



SYLLABUS OF THE DISCIPLINE “BIOLOGICAL CHEMISTRY”

1. General information	
Name of the faculty	Department of the Foreign Students (Dentistry Faculty)
Educational program (branch, specialty, level of higher education, form of training)	22 Public Health, 221 Dentistry, second (master's) level of the higher education, daily form
Academic year	2022-2023
Name of the discipline, code (<i>electronic address is on the web-site of the Danylo Halytsky Lviv National Medical University</i>)	Biological chemistry Code OK 12 Kaf_biochemistry@meduniv.lviv.ua
Department (<i>name, address, tel, e-mail</i>)	Department of Biological Chemistry 79010, Lviv, 54, Pekarska Street tel. +38 (032) 275 76 02 Kaf_biochemistry@meduniv.lviv.ua
Head of the Department (<i>e-mail</i>)	Lesya Kobylinska, PhD, DrSci, professor kobylinska_lesya@meduniv.lviv.ua
Year of training (when the discipline is taught)	Second year of training
Semester (when the discipline is taught)	III-IV
Type	Mandatory
Staff (<i>names, scholar degrees, e-mail</i>)	Iryna Fomenko, PhD, DrSci, professor irynafomenkolviv@gmail.com Lesya Kobylinska, PhD, DrSci, associate professor kobylinska_lesya@meduniv.lviv.ua Natalya Denysenko, PhD, assistant professor denysenko.natalka@gmail.com
Erasmus yes/no (availability of the discipline for students in the framework of the <i>Erasmus+</i>)	No
A person, responsible for the syllabus (receiving comments regarding syllabus, e-mail)	Lesya Kobylinska, PhD, DrSci, professor kobylinska_lesya@meduniv.lviv.ua
Number of ECTS credits	5
Number of hours (<i>lectures/practical classes/students independent work</i>)	Total 150 h (16 lectures / 59 practical classes / 75 students individual work)
Language of training	English
Information on consultations	Consultations are carried out according to the approved plan once per week during the academical year. Consultations before exam are carried out according to the approved plan by lectors.
Address, telephone and working schedule of the Department	-
2. Short annotation to the course	
<i>General characteristics, short course description, peculiarities, advantages</i>	

Teaching of *Biological chemistry* at the Department of the Foreign Students (Dentistry Faculty) in Danylo Halytsky Lviv National Medical University is provided during the second year of studying.

The subject of study in the educational discipline "Biological Chemistry" is the chemical composition of living organisms (the human body) and the biochemical transformations to which the molecules that makeup them are subject. Biological chemistry is based on students' study of medical biology, biophysics, medical chemistry (bioorganic, bioinorganic, physical and colloidal chemistry), and morphological disciplines and are integrated with these disciplines; lays the foundations for students to study molecular biology, genetics, physiology, pathology, general and molecular pharmacology, toxicology and propaedeutics of clinical disciplines, which involves the integration of teaching with these disciplines and the formation of skills to apply knowledge of biological and bioorganic chemistry, primarily biochemical processes that take place in the body of a healthy and sick person, in the process of further education and professional activity; lays the foundations for clinical diagnosis of the most common diseases, monitoring the course of the disease, control over the effectiveness of the use of medicines and measures aimed at preventing the occurrence and development of pathological processes.

3. Aim and scope of the course

1. The aim of the discipline is to study biomolecules and molecular organization of cell structures, general patterns of enzymatic catalysis and biochemical dynamics of transformation of major classes of biomolecules (amino acids, carbohydrates, lipids, nucleotides, porphyrins, etc.), molecular biology and genetics of informational macromolecules. , ie molecular mechanisms of heredity and realization of genetic information, hormonal regulation of metabolism and biological functions of cells, biochemistry of special physiological functions.

2. Learning objectives: To determine the structure of bioorganic compounds and the functions they perform in the human body; the reactivity of the main classes of biomolecules, which provides their functional properties and metabolic transformations in the body; biochemical mechanisms of pathological processes in the human body; features of diagnostics of a physiological condition of an organism and development of pathological processes on the basis of biochemical researches; connection of features of structure and transformations in an organism of bioorganic compounds as bases of their pharmacological action as medicines; basic mechanisms of biochemical action and principles of directed application of different classes of pharmacological agents; biochemical and molecular bases of physiological functions of cells, organs and systems of the human body; functioning of enzymatic processes occurring in membranes and organelles to integrate metabolism in individual cells; norms and changes in biochemical parameters used to diagnose the most common human diseases; on the beginning of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.

