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Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
RUDN University
Medical Institute

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Biological Chemistry - Oral Biochemistry

course title

Recommended by the Didactic Council for the Education Field of:

31.05.03 Dentistry

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

Dentistry

higher education programme profile/specialisation title

1. THE PURPOSE OF MASTERING THE DISCIPLINE

The purpose of mastering the discipline "**Biological chemistry – Biochemistry of the oral cavity**" is to form students' systematic knowledge of the molecular mechanisms of functioning of biological systems; to ensure the creation of a theoretical basis for further study of biomedical and clinical disciplines.

2. REQUIREMENTS to LEARNING OUTCOMES

The mastering of the discipline "**Biological chemistry – Biochemistry of the oral cavity**" is aimed at the formation of the following competencies of students:

General Professional Competences- (GPC)-9

(in accordance with the Federal State Educational Standard of Higher Education (FSES) 3++ 31.05.03 Dentistry).

Table 2.1. List of competencies formed by students during the development of the discipline (results of the development of the discipline)

Competence code	Competence	Indicators of Competence Formation (within the framework of this discipline)
General Professional Competences-9 (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.

3. COURSE IN HIGHER EDUCATION PROGRAM

The discipline "**Biological chemistry – Biochemistry of the oral cavity**" refers to the *basic* part of block B1 of the Higher Education Program.

As part of the Higher Education Program, students also master other disciplines and/or practices that contribute to achieving the planned results of mastering the discipline "**Biological chemistry – Biochemistry of the oral cavity**".

Table 3.1. List of Higher Education Program components that contribute to achieving the planned results of mastering the discipline

Competence Code	The competence	Previous Disciplines	Subsequent disciplines
General Professional Competences-9 (GPC-9)	Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	Human Anatomy - Anatomy of the head and neck Biology Histology, embryology, cytology - Oral Histology Normal physiology, physiology of the maxillofacial region Chemistry	Pathological anatomy - Pathanatomy of the head and neck Pathophysiology - Pathophysiology of the head and neck Forensic medicine

4. THE DISCIPLINE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the discipline "**Biological chemistry – Biochemistry of the oral cavity**" is **6** credits.

Table 4.1. Types of academic activities during the period of the HE program mastering

Types of academic activities	TOTAL, academic hours (ac.h)	Semesters	
		3	4
Classroom learning, <i>ac.h.</i>	140	68	72
Lectures (Lec)	35	17	18
Lab work (Lab)	105	51	54
Practical/seminar classes			
Self-studies, academic hours	31	13	18
Evaluation and assessment (exam or pass/fail grading)	45	27	18
Total workload of the discipline	ac.h.	216	108
	credits	6	3

5. THE COURSE MODULES AND CONTENTS

Table 5.1. The content of the discipline and types of academic activities

Modules and Topics	Content of the topics	Type of academic activities
Course 1. Basic molecules - components of living systems	Topic1.1. 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.	Lec, Lab
	Topic 1.2. 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.	Lec, Lab

	Lipid chemistry, lipid formula. The main representatives of various classes of lipids, including bile acids, cholesterol, fat-soluble vitamins.	
	<p>Topic 1.3. 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>	Lec, Lab
	<p>Topic 1.4. 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, vitamins A, D, E, K. Causes and patterns of hypo- and hypervitaminosis in the body. Antivitamins - concept. Coenzymes are derivatives of vitamins.</p>	Lec, Lab
	<p>Topic 1.5. 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>	Lec, Lab
Course2 Metabolism and energy	<p>Topic 2.1. Introduction to metabolism. Biological oxidation. 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>	Lec, Lab
	<p>Topic 2.2. 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.</p>	Lec, Lab

	<p>Possible pathways for the conversion of glucose-6-phosphate. Anaerobic conversion of glucose (glycolysis). Regulation and energy output of glycolysis.</p> <p>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.</p> <p>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 2.3. Lipid metabolism.</p> <p>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.</p> <p>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>Lec, Lab</p>
	<p>Topic 2.4. Metabolism of amino acids and proteins. Complex protein metabolism.</p> <p>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.</p> <p>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 melatonin. Pathology of protein and amino acid metabolism: hyperammonemia, type I and II,</p>	<p>Lec, Lab</p>

