

Peoples' Friendship University of Russia «RUDN»

Medical Institute

Recommended by MCCH

THE WORKING PROGRAM OF THE DISCIPLINE

Name of the discipline

Biological Chemistry - Biochemistry of the Oral Cavity

Recommended for the direction of training / specialty

31.05.03 Dentistry

Orientation of the program (profile)

Dentistry

1. Goals and objectives of the discipline: to form students' systemic knowledge about the molecular mechanisms of the functioning of biological systems; to ensure the creation of a theoretical basis for further study of biomedical and clinical disciplines.

2. Place of discipline in the structure of general education program of higher education:

The discipline "Biological chemistry - Biochemistry of the oral cavity" belongs to the compulsory part of block 1 of the curriculum.

Table 1 shows the previous and subsequent disciplines aimed at the formation of the discipline's competencies in accordance with the competency matrix general education program of higher education.

Table № 1

Prior and subsequent disciplines aimed at the formation of competencies

№	Code and name of competence	Preceding disciplines	Parallel disciplines	Subsequent disciplines
General professional competencies (GPC)				
	GPC-9. Able to assess morphological and functional states and pathological processes in the human body to solve professional problems	Human anatomy - head and neck anatomy, biology, histology, embryology, cytology - histology of the oral cavity, normal physiology, physiology of the maxillofacial region chemistry.	Human anatomy - head and neck anatomy, histology, embryology, cytology - histology of the oral cavity, normal physiology, physiology of the maxillofacial region microbiology, virology - oral microbiology topographic anatomy and operative surgery of the head and neck.	Pathological anatomy - pathological anatomy of the head and neck, pathophysiology - pathophysiology of the head and neck, forensic medicine

3. Requirements for the results of mastering the discipline:

The process of studying the discipline "Biological chemistry - Biochemistry of the oral cavity" is aimed at the formation of the following competencies:

Table № 2

Formed competencies

Competencies	Competency name	Competence achievement indicators
General professional competencies GPC-9	Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	GPC-9.1. Being able to use the algorithm of clinical, laboratory and functional diagnosis in dealing with professional tasks.
		GPC-9.2. Evaluating the results of clinical, laboratory and functional diagnosis in dealing with professional tasks.
		GPC-9.3. Determining morpho-functional, physiological states and pathological processes of the human body.

As a result of studying the discipline "Biological chemistry - Biochemistry of the oral cavity" the student must

Know:

- safety regulations and work in biochemical laboratories with reagents, devices, animals;
- physicochemical essence of the processes occurring in a living organism at the molecular, cellular, tissue and organ levels; structure and chemical properties of the main classes of biologically important organic compounds;
- the main metabolic pathways for the conversion of carbohydrates, lipids, amino acids, purine and pyrimidine bases, the role of cell membranes and their transport systems in metabolism; the structure and functions of the most important chemical compounds (nucleic acids, natural proteins, water-soluble and fat-soluble vitamins, hormones, etc.);
- fundamentals of hemoglobin chemistry, its participation in gas exchange and maintenance of the acid-base state;
- theoretical foundations of informatics in medical and biological systems, the use of information computer systems.

Be able to:

- use educational, scientific, popular science literature, the Internet and the educational portal for professional activities;
- use physical, chemical and biological equipment;
- make calculations based on the results of the experiment, conduct elementary statistical processing of experimental data;
- classify chemical compounds based on their structural formula;
- to predict the direction and result of physicochemical processes and chemical transformations of biologically important substances;
- use the IUPAC nomenclature to make names according to the formulas of typical representatives of biologically important substances;
- distinguish normal levels of metabolites in blood serum (glucose, urea, bilirubin, uric acid, lactic and pyruvic acid, etc.) from pathologically altered ones, read the proteinogram and explain the reasons for the differences;
- interpret the data of enzyme-diagnostic studies of blood serum.