Analyze the compliance of the structure of bioorganic compounds with the physiological functions they perform in the human body. Interpret the features of the physiological state of the organism and the development of pathological processes on the basis of laboratory tests. Analyze the reactivity of carbohydrates, lipids, amino acids, which provides their functional properties and metabolic transformations in the body. Interpret the features of the structure and transformations in the body of bioorganic compounds as the basis of their pharmacological action as drugs. Interpret the biochemical mechanisms of pathological processes in the human body and the principles of their correction. Explain the main mechanisms of biochemical action and the principles of targeted use of different classes of pharmacological agents. Explain the biochemical and molecular basis of physiological functions of cells, organs and systems of the human body. Analyze the results of biochemical studies and changes in biochemical and enzymatic parameters used to diagnose the most common human diseases. Classify the results of biochemical studies and changes in biochemical and enzymatic parameters used to diagnose the most common human diseases. Interpret the importance of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.

3. Competences and learning outcomes, the formation of which provides the study of the discipline (*general competence -GC*):

- Ability to abstract thinking, analysis and synthesis.
 - Knowledge and understanding of the subject area and understanding of professional activity.
 - Ability to apply knowledge in practical activities.
 - Ability to communicate in the national language both orally and in writing.
 - Ability to communicate in English.
 - Skills in using information and communication technologies.
 - Ability to search, process and analyze information from various sources.
 - Ability to identify, pose and solve problems.
 - Ability to be critical and self-critical.
 - Ability to work in a team.
 - The ability to act socially responsibly and consciously.
- special (professional, subject):
- Ability to collect medical information about the patient and analyze clinical data.
 - Ability to interpret the results of laboratory and instrumental research.
 - Ability to diagnose: determine preliminary, clinical, final, accompanying diagnosis, emergency conditions.

4. Course prerequisites

Biological chemistry as a discipline:

1. based on the knowledge of students obtained on the basis of the State Standard of Education in such disciplines as medical biology, inorganic and organic chemistry, human anatomy, histology;
2. provides a high level of general medical training;
3. lays the foundation for students to further master their knowledge of specialized theoretical and clinical professional and practical dental disciplines

5. Program results of learning

List of learning results

Learning outcome code	The content of the learning outcome	Reference to the competency matrix code
<i>The code is created when filling the syllabus (category: Kn – knowledge, general competencies, PL-professional competencies)</i>	<i>Learning outcomes determine that the student must know, understand and be able to perform, after completing the discipline. Learning outcomes follow from the set learning goals. To enroll in the discipline, it is necessary to confirm the achievement of each learning outcome.</i>	Symbol of the Program Learning Outcome Code in the Higher Education Standard
<i>Kn-1</i>	Know the structure of bioorganic compounds and the functions they perform in the human body.	<i>PL-2</i>
<i>Kn-2</i>	Know the reactivity of the main classes of biomolecules, which provides their functional properties and metabolic transformations in the body.	<i>PL-3</i>
<i>Kn-3</i>	To know the biochemical mechanisms of pathological processes in the human body.	<i>PL-4</i>
<i>Kn-4</i>	To know about the peculiarities of the diagnosis of the physiological state of the organism and the development of pathological processes on the basis of biochemical studies.	<i>PL-6</i>
<i>Kn-5</i>	To know about the peculiarities of the structure and transformations in the body of bioorganic compounds as the basis of their pharmacological action as drugs.	<i>PL-9</i>

