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Federal State Budget Educational Institution
of Higher Education
Pacific State Medical University
of the Ministry of Health of the Russian Federation

APPROVED BY
First Vice-Rector
_____ / Trankovskaya L.V./
"9" июня 2025

DISCIPLINE WORK PROGRAM

Б1.О.08 Biological chemistry - Oral biochemistry

(name of discipline)

Specialty	**31.05.03 Dentistry for international students (in English)** (code, name)
Degree	Specialist's degree
Profile	02 "Healthcare" (in the field of providing health care in patients with dental pathology)
Mode of study	Full-time
Period of mastering the BEP	**5 years** (nominal length of study)
Institute	of Fundamentals and Information Technologies in Medicine

Vladivostok, 2025

Program of the discipline **Б1.О.08 Biological chemistry - Oral biochemistry** is based on:
1) Federal State Educational Standard of Higher Education for the specialty approved by the Order No. 984 of Ministry of Science and Higher Education of the Russian Federation
dated August 12, 2020.

2) Curriculum for the 31.05.03 Dentistry for international students (in English), profile 02 "Healthcare" (in the field of providing health care in patients with dental pathology), approved by the Academic Council of FSBEI HE PSMU of the Ministry of Health of Russia, Report No. 8/24-25 dated March 31, 2025.

Work program for the discipline was developed by the writing team of the Institute of Fundamentals and Information Technologies in Medicine of the FSBEI HE PSMU of the Ministry of Health of Russia, under the guidance of the director of the institute Candidate of Medical Sciences Bagryantsev V.N.

Developed by:

Assistant professor	Candidate of Biological sciences, Associate professor	Artyukova O.A.
(position held)	(academic degree, academic title)	(full name)

1. GENERAL PROVISIONS

1.1. Purpose and Objectives of Mastering Б1.О.08 Biological chemistry - Oral biochemistry

The purpose of mastering the discipline is acquiring knowledge about the structure, properties and functions of biomolecules and the main metabolic pathways of their transformations, which determine the state of health and adaptation of the body under normal conditions and during the development of pathologies. In accordance with the ultimate goals of student education within the specialty, the program includes specialized topics reflecting the interrelationship of biochemical processes occurring in the body with the state of tissues and secretions of the oral cavity, which have implications for applied fields, primarily for the practice of preventing, treating, and diagnosing dental diseases

Objectives of mastering the discipline:

1. Acquire systemic knowledge about the chemical structure of the main substances of the body and the molecular foundations of biochemical processes at the core of life;
2. Learn about the basic laws of metabolic processes, regulation of metabolism and its relationship with the functional activity of the tissues and organs of the oral cavity;
3. Study the molecular mechanisms of the pathological processes in the oral cavity;
4. Study the methods of biochemical research, ability to use research results to assess the state of human health, diagnose diseases, predict and assess the effectiveness of treatment.

2. DISCIPLINE AS PART OF THE BASIC EDUCATIONAL PROGRAM

Discipline **Б1.О.08 Biological chemistry - Oral biochemistry** is included in the mandatory part of the Unit 1 of the basic educational program for the specialty 31.05.03 Dentistry for international students (in English), profile 02 "Healthcare" (in the field of providing health care in patients with dental pathology), and is part of the 2nd and 3rd semesters' curriculum.

3. PLANNED LEARNING OUTCOMES OF THE DISCIPLINE

3.1. Mastering the discipline **Б1.О.08 Biological chemistry - Oral biochemistry** is aimed at the development of students' competencies. The discipline facilitates the development of students' competencies corresponding to the types of professional activity.

Name of competency category (group)	**Code and Name of competency of the graduate**	**Competency Indicators**
General Professional Competencies		
Basis of fundamental and natural science knowledge	GPC-8. Is able to use basic concepts and methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activities	CI.GPC-8_1- employs basic concepts of physics, chemistry, mathematics and natural sciences CI.GPC-8_2- - has a grasp of basic methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activity CI.GPC-8_3- evaluates the efficacy of basic methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activity

3.2. Types of professional activity corresponding to competencies developed over the course of mastering **Б1.О.08 Biological chemistry - Oral biochemistry**:

Types of professional activity objectives

1. Medical

Kinds of professional activity objectives

1. examination of the patient in order to make a diagnosis;

2. prescribing pharmacological and non-pharmacological treatment and monitoring its efficiency and safety

3.3. Planned learning outcomes of mastering the discipline are represented by knowledge, skills, abilities and/or experience, characterize the stages of developing competencies and ensure achievement of the planned outcomes of mastering the basic educational program. Learning outcomes of a discipline are correlated with competency indicators.