Master:

- chemical and biochemical terminology;
- basic technologies for searching and converting information, including using educational resources;
- the concept of limitations in the reliability of information and the specifics of the most common laboratory tests;
- an algorithm for clinical, laboratory and functional diagnostics in solving professional problems;
- preliminary diagnosis skills based on the results of biochemical studies of human biological fluids.

4. The scope of the discipline and types of educational work

The total workload of the discipline is 6 credit units **for full-time education**.

Type of educational work for full-time education	Total hours	Semesters / module	
		3	4
Classroom lessons (total)	140	68	72
Including:			
Lectures	35	17	18
Practical lessons (PL)	-	-	
Seminars (S)	-	-	
Laboratory work (LR)	105	51	54
Independent work (total)	76	40	36
Total labor	hour	216	108
	credits	6	3

5. Content of the discipline

5.1. Contents of sections and topics of the discipline

Name of the discipline section	Section content (topics)
Section 1. Basic molecules - components of living systems	<p>Topic 1. Introduction to biochemistry. Proteins: structure, properties, functions Introductory conversation. Subject, tasks and main directions of biological chemistry. The main chemical components of living systems. The concept of the structure of proteins. Amino acids are monomers of protein molecules and peptides. Proteinogenic amino acids. Classification of amino acids, their physical and chemical properties. Biologically active peptides (for example, oxytocin, vasopressin, glutathione, aspartame). The structure of proteins, the concept of domains in their molecules. Monomeric and oligomeric proteins. The concept of protein folding, chaperones, ubiquitin and proteasomes. The relationship between the structure of proteins and their function. Physicochemical properties of proteins.</p> <p>Topic 2. Complex proteins, nucleic acids, lipids Conjugated (complex) proteins: nucleoproteins, chromoproteins, phosphoproteins, glycoproteins, proteoglycans, lipoproteins, metalloproteins, complex enzyme proteins. Features of their chemical structure and biological role. Nucleoproteins: a role in the phenomena of heredity. The structure, biological functions of mononucleotides, the nature of their binding in nucleic acids. ATP is a phosphate donor during protein phosphorylation and the beginning of mineralization. Lipid chemistry, lipid formula. The main representatives of various classes of lipids, including bile acids, cholesterol, fat-soluble vitamins.</p> <p>Topic 3. Enzymes Active center of enzymes, their adsorption and catalytic sites; allosteric center. Coenzymes - the concept of their functional role and chemical diversity. Features of enzymes as biocatalysts. Enzyme classification. Enzyme activity measurement, international units of activity. Dependence of enzyme activity on substrate concentration, temperature and pH; substrate specificity and specificity of the reaction direction. Regulation of enzymatic activity. Enzyme inhibitors: irreversible and reversible; competitive, non-competitive; the concept of retroinhibition. Reversible enzyme inhibition - the mechanism of many drugs action.</p> <p>Topic 4. Vitamins Vitamins - essential factors of human nutrition. Distribution of vitamins in nature. Classification of vitamins, characteristics of individual vitamins - thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folic acid, cobalamin, ascorbic acid,</p>

