

AMENDMENTS AND CHANGES TO THE CURRICULUM IN THE EDUCATIONAL DISCIPLINE «Biological chemistry» for the specialty 7-07-09-11-03_Dentistry__

for 2024/2025 academic year

Amendments and changes	Basis/Reason
1. Changes have been introduced into the Explanatory Note (appendix 1)	Educational Plan for 2024/2025 academic year
2. Changes have been introduced into the Thematic Plan (appendix 2)	Educational Plan for 2024/2025 academic year
3. Changes have been introduced into the Educational Discipline Curricular Chart (appendix 3)	Educational Plan for 2024/2025 academic year
4. List of practical skills have been actualized (appendix 4)	Department meeting of 19.06.2024
5. The content of the topic «Physical and chemical properties of blood» completed with data about adsorption properties of medical polysulphone different modifications in terms of blood plasma proteins	The acts of introduction of the research results to educational process

The curriculum is revised and approved at the department of biological chemistry meeting (protocol # 13 of 19.06.2024)

Head of the department of *Biological Chemistry*



A.D.Taganovich

APPROVED

Dean of the Faculty of International Students



O.S.Ishutin

Changes in the Explanatory Note

Total number of hours for the study of the discipline is 206 academic hours, of which 120 classroom hours and 87 hours of student independent work. Classroom hours according to the types of studies: lectures - 33_ hours of lectures, 87 hours of laboratory classes.

ALLOCATION OF ACADEMIC TIME
ACCORDING TO SEMESTERS OF STUDY

Code, name of the specialty		7-07-09 11-03 «Dentistry»				
		2	3	98	108	54
semester	total	in-class	lectures	15	66	
				18	54	
				supervised student independent work	-	-
				laboratory studies (practical classes and seminars)	36	51
			including	32	54	
	out-of-class self-studies	32	54			
Form of intermediate assessment	Number of academic hours	Credit	Examination			

THEMATIC PLAN

Section (topic) name		lectures (incl. SSIW)	practical (laboratory or seminars)
Number of class hours			
1. Introduction to the discipline «Biological Chemistry». Enzymes			
1.1. Introduction to the discipline «Biological Chemistry». Structure and functions of proteins			3
1.2. Structure, properties and mechanisms of action of enzymes			3
1.3. Regulation of the enzyme action		1,5	3
2. Introduction to metabolism. Biological oxidation. Central metabolic pathways			
2.1. Introduction to metabolism and energy exchange. Central pathways of metabolism		1,5	3
2.2. Biological oxidation		1,5	6
3. Carbohydrate metabolism and functions			
3.1. Carbohydrates. Major pathways of glucose metabolism in the cell. Glycogen metabolism		1,5	3
3.2. Dichotomy. Gluconeogenesis		1,5	3
3.3. Secondary pathways of glucose metabolism. Regulation of glucose metabolism. Peculiarities of carbohydrate utilization by oral cavity bacteria		1,5	6
4. Lipid metabolism and functions			
4.1. Classification of lipids. Lipid digestion and absorption.		1,5	3
4.2. Cholesterol metabolism. Transport of exogenous and endogenous lipids. Disorders of lipid metabolism		1,5	3
4.3. Intracellular metabolism of fatty acids. Ketone bodies. Eucosanoids and their role in regulation of metabolism and physiological functions		1,5	6
5. Simple protein and amino acid metabolism			
5.1. Protein digestion. The role of proteolysis. Pathways of amino acid utilization in the cell		1,5	3
5.2. Intracellular amino acid metabolism. Amino acid synthesis		1,5	2
5.3. Ammonia detoxification			2
6. Nucieoprotein metabolism. Structure and synthesis of nucleic acids. Protein biosynthesis. Techniques of molecular biology			
6.1. Structure and metabolism of nucleoproteins		3	2
		4,5	6

Section (topic) name		lectures (incl. SSIW)		practical (laboratory or seminars)		Number of class hours
6.2. Biosynthesis of nucleic acids and proteins.		1,5		4		
7. Regulation of metabolism. Biochemistry of hormones		4,5		6		
7.1. Principal mechanisms of metabolism regulation.		1,5		2		
7.2. Structure, mechanism of action and influence of major hormones on metabolism		3		4		
8. Biochemistry of organs and tissues		6		14		
8.1. Biochemistry of the blood		1,5		4		
8.2. Biochemistry of the liver		1,5		2		
8.3. Biochemistry of the connective tissue and teeth.		1,5		8		
9. Biochemistry of nutrition		1,5		6		
9.1. Essential nutritive factors and their role in oral organs development		1,5		4		
9.2. Calcium and phosphorus metabolism.				2		
Microelements						
Total hours		33		87		