4. SCOPE AND CONTENT OF THE DISCIPLINE

4.1. Scope of the Discipline and Types of Academic Work

Type of Academic Work		**Total Hours**	**Semesters**	**Semesters**
			2	**3**
			hours	**hours**
1		2	3	3
Classroom hours (total), including:		**120**	**70**	**50**
Lectures (L)		36	18	18
Practical classes (C)		84	52	32
Independent work of the student (IW), including:		**69**	**38**	**31**
Preparing for classes (CP)		59	32	27
Preparing for continuous assessment (CAP)		10	6	4
Interim assessment		27		27
Type of interim assessment	pass/fail test (T)			
	exam (E)	E		E
TOTAL: TOTAL credit value	hrs.	**216**	**108**	**108**
	credits	**6**	**3**	**3**

4.2. Contents of the Discipline

4.2.1. Topics of Discipline Lectures and Academic Hours per Semester

No.	**Lecture Topic**	**Hours**
1	2	3
Semester No. 2		
1.	Introduction. Structural organization of proteins. Features of oligomeric protein functioning. The role of proteomics in medicine	2
2.	Enzymes. Enzyme structure, cofactors, and coenzymes. The role of vitamins and bioelements. Isoenzymes	2
3.	Types and significance of enzyme activity regulation. Enzyme inhibition. Application of enzymes in medicine	2
4.	Biological oxidation and energy metabolism. General catabolism pathway. Tricarboxylic acid cycle. Organization of the mitochondrial respiratory chain,	2

	ATP synthesis. Action of inhibitors and uncouplers. Energy-deficient states	
5.	Organization of the mitochondrial respiratory chain, ATP synthesis. Action of inhibitors and uncouplers. Extramitochondrial oxidation. Microsomal oxidation. Free radical oxidation, active forms of oxygen. Antioxidant protection	2
6.	Carbohydrate metabolism. Glycolysis, dependence of the process on oxygen supply. Gluconeogenesis. Pentose phosphate pathway of glucose conversion. Regulation of blood glucose levels	2
7.	Lipids of biological membranes, connection with cell function and adaptation. Synthesis and breakdown of lipids. Fatty acid metabolism. Synthesis of ketone bodies	2
8.	Synthesis of TAG and phospholipids. Lipotropic factors. Synthesis and excretion of cholesterol. Transport lipoproteins in blood, structure, functions. Biochemistry of atherosclerosis	2
9.	Metabolism of nucleic acids and nucleotides, metabolic disorders. Mechanisms of matrix biosynthesis: DNA replication and repair, RNA transcription. Protein biosynthesis	2
Hours per semester total		**18**
Semester No. 3		
1.	The role of hormones in regulating metabolism. Regulation of the metabolism of major energy carriers	2
2.	Hormonal regulation of calcium and phosphate metabolism. Regulation of water and salt metabolism	2
3.	Blood biochemistry. Erythrocyte metabolism. Blood plasma proteins. Heme metabolism and iron metabolism	2
4.	Connective tissue biochemistry	2
5.	Bone tissue biochemistry, regulation of osteogenesis, resorption, and mineralization of bone tissue	2
6.	Biochemistry of mineralized tooth tissues (enamel, dentin, pulp, cementum)	2
7.	Formation of mixed saliva. Inorganic components of saliva and oral fluid	2
8.	Proteins and enzymes of mixed saliva. Non-protein organic substances in saliva. Protective systems of the oral cavity	2
9.	Biochemistry of gingival fluid and supragingival formations (dental plaque, dental calculus)	2
Hours per semester total		**18**

4.2.2. Topics of Discipline Practical Classes and Academic Hours per Semester

No.	**Practical Class Topic**	**Hours**
1	2	3
Semester No. 2		
1	Structure and functions of proteins. Physicochemical properties of proteins, protein precipitation reactions. Practical skills training: purification of protein solutions (dialysis), reversible protein precipitation reactions, irreversible protein precipitation reactions	4
2	Structure of enzymes, features of enzymatic catalysis. Enzyme activators and inhibitors. Enzymodiagnostics, enzymopathology. Practical skills training: effect of pH, temperature, inhibitors and activators on the catalytic activity of enzymes	4
3	Structure and functions of vitamins. Practical skills training - determination of vitamin C in plant products. Module 1 knowledge assessment: "Structure, properties and functions of proteins. Enzymes. Coenzyme functions of vitamins".	4