<i>Kn-6</i>	Know the basic mechanisms of biochemical action and the principles of targeted use of different classes of pharmacological agents.	<i>PL-10</i>
<i>Kn-7</i>	Know the biochemical and molecular basis of physiological functions of cells, organs and systems of the human body.	<i>PL-14</i>
<i>Kn-8</i>	Know the functioning of enzymatic processes occurring in membranes and organelles to integrate metabolism in individual cells.	<i>PL-15</i>
<i>Kn-9</i>	Know the norms and changes in biochemical parameters used to diagnose the most common human diseases.	<i>PL-17</i>
<i>Kn-10</i>	To know the beginnings of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.	
<i>Skills</i>		
<i>Sk-1</i>	Analyze the compliance of the structure of bioorganic compounds with the physiological functions they perform in the human body.	
<i>Sk-2</i>	Interpret the features of the physiological state of the organism and the development of pathological processes on the basis of laboratory tests.	
<i>Sk-3</i>	Analyze the reactivity of carbohydrates, lipids, amino acids, which provides their functional properties and metabolic transformations in the body.	
<i>Sk-4</i>	Interpret the features of the structure and transformations in the body of bioorganic compounds as the basis of their pharmacological action as drugs.	
<i>Sk-5</i>	Interpret the biochemical mechanisms of pathological processes in the human body and the principles of their correction.	
<i>Sk-6</i>	Explain the main mechanisms of biochemical action and the principles of targeted use of different classes of pharmacological agents.	
<i>Sk-7</i>	Explain the biochemical and molecular basis of physiological functions of cells, organs and systems of the human body.	
<i>Sk-8</i>	Analyze the results of biochemical studies and changes in biochemical and enzymatic parameters used to diagnose the most common human diseases	
<i>Sk-9</i>	Classify the results of biochemical studies and changes in biochemical and enzymatic parameters used to diagnose the most	

	common human diseases.	
<i>Sk-10</i>	Interpret the importance of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.	
<i>Autonomy and responsibility</i>		
<i>AR-1</i>	Be responsible for the timely acquisition of modern knowledge.	
<i>AR-2</i>	Be responsible for the timely acquisition of basic general and professional knowledge.	
<i>AR-3</i>	Be responsible for the timeliness of decisions in these situations.	
<i>AR-4</i>	Responsible for the quality of the tasks	
<i>AR-5</i>	Be responsible for the timely acquisition of knowledge and handling of information	
<i>AR-6</i>	Be responsible for the quality of work.	
<i>AR-7</i>	Be responsible for your civic position and activities	
<i>AR-8</i>	Be responsible for literacy in professional communication.	
<i>Competencies and professional competencies</i>		
<i>GC-1</i>	Ability to abstract thinking, analysis and synthesis.	
<i>GC -2</i>	Knowledge and understanding of the subject area and understanding of professional activity.	
<i>GC-3</i>	Ability to apply knowledge in practice.	
<i>GC-5</i>	Ability to communicate in the national language both orally and in writing.	
<i>GC-5</i>	Ability to communicate in English.	
<i>GC-6</i>	Skills in the use of information and communication technologies.	
<i>GC-7</i>	Ability to search, process and analyze information from various sources.	
<i>GC-9</i>	Ability to identify, pose and solve problems.	
<i>GC-10</i>	The ability to be critical and self-critical.	
<i>GC-11</i>	Ability to work in a team.	
<i>GC-13</i>	The ability to act socially responsibly and consciously.	
<i>PC-1</i>	Ability to collect medical information about the patient and analyze clinical data.	
<i>PC-2</i>	The ability to interpret the results of laboratory and instrumental research.	
<i>PC-3</i>	Ability to diagnose: determine preliminary, clinical, final, accompanying diagnosis, emergency conditions.	
6. Format and contents of the course		
Course format (specify full-time or part-time)	eye	
Kind of occupations	Number of hours	Number of groups
lectures	16	10