CONTENT OF THE EDUCATIONAL MATERIAL

8.3. Biochemistry of the connective tissues and teeth

Cells of the connective tissue, characteristics of metabolism. Chemical composition of intercellular substance. Proteins of connective tissues. Collagen as a glycoprotein: structural variability, covalent nature of the connection of the carbohydrate component with the protein. Isocollagens, their general characteristics. Features of the synthesis and breakdown of collagen. Non-collagen proteins of connective tissues: elastin, features of synthesis and breakdown, role in the human body. Adhesive proteins: structural features.

Proteoglycans, mucoproteins, glycoproteins: structural features of their carbohydrate: fragments.

The functional role of connective tissue phosphoproteins, their participation in processes of mineralization.

Connective tissue changes with aging. Influence of nutrition on connective tissue metabolism.

Biochemistry of bone tissue. Bone proteins: structural, calcium-binding, osteoinductive, osteogenesis inhibitors. Features of the amino acid composition. The role of proteins in the processes of osteogenesis. Mechanisms of bone tissue mineralization. Regulation of the processes of bone tissue mineralization and demineralization.

Enamel. Features of the enamel development. Immature enamel. Enamel proteins, features of their structure. Enamel minerals. Enamel apatite. Influence of the environment and nutritional factors on the processes of enamel mineralization and demineralization. Chemical bases of development of caries. Risk factors of caries development and ways of prevention.

Dentine. Chemical composition. Dentin collagen. Proteoglycans. The structure of the mineral component of dentin. The concept of secondary dentin.

Cement. Chemical composition. Cement collagen. Proteoglycans, other organic cement molecules. The structure of the mineral component of cement.

Pulp of the tooth. Features of the chemical composition. The role of the pulp.

Cuticle. enamel pellicle, dental plaque, tartar, chemical composition, mechanisms of formation, The role of microorganisms and products of their metabolism in the oral cavity.

Gingival fluid, chemical composition. The role of gingival fluid under physiological and pathological conditions. The role of white blood cells in the oral cavity.

Dental fluid, features of the chemical composition of enamel fluid, its participation in enamel remineralization. The fluid of dentine tubules: chemical composition, its participation in tooth trophism.

9. Biochemistry of nutrition

9.1. Essential nutritive factors and their role in development of oral cavity

organs

Requirement of proteins. Nitrogen balance. Total urine nitrogen as a criterion for the protein metabolism. «Wear factor» and the physiological minimum of protein in the diet. Qualitative composition of dietary proteins. Essential and non-essential amino acids, their daily requirement. Exogenous and endogenous amino acids pools. The

rate of renewal of individual body proteins. Dietary proteins and tooth development. Dietary lipids. Requirements for the lipid composition of dietary products. Carbohydrates as constituents of food. Essential nutritional factors.

The role of nutrition in the physiology and pathology of the oral cavity. Parenteral nutrition in dentistry.

Vitamins: classification. Water-soluble and fat-soluble vitamins, features of the mechanisms of action, participation in metabolic processes. Causes of vitamin deficiency: exogenous and endogenous deficiency and avitaminoses. Hypervitaminosis and their causes. Daily requirement for vitamins. The content of vitamins in dietary sources. Influence of vitamins on metabolism in tissues of teeth and oral cavity. Vitamins as drugs in dentistry.

9.3. Calcium and phosphorus metabolism. Microelements

Calcium and phosphorus requirement, mechanisms of absorption, distribution in the human body. Apatites: mechanisms of formation. The structure of hydroxyapatite crystals, the role of the environment surrounding the crystals on the mechanism of crystal formation. Isoionic and isomorphous substitution. Carbonate, strontium, plumbous apatites. The role of fluorine in the formation of apatite crystals. Biological fluids as an example of a supersaturated solution of calcium and phosphorus. The role of the seed in the formation of hydroxyapatite crystals. Epitaxis. Plasma calcium. Regulation of calcium and phosphorus level in the blood. Hormones of the parathyroid and thyroid glands. Vitamin D and its active forms.

Microelements: biological role of iron, zinc, copper, magnesium. Fluorine metabolism in the human body.