4	General pathways of catabolism. Oxidative decarboxylation of pyruvate. Krebs cycle. Mitochondrial oxidation, ATP synthesis. Practical skills training: vitamins B1 and B2 identification tests	4
5	Non-mitochondrial oxidation in the body. Module 2 knowledge assessment: "Biological oxidation"	4
6	Digestion of carbohydrates. Main pathways of glucose metabolism. Anaerobic glycolysis. Difference of final proton acceptors in aerobic oxidation and anaerobic glycolysis. Glucose biosynthesis (gluconeogenesis)	4
7	Pentose phosphate cycle of glucose oxidation. Glycogen synthesis and breakdown. Regulation of carbohydrate metabolism. Biochemical methods for diagnosing carbohydrate metabolism disorders. Practical skills training: determining serum/urine glucose levels, assessing glucose tolerance. Module 3 knowledge assessment: “Carbohydrate metabolism”	4
8	Lipid composition of membranes. Mechanisms of substance transport across membranes. Main stages of transmembrane signal transmission. Fat digestion. β-oxidation of fatty acids. Ketogenesis. Synthesis of TAGs, phospholipids	4
9	Cholesterol, functions, synthesis. Transport lipoproteins in blood. Atherosclerosis as a consequence of cholesterol and lipoprotein metabolism disorders. Practical skills training: determining the amount of cholesterol in blood. Module 4 knowledge assessment: “Lipid metabolism”	4
10	Protein digestion. Practical skills training: determining the acidity of gastric juice. Amino acid metabolism: deamination, transamination. Ammonia formation, urea biosynthesis. Practical skills training: determining the amount of urea in blood and urine	4
11	Decarboxylation of amino acids, formation of biogenic amines. Transmethylation reactions, role of vitamins B9 and B12. Metabolism of individual amino acids. Module 5 knowledge assessment: “Amino acid metabolism”	4
12	Structure and functions of DNA and RNA. Biosynthesis and catabolism of nucleotides. Practical skills training: quantitative determination of uric acid in blood/urine	4
13	Mechanisms of matrix biosynthesis. Gene mutations. Module 6 knowledge assessment: “Biosynthesis of nucleic acids and proteins”	4
Hours per semester total		**52**
Semester No. 3		
1	The role of hormones in regulating metabolism. Regulation of the metabolism of primary energy sources. Practical skills training: qualitative reactions to hormones	4
2	Hormonal regulation of water-salt metabolism and calcium metabolism. Module 7 knowledge assessment: “Hormonal Regulation of Metabolism”	4
3	Blood plasma proteins. Synthesis and catabolism of heme. Practical skills training: quantitative determination of total protein in blood serum using refractometry	4
4	Bilirubin metabolism. Jaundice. Practical skills training: thymol turbidity test. Module 8 knowledge assessment: “Blood biochemistry”	4
5	Biochemistry of connective tissue, extracellular matrix, and bone tissue. Processes of osteogenesis, resorption, and mineralization of bone tissue, their regulation	4
6	Features of the metabolism of mineralized tissues of the oral cavity (enamel, dentin, pulp). HA, possible variants of changes in their structure	4
7	Formation of mixed saliva (oral salivation). Inorganic components, physicochemical	4

	properties of saliva. Proteins, enzymes, organic substances of saliva that are not of a protein nature. Practical skills training: determination of salivation rate, surface tension and pH of saliva, type of microcrystallization, amount of calcium and catalase activity	
8	Gingival fluid. Biochemistry of supragingival formations (dental plaque, dental calculus). Mechanisms of caries development. Module 9 knowledge assessment :"Biochemistry of tissues and fluids of the oral cavity"	4
Hours per semester total		**32**