	<p>vitamins A, D, E, K. Causes and patterns of hypo- and hypervitaminosis in the body. Antivitamins - concept. Coenzymes are derivatives of vitamins.</p> <p>Topic 5. Hormones Hormones are the coordinators of biochemical processes. Subordination of endocrine organs. Classification of hormones by chemical structure and place of synthesis. The main mechanisms of hormone action. The concept of hormones role in metabolism regulation.</p>
<p>Section 2. Metabolism and energy</p>	<p>Topic 1. Introduction to metabolism. Biological oxidation Stages of metabolism in the body. The central role of acetyl-CoA in metabolic processes. Concept of compounds with high group transfer potential. The tricarboxylic acid (TCA) cycle as the final stage in the catabolism of acetyl fragments formed during the breakdown of carbohydrates, lipids and amino acids; its connection with biological oxidation. Biological oxidation (tissue respiration) as a set of redox processes involving oxygen. Mitochondrial oxidation (the respiratory electron transport chain) is the main way of oxygen utilization in the body. Respiratory chain components. Nicotinamide and flavin dehydrogenases as the initial links of the respiratory chain. Oxidative phosphorylation of ADP. The concept of substrate phosphorylation of ADP.</p> <p>Topic 2. Metabolism of carbohydrates The biological role of carbohydrates. Classification of carbohydrates. The role of carbohydrates in metabolism, energy storage. The central role of glucose in carbohydrate metabolism. Possible pathways for the conversion of glucose-6-phosphate. Anaerobic conversion of glucose (glycolysis). Regulation and energy output of glycolysis. Synthesis (glycogenesis) and breakdown (glycogenolysis) of glycogen. Energy yield of glycogenolysis. Hormonal regulation of glycogen synthesis and breakdown. Features of carbohydrate metabolism in muscles and liver. The concept of gluconeogenesis and the starting for glucose synthesis. Stages of gluconeogenesis and its regulation. Cory cycle. Aerobic carbohydrate metabolism. Oxidative decarboxylation of pyruvate. Energy yield of aerobic breakdown of glucose. Oxidative stages and biological significance of the pentose phosphate pathway of glucose oxidation in different tissues. The consequences of thiamine deficiency in the body. Features of carbohydrate metabolism in erythrocytes. Glucose-6-phosphate dehydrogenase, NADPH, glutathione, and drug-induced hemolytic anemia. Disorders of carbohydrate metabolism (hypo- and hyperglycemia, their causes; type 1 and 2 diabetes, lactase deficiency, Von Gierke's disease). Diagnostic value of glucose tolerance test (sugar load) and determination of glycosylated hemoglobin in blood.</p> <p>Topic 3. Lipid metabolism Triacylglycerols (TAG) breakdown in adipocytes, hormone-sensitive lipase. Conversion of glycerol. Synthesis of TAG, sources of glycerol in various tissues. Beta-oxidation of fatty acids in mitochondria, the role of carnitine. Fatty acid biosynthesis (sources of acetyl-CoA and NADPH (H⁺) in various tissues. Acetone bodies (biological role). The central role of acetyl-CoA in lipid metabolism. Ways of cholesterol transformation in the body, regulation of its synthesis. The relationship between the metabolism of fats and carbohydrates. Regulation of lipid metabolism.</p> <p>Topic 4. Metabolism of amino acids and proteins. Complex protein metabolism Amino acid catabolism: transamination of amino acids, deamination of amino acids, decarboxylation of amino acids, biogenic amines, their physiological and pharmacological action, hydroxylation of amino acids, the mechanism of this process (the role of ascorbate, tetrahydrobiopterin). Glucose-alanine cycle. Conversion of a nitrogen-free amino acid residue. Glycogenic and ketogenic amino acids. Specific pathways for the exchange of individual amino acids: glycine, serine and methionine as donors of one-carbon fragments. Phenylalanine, tyrosine and tryptophan as starting molecules for the synthesis of catecholamines, serotonin and</p>