ACADEMIC DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	Number of hours		Supervised student work	Practical skills	Form of control	
		lectures	practical (laboratory or seminars)			of practical skills	of current / intermediate assessment
2 semester							
	Lectures						
1.	Enzymology	1,5					
2.	Introduction to metabolism and energy exchange. Central catabolic pathway: Krebs cycle	1,5					
3.	Biological oxidation. Tissue respiration. Oxidative phosphorylation	1,5					
4.	Carbohydrate metabolism. Glycogen metabolism. Anaerobic oxidation of glucose	1,5					
5.	Carbohydrate metabolism. Aerobic pathway of glucose oxidation. Gluconeogenesis	1,5					
6.	Carbohydrate metabolism. Pentose phosphate and glucuronic pathways of glucose metabolism	1,5					
7.	Lipid metabolism. Digestion and absorption. Transport of exogenous lipids in the blood	1,5					
8.	Transport of endogenous lipids in the blood. Atherosclerosis: mechanisms of development	1,5					
9.	Intracellular metabolism of fatty acids. Ketosis	1,5					
10.	Simple protein metabolism. Digestion and absorption of proteins.	1,5					

		Practical (laboratory or seminar) lessons							
1.1		Introduction to biochemistry. 3D structure of proteins. Physical and chemical properties of proteins. Lab. work. Salting out and precipitation of proteins.	3						interviews, surveys, tests, online tests
1.2		Enzymes. Classification, structure, properties. Lab. work: Effect of various factors on enzyme activity	3						interviews, surveys, tests, online tests
1.3		Regulation of enzyme action Lab. work: Quantitative determination of enzyme activity	3			Quantitative determination of amylase activity in oral fluid	Written laboratory report with oral defense		interviews, surveys, tests, online tests
2.1		Introduction to metabolism. Central metabolic pathway – Krebs cycle Lab. work: Studying of citric acid cycle functioning	3						interviews, surveys, tests, online tests
2.2		Biological oxidation. Oxidative phosphorylation. Pathways of oxygen utilization by cells. Lab. work: Studying of oxidative phosphorylation. Detection of oxidoreductases	3						interviews, surveys, tests, online tests
2.2		Colloquium «Introduction to biochemistry, enzymes, introduction to metabolism. Biological oxidation. Central metabolic pathways»	3						Colloquium*
3.1		Digestion of carbohydrates. Glycogenesis and glycogenolysis. Glycolysis and alcoholic fermentation. Lab. work: Detection of alcoholic fermentation products	3						interviews, surveys, tests, online tests
3.2		Metabolic pathways of pyruvate. Gluconeogenesis. Aerobic oxidation of glucose (CO_2 and H_2O).	3						interviews, surveys, tests, online tests

	Lab. work: Determination of pyruvate in the urine							
3.3	Secondary pathways of glucose metabolism: pentose phosphate and glucuronic pathways. Features of carbohydrate metabolism in oral bacteria. Lab. work: Hormones influence on blood glucose level		3		Quantitative determination of blood glucose	Written laboratory report with oral defense	interviews, surveys, tests, online tests	
3.3	Colloquium «Carbohydrate metabolism»		3				Colloquium*	
4.1	Lipid metabolism. Lipid digestion, absorption and resynthesis. Transport of exogenous lipids Lab. work: Emulsification of triacylglycerols with bile acids. Kinetics of pancreatic lipase action		3				interviews, surveys, tests, online tests	
4.2	Lipid transport in blood. Cholesterol metabolism. Storage and mobilization of lipids. Lab. work: Determination of plasma β -lipoproteins		3		Determination of plasma β -lipoproteins	Written laboratory report with oral defense	interviews, surveys, tests, online tests	
4.3	Intracellular metabolism of fatty acids. Ketone bodies. Lab. work: Quantitative determination of cholesterol in serum		3		Quantitative determination of cholesterol in serum	Written laboratory report with oral defense	interviews, surveys, tests, online tests	
4.3	Colloquium «Lipid metabolism and functions».		3			Written laboratory report with oral defense	Colloquium*	
4.3	Determination of blood glucose level		3		Quantitative determination of blood glucose	Written laboratory report with oral defense*		
5.1	Digestion and absorption of proteins. Lab. work: Analysis of gastric juice		3		Analysis of gastric juice acidity		interviews, surveys, tests, online tests	
4.3	Final lesson «Introduction to biochemistry. Enzymes. Introduction to metabolism. Biological oxidation. Central metabolic pathways. Carbohydrate metabolism and functions. Lipid metabolism and functions»		3				Credit	