4.2.3. Independent Work of the Student

No.	Name of the Discipline Section	Type of IW	Total Hours
1	3	4	5
	Semester No. 2		
1	Module 1. Structure, properties and functions of proteins. Enzymes - protein catalysts. Coenzyme functions of vitamins	- Preparing for practical classes - Working with tests - Compiling tables: "Methods of protein examination"; "Classification of proteins"; "Select vitamins: A, D, E, K, B1, B2, B5, PP, B6, C, B9, B12. Sources, manifestations of vitamin deficiency" - Compiling a glossary of terms of the Module - Preparing for continuous assessment	8
2	Module 2. Biological oxidation. Energy metabolism	- Preparing for practical classes - Working with tests - Compiling tables - Compiling a glossary of terms of the Module - Preparing for continuous assessment - Independent studying the topic of "Antioxidants" - Writing a report (slides presentation)	6
3	Module 3. Metabolism of carbohydrates	- Preparing for practical classes - Working with tests - Compiling a glossary of terms of the Module - Preparing for continuous assessment - Writing a report (slides presentation)	6
4	Module 4. Metabolism of lipids. Biological membranes	- Preparing for practical classes - Working with tests - Compiling table: "Lipotropic factors" - Compiling a glossary of terms of the Module - Drawing the membrane structure - Preparing for continuous assessment - Independent studying the topic of "Cell membranes and their functions" - Writing a report (slides presentation)	6
5	Module 5. Metabolism of amino acids	- Preparing for practical classes - Working with tests - Compiling table: "Biogenic amines" - Compiling a glossary of terms of the Module - Preparing for continuous assessment	6
6	Module 6. Biosynthesis of	- Preparing for practical classes	6

	nucleic acids and proteins. Fundamentals of molecular genetics	- Working with tests - Compiling table: “Types of mutations” - Compiling a glossary of terms of the Module - Preparing for continuous assessment - Writing a report (slides presentation)	
Hours per semester total			**38**
Semester No. 3			
7	Module 7. Hormonal regulation of metabolic processes and body functions.	- Preparing for practical classes - Working with tests - Compiling table: “Hormones” - Compiling a glossary of terms of the Module - Preparing for continuous assessment - Writing a report (slides presentation)	6
8	Module 8. Blood biochemistry	- Preparing for practical classes - Working with tests - Compiling tables: “Blood plasma proteins”, “Jaundice” - Compiling a glossary of terms of the Module - Preparing for continuous assessment - Writing a report (slides presentation)	6
9	Module 9. Biochemistry of tissues and fluids of the oral cavity	- Preparing for practical classes - Working with tests - Compiling a glossary of terms of the Module - Preparing for module knowledge assessment - Writing a report (slides presentation)	19
Hours per semester total			**31**

5. REQUIREMENTS FOR IMPLEMENTATION OF DISCIPLINE

5.1. Discipline Requirements for Educational Materials and Provided Information

Essential reading

No.	Name/Title, Resource Type	Author(s)/Editor	Publisher Imprint, Web Address	Number of Copies (accesses) in the Library and Information Center
1	**2**	**3**	**4**	**5**
1	Биологическая химия и биохимия полости рта. Ситуационные задачи и задания : учеб. пособие	С. Е. Северин, В. А. Голенченко, Т. А. Титова и др.; под ред. С. Е. Северина	М. : ГЭОТАР-Медиа, 2017. – 239 с.	20
2	Биологическая химия. Биохимия полости рта : учеб. для мед. вузов	Т. П. Вавилова, А. Е. Медведев	М.: ГЭОТАР-Медиа, 2016. - 560 с. URL: http://www.studentlibrary.ru	Unlimited access
3	Биохимия тканей и полости рта : учеб. пособие. 3-е изд., перераб. и доп. [Electronic	Вавилова, Т. П.	М. : ГЭОТАР-Медиа, 2023. - 208 с. URL: http://www.studentlibrary.	Unlimited access

	resource]		ru/	

Supplementary reading

No.	Name/Title, Resource Type	Author(s)/Editor	Publisher Imprint, Web Address	Number of Copies (accesses) in the Library and Information Center
1	2	3	4	5
1	Биохимия полости рта : учеб. пособие [Electronic resource]	Л.А. Данилова, Н.А. Чайка.	СПб. : СпецЛит, 2012. - 62 с. URL: http://books-up.ru	Unlimited access
2	Биологическая химия и биохимия полости рта. Ситуационные задачи и задания : учеб. пособие [Electronic resource]	под ред. А. И. Глухова.	М. : ГЭОТАР-Медиа, 2023. - 240 с. URL: http://studentlibrary.ru	Unlimited access
3	Витамины и витаминоподобные вещества в практике врача-стоматолога [Electronic resource]	О.А. Артюкова; А.К. Яценко.	Владивосток : Медицина ДВ, 2020. — 101 с. URL: https://lib.rucont.ru/	Unlimited access

Online resources

1. Electronic library system "Student Consultant" http://studmedlib.ru/
2. Electronic library system "University Library Online"http://www.biblioclub.ru/
3. Electronic library system "Urait" https://urait.ru/
4. Electronic library system "BookUp" https://www.books-up.ru/
5. Resources owned by the Library and Information Center of FSBEI HE PSMU of the Ministry of Health of Russia https://tgmu.ru/university/bibliotechno-informacionnyj-centr/resursy-bic/sobstvennye/

Online resources and respective user guides are available on the Library and Information Center website Library and Information Center — PSMU (tgmu.ru)

5.2. Discipline Requirements for Facilities and Resources

Information on the facility and resource availability and requirements of the discipline is available on the Facility and resource availability and requirements. FSBEI HE PSMU of the Ministry of Health of Russia (tgmu.ru)" page of the official website of the university.