	<p>melatonin. Pathology of protein and amino acid metabolism: hyperammonemia, type I and II, phenylketonuria, alkaptonuria, albinism, Hartnup's disease, maple syrup disease.</p> <p>Initial molecules for the synthesis of nucleotides in the body. Rescue paths for nitrogenous bases. Decomposition products of pyrimidine and purine nucleotides. The role of xanthine oxidase. Uric acid as a final product of the purine nucleotides breakdown. Violation of the purine nucleotides exchange (gout, Lesch-Nyan syndrome).</p>
<p>Section 3. Biochemistry of body fluids</p>	<p>Topic 1. Biochemistry of blood and urine</p> <p>Buffer systems of blood and saliva. Factors that determine pH constancy. Dissociation constants, Henderson-Hasselbach equation. Indicators of the state of the buffer systems of the blood. Violations of acid-base balance: alkalosis and acidosis, metabolic and respiratory. Hyperammonemia and mechanisms of ammonia neutralization. Neutralization of ammonia in cells: sources of ammonia, mechanism of its toxic action, binding (neutralization) of ammonia: ornithine (urea) cycle, formation of glutamine (in the brain) and asparagine, reductive amination of α-ketoglutarate, synthesis of creatine, formation and excretion of ammonium salts through the kidneys.</p> <p>Blood composition. Protein composition of blood, fractions of blood proteins, dysproteinemia, paraproteinemia. The main proteins of blood plasma: albumin, globulins. Functions of the main proteins of blood serum. Methods for quantitative analysis of protein fractions of blood. Hemoglobin: structure, normal variants and pathological forms of hemoglobin (HbA, HbA2, HbF, HbA1C, MetHb, HbCO, HbS), the concept of thalassemia. Regulation of the hemoglobin binding with oxygen. Bohr effect. Features of iron absorption and transport in the body. Initial and final stages of heme synthesis. Regulation of heme synthesis. Heme breakdown. Indirect and direct bilirubin. The concept of porphyria and jaundice.</p> <p>Coagulation system of the blood. Blood coagulation cascade. Fibrinous thrombus formation. Anticoagulant blood system. Fibrinolysis. Blood clotting disorders (coagulopathy).</p> <p>Urine composition. Relative density, acidity, inorganic components of urine.</p> <p>Introduction to laboratory diagnostics. Basic biochemical parameters in blood plasma and urine in diabetes mellitus, myocardial infarction, crush syndrome, hemolysis, liver dysfunction (cytolysis syndrome, hepatocellular failure syndrome), biliary obstruction, renal failure, pancreatitis. Bile pigments (total and direct bilirubin), hepatocyte enzymes (alanine and aspartate aminotransferases, alkaline phosphatase, γ-glutamyl transferase), indicators of protein-synthetic liver function (total protein, albumin, α1-antitrypsin, prothrombin, prothrombin index (PTI) and international normalized ratio (INR)). Isozymes, their role in enzyme diagnostics. The concept of immobilized enzymes. Indicators of biochemical analysis of urine and their diagnostic value: urea, creatinine, uric acid, urobilinogen, oxalate. Pathological conditions accompanied by proteinuria, glucosuria, ketonuria. Enzymes detected in urine: pancreatic amylase and its diagnostic value.</p> <p>Topic 2. Biochemistry of oral fluids</p> <p>Mixed saliva composition. Saliva secretion. Regulation of secretion and production of saliva. Inorganic and organic components of mixed saliva. Micellar structure of saliva. Gingival fluid.</p> <p>Saliva proteins: mucins; proteins rich in proline; histatins, lactoferrin, group-specific glycoproteins. Immunoglobulins: structure and function, types of immunoglobulins.</p> <p>Saliva enzymes: digestive enzymes, antioxidant enzymes, acid and alkaline phosphatases, carbonic anhydrase.</p> <p>Oxidative stress: reactive oxygen species, redox balance, respiratory burst, damage to proteins, lipids, nucleic acids by reactive oxygen species. The antioxidant system of the human body: a brief description of the enzymatic (catalase, peroxidase, superoxide dismutase) and non-enzymatic links of the antioxidant defense.</p> <p>Superdental formations: cuticle, pellicle, plaque, tartar. Features of the biochemical composition.</p>