				51				
	Lectures							
1.	Protein metabolism. Intracellular amino acid metabolism. Ammonia detoxification	1,5						
2.	Nucleic acid metabolism	1,5						
3.	Matrix biosynthesis	1,5						
4.	Modern techniques of molecular biology	1,5						
5.	Introduction to endocrinology	1,5						
6.	Biochemistry of hormones. Mechanisms of hormone action	1,5						
7.	Biochemistry of hormones. Impact of major hormones on metabolism	1,5						
8.	Biochemistry of nutrition.	1,5						
9.	Biochemistry of the blood. System of hemostasis	1,5						
10.	Biochemistry of the connective tissue	1,5						
11.	Biochemistry of the oral fluid and teeth	1,5						
12.	Biochemistry of the liver	1,5						
	Practical (laboratory or seminar) lessons							
5.2	Intracellular amino acid metabolism. Lab. work: Evaluation of transaminase activity in the blood			2				interviews, surveys, tests, online tests
5.3	Detoxification of ammonia. Lab. work: Determination of non-protein nitrogen in blood and urea in urine				Determination of urea in urine	Written laboratory report with oral defense		interviews, surveys, tests, online tests
6.1	Chemistry of nucleoproteins Lab. work: Determination of uric acid and total nitrogen in urine			2				interviews, surveys, tests, online tests
6.2	Matrix biosyntheses (synthesis of DNA, RNA, proteins). Modern techniques of molecular biology							interviews, surveys, tests, online tests
6.2	Colloquium «Simple proteins and amino acids metabolism», «Nucleoprotein metabolism», «Structure and synthesis of nucleic acids», «Nucleoprotein metabolism. Structure and			2				Colloquium*

	synthesis of nucleic acids. Protein biosynthesis. Techniques of molecular biology»						
7.1	Principal mechanisms and peculiarities of hormone action. Mechanism of hormone action	2					interviews, surveys, tests, online tests
7.2	Biochemistry of hormones. Hypothalamic, pituitary, adrenal cortex, thyroid and parathyroid hormones. Lab. work: Qualitative reactions for hormones	2					interviews, surveys, tests, online tests
7.2	Biochemistry of hormones. Hormones regulating blood glucose level. Diabetes mellitus Lab. work: Glucose tolerance test	2					interviews, surveys, tests, online tests
8.2	Biochemistry of the liver Lab. work: Determination of protein colloid resistance and total bilirubin in serum	2			Determination of total bilirubin in serum	Written laboratory report with oral defense	interviews, surveys, tests, online tests
9.1	Biochemistry of nutrition. Role of proteins, fats, carbohydrates, vitamins Lab. work: Qualitative reactions for vitamins. Determination of vitamin C in urine	2			Determination of vitamin C in urine	Written laboratory report with oral defense	interviews, surveys, tests, online tests
9.1	Colloquium « Regulation of metabolism. Biochemistry of hormones. Biochemistry of nutrition. Biochemistry of the liver»	2					Colloquium*
8.1	Biochemistry of the blood. Physical and chemical properties of the blood. Serum proteins Lab. work: Separation of serum proteins by electrophoresis on acetyl cellulose.	2					interviews, surveys, tests, online tests
8.1	Blood plasma proteins. System of hemostasis. Lab. work. Determination of calcium and chlorides in blood serum	2					interviews, surveys, tests, online tests
9.2	The role of minerals in bone tissue and teeth formation. The role of calcium, phosphorus, magnesium, fluorine, iron, zinc, cooper. Regulation of calcium and phosphorus metabolism.	2			Determination of calcium in oral fluid	Written laboratory report with oral defense	interviews, surveys, tests, online tests

	Lab. work. Determination of calcium in oral fluid								
8.3	Biochemistry of the connective tissue. Biochemistry of oral organs and oral fluid Lab. work. Determination of saliva pH. Detection of minerals and proteins in the bone tissue. Determination of chlorides in oral fluid	2						interviews, surveys, tests, online tests	
8.3	Colloquium «Biochemistry of the blood. Biochemistry of the connective tissue and teeth. Biochemistry of the oral fluid. Calcium and phosphorus metabolism. Microelements»	2						Colloquium*	
8.3	Analysis of gastric juice and oral fluid	2				Analysis of gastric juice acidity Determination of calcium in oral fluid	Written laboratory report with oral defense *		
8.3	Final lesson « Simple protein and amino acid metabolism. Metabolism of nucleoproteins. Structure and synthesis of nucleic acids. Protein biosynthesis. Techniques of molecular biology. Regulation of metabolism. Biochemistry of hormones. Biochemistry of the blood. Biochemistry nutrition. Biochemistry of organs and tissues»	2						interviews, surveys, tests, online tests	
	Detection and assessment of the students' knowledge in biological chemistry							Examination*	

*This is a mandatory form of current certification (each student will receive a mark)