice, financial advice, legislative comments, etc. [Electronic resource] - Access mode: http://www.consultant.ru/	from any computer on the Internet

Official website of the Ministry of Health of the Russian Federation	National Clinical Guidelines [Electronic resource] - Access mode: cr.rosminzdrav.ru - Clinical recommendations	from any computer on the Internet

9. Material and technical support for mastering an academic discipline

9.1. List of premises for classroom activities for the discipline

1. 7 specially equipped classrooms equipped with laboratory tables for seminars, practical lessons in the study of the subject
2. 2 specially equipped scientific laboratories for the implementation of research work of students

9.2. List of equipment for classroom activities for the discipline

: water baths, photoelectrocolorimeters, laboratory centrifuges, thermostats, spectrophotometers, ionometers, urine analyzers, laboratory glassware, tripods, sets of appropriate reagents, tweezers, Petri dishes, flasks, test tubes, pipettes, reagent bottles; filter paper;
multimedia systems for lecturing (laptop, projector, screen), TVs, laptop with multimedia attachment, computers, printers, scanners, whiteboards.

9.3. A set of licensed and freely distributed software, including domestic production

Item no.	**Software**	**number of licenses**	**Type of software**	**Manufacturer**	**Number in the unified register of Russian software**	**Contract No. and date**
1	Wtware	100	Thin Client Operating System	Kovalev Andrey Alexandrovich	1960	2471/05-18 from 28.05.2018
2	MyOffice is Standard. A corporate user license for educational organizations, with no expiration date, with the right to receive updates for 1 year.	220	Office Application	LLC "NEW CLOUD TECHNOLOGIES"	283	without limitation, with the right to receive updates for 1 year.
3	LibreOffice		Office Application	The Document Foundation	Freely distributed software	
4	Windows 10 Education	700	Operating systems	Microsoft	Azure Dev Tools for Teaching Subscription	

5	Yandex. Browser		Browser	«Yandex»	3722	
6	Subscription to MS Office Pro for 170 PCs for FGBOU VO "PIMU" of the Ministry of Health of Russia	170	Office Application	Microsoft		23618/HN10 030 LLC "Softline Trade" from 04.12.2020

10. List of changes to the working program (to be filled out by the template).

№	Date of change	Protocol number of the Department meeting	Content of change	Signature

Department of
Name of the department

CHANGE REGISTRATION SHEET

working program for the academic discipline
NAME OF THE ACADEMIC DISCIPLINE

Field of study / specialty / scientific specialty: _____
(code, name)

Training profile: _____
(*name) - for master's degree programs*

Mode of study: _____
full-time/mixed attendance mode/extramural

Position	Number and name of the program section	Contents of the changes made	Effective date of the changes	Contributor's signature
1				

Approved at the department meeting
Protocol No. _____of _____20__

Head of the Department
_____ _____/_____
department name, academic title signature print name