5.3. List of Information Technologies, Information and Reference Systems, Licensed and Free Software (Including Domestically-developed Software):

1. PolycomTelepresence M100 Desktop Conferencing Application (Videoconference system)
2. SunRav Software tTester

3. 7-PDF Split & Merge
4. ABBYYFineReader
5. Kaspersky Endpoint Security
6. INDIGO online testing system
7. Microsoft Windows 7
8. Microsoft Office Pro Plus 2013
9. 1C:University
10. GARANT system
11. MOODLE (Modular Object-Oriented Dynamic Learning Environment)

6. ASPECTS OF THE IMPLEMENTATION OF THE DISCIPLINE FOR STUDENTS WITH DISABILITIES AND SPECIAL NEEDS

6.1. Availability of Accessible Environment

For students with disabilities and special needs, if a written application is submitted, lectures and practical classes are carried out taking into account health limitations, individual capabilities and medical status (hereinafter referred to as individual characteristics) of the student. Compliance with the following general requirements is ensured: teaching aids for collective and individual use are provided, required technical assistance is provided by an assistant; buildings and premises where lectures and practical classes are taking place meet accessibility requirements, other arrangements lack of which makes it impossible or difficult to master the discipline are made.

6.2. Ensuring Compliance with General Requirements

When lectures and practical classes are carried out at the written application of the student, the following general requirements are met: lectures and practical classes for students with disabilities and special needs take place at the same location as for students who do not have disabilities, if this does not cause difficulties for students; an assistant (assistants), who provide(s) students with the necessary technical assistance taking into account individual characteristics of the student, is (are) provided; necessary teaching aids are provided, taking into account individual characteristics of the student.

6.3. Availability of the Internal Policies and Procedures of FSBEI HE PSMU of the Ministry of Health of Russia to Students with Disabilities in a Format Accessible to Them.

All internal policies and procedures of FSBEI HE PSMU of the Ministry of Health of Russia concerning the discipline are made available to students with disabilities in a format accessible to them.

6.4. Increase in the Time Limit of Interim Assessment for Students with Disabilities and Special Needs in Relation to the Established duration

Format of the interim assessment of academic performance within the scope of the discipline conducted for students with disabilities and special needs is selected taking into account individual characteristics of the students (orally, by writing on paper, by typing on a computer, as a test, etc.). The duration of the interim assessment in relation to the established duration is increased at the written application of the student with disabilities. Time limit for the student's preparation for the test is increased by at least 0.5 hours.

7. STAFFING REQUIREMENTS OF THE DISCIPLINE

Academic teaching personnel that ensure the implementation of the discipline education process meet the requirements of the Federal State Educational Standard of Higher Education for the 31.05.03 Dentistry for international students (in English) specialty; list of the aforementioned personnel is available on the website of the educational organization.



8. TUTORIAL WORK

Type of tutorial work	Forms and approaches to tutorial work	Assessment criteria
Assistance in personal growth	Overt Talks and problem-centric debates aimed at promotion of healthy lifestyle. Participation in interdepartmental conferences aimed at formation of healthy lifestyle and development of skills necessary to preserve and improve health.	Portfolio
	Covert – creating atmosphere and infrastructure. Developing a culture of healthy lifestyle, the ability to preserve and improve health. Creating atmosphere of kindness and respect with a high level of communication during implementation of the discipline.	
Civic position and values	Overt Conducting events that facilitate development of civil culture (roundtable discussions, discussions/debates, and talks). Short discussions on current significant events in case the latter occur.	Portfolio
	Covert Focusing on civic values-oriented position and legal awareness. Cultivating mindful social position during professional activity.	
Social values	Overt Highlighting aspects of organization of healthy lifestyle based on health-preserving technologies. Highlighting ecology-related questions, environmental issues as a factor affecting population health and select population risks.	Portfolio
	Covert Identification in social structure during period of education and in professional activity.	