	<p>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>Course 3 Biochemistry of body fluids</p>	<p>Topic 3.1. 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, HbA_{1C}, 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</p>	<p>Lec, Lab</p>

	<p>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>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.</p> <p>Decay of proteins, change in acid-base balance, digestive disorders in the oral cavity due to overgrowth of bacteria.</p>	<p>Lec, Lab</p>
	<p>Topic 3.3. Biochemistry of inflammation.</p> <p>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.</p> <p>The diagnostic value of the biochemical analysis of saliva.</p> <p>Changes in the analysis of saliva with periodontitis and caries.</p> <p>Changes in the composition of saliva in acute pancreatitis, renal failure, diabetes mellitus, hypothyroidism and Itsenko-Cushing's syndrome.</p>	<p>Lec, Lab</p>
	<p>Topic 3.4. Biochemistry of digestion.</p> <p>Salivary enzymes: amylase, lysozyme, maltase, lingual lipase, DNase and RNase.</p> <p>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.</p> <p>Digestion of fats. Lingual and pancreatic lipase. Activation mechanism. Bile. The composition of the hepatic bile. Bile</p>	<p>Lec, Lab</p>

	<p>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.</p> <p>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>Course 4 Biochemistry of connective tissue</p>	<p>Topic 4.1. Biochemistry of the main proteins of connective tissue.</p> <p>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 sclerodermia.</p> <p>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>	Lec, Lab
	<p>Topic 4.2. Biochemistry of the main non-protein components of the connective.</p> <p>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.</p> <p>Mucopolysaccharidoses: congenital enzyme deficiencies in mucopolysaccharidoses I (Hurler / Scheie), II (Hunter) type, clinical signs, principles of diagnosis and treatment. Enzyme replacement therapy.</p>	Lec, Lab
	<p>Topic 4.3. Biochemistry of mineralized tissues.</p> <p>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>	Lec, Lab

	<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. Composite materials, implants and their changes in the oral cavity over time.</p>	
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6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENT

Table 6.1. Logistical and material provision of the discipline.

Classroom for Academic Activity Type	Classroom Equipment	Specialized educational/laboratory equipment, software and materials for the mastering of the discipline
Learning-and Research Lab	A classroom for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment. (The classroom 334)	<p>Classrooms with a set of specialized furniture, equipped with multimedia projectors and motorized screens</p> <p>NEC V 260X Projector, Motorized Screen for Master Control Projector 203X203. laboratory equipment: Fume hood, CENTRIFUGE OIИH-8, KFK-3-01 photoelectrocolorimeter, Electric drying cabinet SNOL 67/350, Thermoblock ПЭ-4030 36 гн. d-23*45mm, Spectrophotometer Specord M -40, Electrophoretic chamber, 1mm, Analytical balance EP214C, Laboratory washing table 985*610*900.</p> <p>Corporate Licensing Program (Microsoft Subscription) Enrollment for Education Solutions 90-07-001-00599-8</p> <p>Non-exclusive Right (2016)</p> <p>Registration Key (2016)</p> <p>*Windows 10 Education Desktop Education ALNG LicSAPk MVL A Faculty EES</p> <p>•Win Pro SP1 x64 7, License № 1620000996000270, ssue date 3.5.2014.</p> <p>CFX Manager Software</p>