practical	59	10
seminars	-	
individual student work	75	10

7. Topics and content of the course

Code of classes type	Topic	Learning content	Code of the results of the teaching	Lecturer
L-1	Biochemistry as a science. Enzymes. Regulation of enzymatic processes. Enzymology.	To acquaint students with the subject and tasks of biochemistry. Describe the physicochemical properties of enzymes, the mechanism of their action and regulation. To acquaint students with enzyme diagnostics, enzyme therapy and enzymopathy	<i>Kn-1</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Kn-8</i> <i>AR-1</i> <i>AR-2</i> <i>GC-1</i> <i>GC-6</i>	Prof. Kobylinska L.I.
L-2	Metabolism of carbohydrates, its regulation and changes in pathology	To acquaint students with the process of carbohydrate digestion, the use of carbohydrates in various metabolic pathways, anaerobic and aerobic glycolysis, glycogen metabolism, gluconeogenesis, hormonal regulation of carbohydrate metabolism. Describe the causes, mechanism of development, diagnostic criteria for diabetes	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>GC-1</i> <i>GC-6</i>	Prof. Fomenko I.S.
L-3	Metabolism of lipids, its regulation and changes in pathology	To acquaint students with the process of lipid digestion in the digestive tract, the functions of simple and complex lipids, metabolic transformations: synthesis-decomposition of simple and complex lipids, the processes of oxidation and synthesis of fatty acids, pathological processes - obesity, steatosis, atherosclerosis	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>GC-1</i> <i>GC-6</i>	Prof. Kobylinska L.I.
L-4	Metabolism of amino acids. General pathways of amino acid turnover. Metabolism of ammonia: urea	To acquaint students with general and specific ways of amino acid metabolism; by the formation and destruction of ammonia, pathological processes of amino acid metabolism and the ornithine cycle of urea	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i>	Prof. Fomenko I.S.

	synthesis and its disorders. Hereditary enzymopathias of distinct amino acids.		<i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>GC-1</i> <i>GC-6</i>	
L-5	Basic molecular biology and genetics	To acquaint students with the synthesis and breakdown of purine and pyrimidine nucleotides, regulation of these processes, and pathological changes that may occur when these exchanges are disturbed. To acquaint students with the processes of replication, transcription and broadcasting.	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>GC-1</i> <i>GC-6</i>	Prof. Fomenko I.S.
L-6	Biochemistry of hormones: molecular mechanisms of hormone action; pathology of endocrine action.	Introduce students to the general characteristics of hormones, types of receptors, the mechanism of action of hormones of protein-peptide nature and steroid hormones, to characterize the features of each hormone and pathological processes that occur in the absence / excess of a hormone	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-10</i> <i>Sk-2</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-6</i>	Prof. Kobylinska L.I.
L-7	Biochemistry of blood. Coagulation and fibrinolytic systems. Pathobiochemistry of blood.	To acquaint students with the process of vascular-platelet and coagulation hemostasis, the mechanism of fibrinolysis, to characterize the anticoagulant system, features and structure of the immune system. Explain the mechanism of development of blood coagulation disorders and immunodeficiency states	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>GC-1</i> <i>GC-6</i>	Prof. Fomenko I.S.
L-8	Biochemical functions of liver. Biochemistry of jaundices; biotransformation of foreign substances in	To acquaint students with the classification of xenobiotics and features of their metabolism in the human body. Describe the stages of disposal of foreign substances. Biochemical reactions conjugation of toxic substances	<i>Kn-1</i> <i>Kn-4</i> <i>Kn-6</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-4</i>	Prof. Kobylinska L.I.

	liver.		<i>Sk-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>GC-1</i> <i>GC-6</i>	
P-1	Objectives and assignments of biochemistry. Aims and methods of biochemical investigations.	<p>Biological chemistry as a science. The place of biochemistry among other medical and biological disciplines. Objects of study and tasks of biochemistry. The leading role of biochemistry in establishing the molecular mechanisms of pathogenesis of human diseases. Connection of biochemistry with other biomedical sciences. Medical biochemistry. Clinical Biochemia. Biochemical laboratory diagnostics.</p> <p>Structural and functional components of cells, their biochemical functions. Classes of biomolecules. Their hierarchy and origin. Basic and methods of biochemical research.</p>	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-11</i>	According to the time-table
P-2	Physico-chemical properties and structure of enzyme proteins. Mechanism of action and kinetics of enzymatic catalysis.	<p>Physicochemical properties of enzymes: surface charge of the molecule, solubility, thermodynamic stability of protein-enzyme molecules, precipitation, denaturation, interaction with ligands and its functional significance.</p> <p>Simple and complex proteins-enzymes, prosthetic groups of complex proteins-enzymes (cofactors, coenzymes). Structure of enzymes: active, regulatory (allosteric) centres.</p> <p>Levels of structural organization of enzymes. Multienzyme complexes, enzymatic ensembles, multifunctional enzymes, their advantages.</p> <p>Nomenclature and classification of enzymes. Types of reactions catalyzed by individual classes of enzymes. Mechanism of action and kinetics of enzymatic reactions: dependence of the reaction rate on temperature, pH of the medium, substrate concentration.</p> <p>Specificity of enzymes.</p> <p>Intracellular localization of enzymes, tissue (organ) specificity of enzymes. Saliva enzymes.</p> <p>Isoenzymes, multiple molecular forms of enzymes. Principles and methods of detecting enzymes in biological objects. Units of activity and amount</p>	<i>Kn-1</i> <i>Kn-8</i> <i>Sk-1</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-2</i>	According to the time-table