	<p>Enzymes of microorganisms: bacterial urease, nitrate reductase and nitrite reductase. The role of bacterial metabolism in the development of oral diseases. Enzyme systems of bacteria. Decay of proteins, change in acid-base balance, digestive disorders in the oral cavity due to overgrowth of bacteria.</p> <p>Topic 3. Biochemistry of inflammation Inflammatory mediators. Eicosanoids. Interleukins. Acute phase proteins. Changes in the biochemical blood test during inflammation, markers of inflammatory processes. Influence of inflammation on the process of bone mineralization. The diagnostic value of the biochemical analysis of saliva. Changes in the analysis of saliva with periodontitis and caries. Changes in the composition of saliva in acute pancreatitis, renal failure, diabetes mellitus, hypothyroidism and Itsenko-Cushing's syndrome.</p> <p>Topic 4. Biochemistry of digestion Salivary enzymes: amylase, lysozyme, maltase, lingual lipase, DNase and RNase. The biological value of proteins. The completeness of protein nutrition. Protein norms in the diet. The rate of renewal of individual body proteins. Digestion of proteins. Digestive enzymes of the stomach and pancreas. Mechanisms of their activation. The role of hydrochloric acid. Conversion of amino acids in the intestine under the action of microflora enzymes. Digestion of fats. Lingual and pancreatic lipase. Activation mechanism. Bile. The composition of the hepatic bile. Bile functions. Bile acids: primary and secondary, conjugated bile acids. Enterohepatic circulation of bile acids. The role of bile acids in the digestion of fats. Features of absorption and transport of lipids; the role of bile acids and lipoproteins. Resynthesis of triacylglycerols (TAG) and other dietary lipids in enterocytes. Digestion of carbohydrates. Amylase lingual and pancreatic. Oligo-alpha-1,6-glycosidase. Enzymes of cavity and parietal digestion: sucrose-isomaltase complex, glycoamylase complex, lactase.</p>
<p>Section 4. Biochemistry of connective tissue</p>	<p>Topic 1. Biochemistry of the main proteins of connective tissue Collagens. Types of collagens, amino acid composition of type I collagen, levels of structural organization of type I collagen, collagen maturation process. Post-translational modification: hydroxylation of proline and lysine amino acid residues, glycosylation. Intermolecular cross-linking of collagen: the formation of allysin, lysine-norleucine. Desmозine and pyridinoline. Collagen breakdown process, matrix proteinases, biochemical markers of collagen breakdown: hydroxyproline, C- and N-telopeptides, their clinical significance. Regulation of collagen synthesis and breakdown. Diseases associated with collagen defects: Vrolik syndrome, Ehlers-Danlos syndrome, Alport syndrome, type II achondrogenesis. Collagen maturation disorders in vitamin C deficiency, diabetes mellitus, Menkes disease and systemic scleroderma. Elastin. Structure and function. Changes in the structure of elastin in emphysema, Menkes disease, periodontitis and gingivitis. Fibronectin, laminins, fibrillin (functions and their defining features of the protein structure).</p> <p>Topic 2. Biochemistry of the main non-protein components of the connective Proteoglycans. The structure and function of glycosaminoglycans: hyaluronic acid, heparin, sulfated glycosaminoglycans. The structure of the disaccharide units of glycosaminoglycans. Stages of proteoglycan synthesis, the role of sulfation in the formation of functionally complete glycosaminoglycans. Small and large proteoglycans. Breakdown of glycosaminoglycans: sulfatase and glycosidase. Mucopolysaccharidoses: congenital enzyme deficiencies in mucopolysaccharidoses I (Hurler / Scheie), II (Hunter) type, clinical signs, principles of diagnosis and treatment. Enzyme replacement therapy.</p> <p>Topic 3. Biochemistry of mineralized tissues Organic components of mineralized tissues. Bone matrix proteins. Adhesive proteins: fibronectins, laminins, nidogens, osteopontin, bone sialoprotein, osteonectin. Biological functions. Calcium-binding proteins: osteocalcin, Gla-proteins,</p>