Classroom for Academic Activity Type	Classroom Equipment	Specialized educational/laboratory equipment, software and materials for the mastering of the discipline
		<p>Office Pro Plus 2016 Desktop Education ALNG LicSAPk MVL A Faculty EES 90-07-012-00604-5 Registration Key (2016) Non-exclusive right (2016) MyTestXPro 11.0 is a software system for creating and conducting computer testing of knowledge, collecting and analyzing results. Electronic license/ key (for higher education – university). Symantec Endpoint Protection 11.0 BNDL STD LIC ACAD BAND A BASIC 12 MO 90-07-010-00211-7 Non-exclusive right (2008, IOP No.1.1.16.3/39)</p>
Educational and Scientific Laboratory	Laboratory of Molecular Biological Research Methods (Room 201)	<p>Set of specialized furniture, laboratory medical centrifuge ProfMT, Refrigerator ATLANT XM 6026-031, Freezer Minsk-17, Electronic scales AR0640 Ohaus Europe, Spectrophotometer Hitachi F-2700, Distiller GTL-200, Thermostat, Thermoblock PE-4030 36 gn. d-23*45mm, Bi-beam Spectrophotometer U-2900, Centrifuge L7-55. HP 280 G2 MT V7 Q81E Intel Pentium Dual-Core G4400 Computer There is an Internet connection Corporate Licensing Program (Microsoft Subscription) Enrollment for Education Solutions 90-07-001-00599-8 Non-exclusive right (2016) Registration Key (2016) *Windows 10 Education Desktop Education ALNG LicSAPk MVL A Faculty EES •Win Pro SP1 x64 7, License No. 1620000996000270, issue date 3.5.2014. CFX Manager Software Office Pro Plus 2016 Desktop Education ALNG LicSAPk MVL A Faculty EES 90-07-012-00604-5 Registration Key (2016) Non-Exclusive Right (2016) Symantec Endpoint Protection 11.0 BNDL STD LIC ACAD BAND A BASIC 12 MO 90-07-010-00211-7 Non-exclusive right (2008, IOP No.1.1.16.3/39)</p>
Classroom for students self-	A classroom for independent work of	<p>A set of specialized furniture, HP 15-AC070UR 15.6" Intel Pentium 5 Computers,</p>

Classroom for Academic Activity Type	Classroom Equipment	Specialized educational/laboratory equipment, software and materials for the mastering of the discipline
studies	students (can be used for laboratory classes and consultations), equipped with a set of specialized furniture (The room203)	Refrigerator Biryusa-6, Freezer Minsk-17, Drying Electric Cabinet SNOL 67/350, Thermoblock PE-4030 36 gn. d-23*45 mm, Spectrophotometer Specord M - 40, Electrophoretic chamber, 1mm, Analytical scales EP214C. Products: Microsoft products (OS, office suite, including MS Office/ Office 365, Teams)

7. RECOMMENDED SOURSES for COURSE STUDIES

Main reading:

Printed publications:

1. Berezov T.T. Biochemistry / T.T. Berezov, B.F. Korovkin ; Transl. from the Russian by B.V.Rassadin. - Книга на английском языке. - Moscow: Mir, 1992. - 515 p.
2. Biochemistry. - 3rd edition. - Philadelphia: Harwal Publishing, 1993. - 584 p. : ill. - (The National Medical Series for Independent Study).
3. Marshall William J. Clinical chemistry / W. J. Marshall. - eighth edition - London: Elsevier, 2017. - 413 p.
4. Meisenberg Gerhard. Principles of Medical Biochemistry / G. Meisenberg, W.H. Simmons. - Fourth Edition. - London: Elsevier, 2017. - 617 p.
5. Baynes John W. Medical Biochemistry / J.W. Baynes, M.H. Dominiczac. - Fifth Edition. - London: Elsevier, 2019. - 682 p.
6. Lehninger Principles of Biochemistry, 5th Ed, David L. Nelson and Michael M. Cox, WH Freeman and Company.
7. Harper`s illustrated biochemistry, 26th edition, Murray R, Granner D, Mayes P, Rodwell V, Lange medical books/McGrow-Hill

Electronic and printed full-text materials:

1. Biochemistry with exercises and tasks: textbook / editors by A. I. Glukhov, V. V. Garin. - Moscow: GEOTAR-Media, 2020. - 296 p.: https://lib.rudn.ru:443/MegaPro/UserEntry?Action=Link_FindDoc&id=497894&idb=0

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.

*Educational and methodological materials for independent work of students during the development of the discipline/ module *:*

1. Laboratory workshop on the discipline "**Biological chemistry – Biochemistry of the oral cavity**"
2. Presentation materials for for students on mastering the discipline "**Biological chemistry – Biochemistry of the oral cavity**".

* - all teaching materials for independent work of students are placed in accordance with the current procedure on the discipline page in the TUIS!

8. EVALUATION TOOLKIT AND GRADE SYSTEM FOR ASSESSMENT

Evaluation Toolkit (ET) and a point-rating system (PRS)* for assessment the level of competence formation (part of competencies) based on the results of mastering the discipline "Biological chemistry – Biochemistry of the oral cavity" are presented in the Appendix to this Work Program of the discipline.

* - ET and PRS are formed on the basis of the requirements of the relevant local regulatory act of the RUDN

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