		of enzymes.		
P-3	Study of the regulation of enzymatic processes. Medical enzymology.	<p>Activators and inhibitors of enzymes: examples and mechanisms of their action.</p> <p>Types of enzyme inhibition: reversible (competitive, non-competitive) and irreversible.</p> <p>Regulation of enzymatic processes. Ways and mechanisms of regulation: allosteric enzymes, covalent modification of enzymes, proteolytic activation of enzymes (limited proteolysis).</p> <p>Cyclic nucleotides (cAMP, cGMP) as regulators of enzymatic reactions and biological functions of the cell.</p> <p>Enzymopathies are congenital (hereditary) defects in the metabolism of carbohydrates, amino acids, porphyrins, and purines.</p> <p>Enzyme diagnosis of pathological processes and diseases.</p> <p>Enzymotherapy is the use of enzymes, their activators and inhibitors in medicine.</p>	<p><i>Kn-1</i></p> <p><i>Kn-8</i></p> <p><i>Sk-1</i></p> <p><i>AR-1</i></p> <p><i>AR-2</i></p> <p><i>AR-4</i></p> <p><i>AR-5</i></p> <p><i>AR-6</i></p> <p><i>GC-1</i></p> <p><i>GC-2</i></p> <p><i>GC-3</i></p> <p><i>GC-6</i></p> <p><i>GC-7</i></p> <p><i>GC-11</i></p> <p><i>PC-2</i></p>	According to the time-table
P-4	Study of the role of cofactors and coenzyme vitamins in the manifestation of catalytic activity of enzymes. The role of water- and fat-soluble vitamins in the metabolism of living organisms.	<p>Classification of coenzymes according to their chemical nature and the type of reaction they catalyze.</p> <p>Vitamins as irreplaceable biologically active components necessary for the human body. The history of the discovery of vitamins. Development of vitaminology in Ukraine.</p> <p>Causes of exo- and endogenous hypo- and vitamin deficiency.</p> <p>Vitamins B1 and B2, their structure, biological role, sources for humans, daily requirement. Signs of hypovitaminosis.</p> <p>Structure, properties of vitamin H and pantothenic acid. Their participation in metabolism, main sources, daily need. The role of CoA in exchange processes.</p> <p>Antianemic vitamins (B12, folic acid), their structure, participation in metabolism, human sources, daily need, signs of hypovitaminosis.</p> <p>Vitamins B6 and PP, their structure, biological role, human sources, daily requirement, signs of hypovitaminosis.</p> <p>Vitamins C and P, their structure, biological role, sources for humans, daily requirement. Functional</p>	<p><i>Kn-1</i></p> <p><i>Kn-8</i></p> <p><i>Sk-1</i></p> <p><i>AR-1</i></p> <p><i>AR-2</i></p> <p><i>AR-4</i></p> <p><i>AR-5</i></p> <p><i>AR-6</i></p> <p><i>GC-1</i></p> <p><i>GC-2</i></p> <p><i>GC-3</i></p> <p><i>GC-6</i></p> <p><i>GC-7</i></p> <p><i>GC-11</i></p> <p><i>PC-2</i></p>	According to the time-table