	<p>phosphorins. Gamma-carboxylation of glutamic acid residues, mechanism of binding of calcium ions by bone tissue proteins. Bone enzymes that regulate phosphate metabolism: alkaline phosphatase, acid phosphatase, pyrophosphatase.</p> <p>Mineral components of bone tissue. Hormonal regulation of calcium metabolism. The structure of hydroxyapatites, molar calcium-phosphate coefficient. Isomorphic substitutions of ions in the structure of hydroxyapatites. Fluorosis, Kashin-Beck syndrome, hydroxyapatite arthropathy.</p> <p>Bone tissue remodeling, stages. The process of mineralization of the protein matrix and its regulation. Calcification. Disorders of bone tissue remodeling: osteopetrosis, Paget's disease, osteoporosis, ostomalacia and rickets, hyperostosis, osteogenesis imperfecta.</p> <p>Biochemical markers of formation (C- and N-terminal propeptides, osteocalcin, bone alkaline phosphatase) and bone resorption (collagen breakdown products, osteoclast enzymes and markers of osteocyte activity), their clinical significance.</p> <p>Composite materials, implants and their changes in the oral cavity over time.</p>
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5.2. Sections of discipline and types of classes

№	The name of the discipline section	Lectures	Lab. Works	Self work	Total, hours
1.	Basic molecules - components of living systems	6	21	18	45
2.	Metabolism and energy	11	30	22	63
3.	Biochemistry of body fluids	10	24	20	54
4.	Biochemistry of connective tissue	8	30	16	54
	Total	35	105	76	216

6. Laboratory workshop

№	The name of the discipline section	Name of laboratory work	Labor (hours)
1.	Basic molecules - components of living systems	Color reactions to proteins and amino acids. Spectrophotometric method for determining the concentration of various substances in solution. Plotting calibration curves. Protein quantification by biuret method. Quantification of aspartate aminotransferase and alanine aminotransferase in blood serum.	21
2.	Metabolism and energy	Enzymatic method for the quantitative determination of glucose in serum or plasma. The action of amylase on starch. Oral glucose tolerance test (synonyms: glucose tolerance test, body response to sugar load). Quantitative determination of phosphatidylcholines (lecithins) by phosphorus. Quantification of urea in urine by enzymatic urease / phenol-hypochlorite method.	30
3.	Biochemistry of body fluids	Determination of hydrochloric acid in gastric juice. Quantification of serum cholesterol concentration. Determination of the serum bilirubin content. Quantification of uric acid in urine. Determination of amylase activity in urine.	24

4.	Biochemistry of connective tissue	Determination of the pH value of saliva. Quantification of vitamin C in potatoes. Isolation of mucin from saliva and proof of the presence of carbohydrate components in it. Quantification of serum alkaline phosphatase activity with p-nitrophenyl phosphate. Determination of the content of inorganic phosphorus in saliva.	30
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7. Practical lessons (seminars) are not provided

8. Material and technical support of the discipline:

№	Subjects, disciplines (modules) in accordance with the curriculum	The name of the equipped classrooms, facilities for conducting practical activities with a list of the main hardware and / or software	Actual address of classrooms and facilities	Form of ownership, use (property, operational management, rent, free use, etc.)
1.	Biochemistry (testing)	Comp. classes of the Medical Institute	St. Miklukho-Maclay, 10	operational management
2.	Biochemistry (laboratory studies)	Auditorium of the RUDN University: aud. 329,330, 334, 336 (multimedia projector; personal computer, laboratory equipment *).	St. Miklukho-Maclay, 10	operational management

9. Information support of the discipline:

a) software:

Volume Licensing Program (Microsoft Subscription) Enrollment for Education Solutions (EES) No. 56278518 dated 04/23/2019 (renewed annually, the program is assigned a new number).

b) databases, links and search systems:

1. E-Library System (EBS) of RUDN University and the third-party E-libraries to which students have access on the basis of concluded agreements:

- Electronic library system RUDN - EBS RUDN <http://lib.rudn.ru/MegaPro/Web>

- EBS "University Library Online"

<http://www.biblioclub.ru>

- EBS Yurayt <http://www.biblio-online.ru>

- EBS "Student Consultant" www.studentlibrary.ru

- EBS "Doe" <http://e.lanbook.com/>

- TUIS: <http://esystem.pfur.ru/course/view.php?id=46>

2. Database of medical and biological publications:

- PubMed. English-language textual database of medical and biological publications. Access mode: <https://pubmed.ncbi.nlm.nih.gov/>

- ENZYME. Enzyme nomenclature database. Access mode: <https://enzyme.expasy.org/>

- RUDN University Bulletin: access mode from the RUDN University territory and remotely <http://journals.rudn.ru/>

- Scientific library Elibrary.ru: access by IP-addresses of RUDN University at: <http://www.elibrary.ru/defaultx.asp>
- ScienceDirect (ESD), "FreedomCollection", "Cell Press" ID "Elsevier". There is remote access to the database, access by IP-addresses of RUDN University (or remotely by individual login and password).
- Google Academy (eng. Google Scholar) - a free search engine for full texts of scientific publications of all formats and disciplines. Indexes full texts of scientific publications. Access mode: <https://scholar.google.ru/>
- Scopus - scientometric database of the publishing house "Elsevier". There is remote access to the database.
Access by IP-addresses of RUDN University and remotely by login and password (Grant of the Ministry of Education and Science). Access mode: <http://www.scopus.com/>
- Web of Science. There is remote access to the database. Access to the platform is carried out by IP-addresses of the RUDN University or remotely. Remote access to WOS is activated without administrator intervention after registering on the platform from RUDN University <http://login.webofknowledge.com/>

10. Educational and methodological support of the discipline:

a) basic literature

1. Berezov, T.T. Biochemistry / T.T.Berezov, B.F.Korovkin. – Mir Publishers, Moscow. – 1992. – 519 p.
 2. Lehninger Principles of Biochemistry, 5th Ed, David L. Nelson and Michael M. Cox, WH Freeman and Company.
 3. Harper`s illustrated biochemistry, 26th edition, Murray R, Granner D, Mayes P, Rodwell V, Lange medical books/McGrow-Hill
http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=354380&idb=0
- Биохимия : Практикум для студентов специальностей "Лечебное дело" и "Фармация". - Н.Н. Чернов, Т.Т. Березов, Е.В. Лукашева и др. - Ростов-на-Дону : Феникс, 2017. - 205 с.

b) additional literature

1. Clinical Biochemistry, 2nd edition. Allan Gaw et. al.
2. Marks' Basic Medical Biochemistry: A Clinical Approach, 2nd Edition; Colleen M. Smith, Allan D. Marks, Michael A. Lieberman
3. Topics in dental biochemistry, Levine M. – Springer Science & Business Media, 2010.

11. Methodical instructions for students on mastering the discipline (module)

The study of the discipline is carried out in the following forms: lectures, laboratory studies and independent work of the student. Students are required to attend classes, complete assignments within the framework of classroom and independent work using recommended textbooks and teaching aids, electronic educational resources, databases, information and reference and electronic search systems.

In laboratory classes, target skills and interpersonal communication skills are taught using appropriate laboratory equipment and multimedia technology.

Independent work outside the classroom can take place both in the classrooms of the department and in the computer class of the Medical Institute, where students can perform tasks based on materials developed by the teachers of the department. Extracurricular independent work includes the implementation of individual blocks of tasks formed and developed by the teacher, the preparation of messages on the proposed topics, preparation for the performance of tests (including in the form of tests).

Educational materials in electronic form on a number of topics studied are posted on the department's website, in the personal accounts of employees on the RUDN University Training Portal, in TUIS, on the local resources of the RUDN University electronic library system. The study of the discipline assumes the presence of current, midterm controls and intermediate certification in the discipline.

12. Fund of assessment tools for intermediate certification of students in the discipline (module):

Materials for assessing the level of mastering the educational material of the discipline "Biological chemistry - Biochemistry of the oral cavity" (evaluation materials), including a list of competencies indicating the stages of their formation, a description of indicators and criteria for assessing competencies at different stages of their formation, a description of the assessment scales, typical control tasks or other materials necessary to assess knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities that characterize the stages the formation of competencies, developed in full and available for students on the discipline page in TUIS RUDN.

The program is designed in accordance with the requirements ФГОС ВО.

Developers

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