		<p>relationship between vitamin P and vitamin C. Manifestations of deficiency in the human body.</p> <p>Use of water-soluble vitamins in dental practice.</p> <p>Vitamins of group D, structure, biological role, daily need, sources for humans, signs of hypo- and hypervitaminosis, vitamin deficiency.</p> <p>Vitamin A, structure, biological role, daily need, sources for humans, signs of hypo-hypervitaminosis.</p> <p>Vitamins E, F, structure, biological role, sources for humans, mechanism of action, daily requirement, signs of deficiency, application in medicine.</p> <p>Antihemorrhagic vitamins (K2, K3) and their water-soluble forms, structure, biological role, sources for humans, mechanism of action, daily requirement, signs of deficiency, application in medicine.</p> <p>Use of fat-soluble vitamins in dental practice.</p> <p>Provitamins, antivitamins. Mechanism of action and application in practical medicine.</p> <p>Vitamin-like substances, their structure and role.</p>		
P-5	<p>Metabolic pathways and bioenergetics.</p> <p>Tricarboxylic acid cycle and its regulation and energetic balance</p>	<p>The concept of metabolism and energy. Characteristics catabolic, anabolic and amphibolic metabolic pathways and their significance. Exergonic and endergonic biochemical reactions; the role of ATP and other macroergic phosphates in their conjugation. Intracellular location metabolic pathways in the cell. The methods of studying metabolism. Catabolic metabolic pathways of biomolecules: proteins, carbohydrates, lipids, their characteristics.</p> <p>Citric acid cycle (intracellular localization of enzymes TCA cycle, TCA cycle reactions; characterization of enzymes and nucleotides TCA cycle, substrate phosphorylation reaction of TCA cycle, the impact of allosteric modulators on the regulation of TCA cycle, energy balance Citric acid cycle). Anaplerotic and amphibolic reactions of TCA cycle.</p>	<p><i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i></p>	According to the time-table
P-6	Molecular basis of bioenergetics.	Biological oxidation reactions; types of reactions (dehydrogenase, oxidase, oxygenase) and their biological	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-6</i></p>	According to the

		<p>significance. Tissue respiration. Pyridine-dependent dehydrogenases. The structure of NAD⁺ and NADPH⁺. Their importance in oxidation and reduction reactions.</p> <p>Flavin-dependent dehydrogenases. Building of FAD and FMN. Their role in oxidation and reduction reactions.</p> <p>Cytochromes and their role in tissue respiration. The structure of their prosthetic group.</p> <p>The sequence of the components of the mitochondrial respiratory chain. Molecular complexes of the inner membranes of mitochondria.</p> <p>Oxidative phosphorylation: points of conjugation of electron transport and phosphorylation, coefficient of oxidative phosphorylation.</p> <p>Chemiosmotic theory of oxidative phosphorylation, mitochondrial ATP synthetase.</p> <p>Inhibitors of electron transport in the respiratory chain of mitochondria.</p> <p>Uncouplers of electron transport and oxidative phosphorylation in the mitochondrial respiratory chain.</p>	<p><i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i></p>	time-table
P-7	Study of anaerobic oxidation of glucose	<p>Digestion of carbohydrates in the digestive tract: glycolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of carbohydrate hydrolysis products in the small intestine.</p> <p>Hereditary enzymopathies of digestive processes (insufficiency of disaccharidases, violation of membrane transport of hexoses, absorption of glucose and galactose).</p> <p>Glucose as an important metabolite of carbohydrate metabolism: a general scheme of sources and ways of conversion of glucose in the body.</p> <p>Anaerobic oxidation of glucose. Reaction sequence and enzymes of glycolysis.</p> <p>Glycolytic oxido-reduction: substrates of phosphorylation, and shuttle mechanisms glycolytic oxidation of NADH. Alcohol fermentation, enzymatic reactions. Reactions are common and different for glycolysis and fermentation.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-6</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i></p>	According to the time-table
P-8	Aerobic oxidation of glucose and	<p>Stages of aerobic oxidation of glucose. Oxidative decarboxylation of pyruvate.</p>	<p><i>Kn-1</i> <i>Kn-2</i></p>	According to the

	alternative pathways of monosaccharide metabolism.	Enzymes, coenzymes and the sequence of reactions in the multienzyme pyruvate dehydrogenase complex. Comparative characteristics of bioenergetics of aerobic and anaerobic oxidation of glucose. The Pasteur effect. Pentose phosphate pathway of glucose oxidation: process scheme and biological significance. Metabolic ways of conversion of fructose and galactose; hereditary enzymopathies of their metabolism.	<i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-3</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-2</i>	time-table
P-9	Study of glycogen catabolism and biosynthesis. Biosynthesis of glucose - gluconeogenesis.	Glycogen biosynthesis: enzymatic reactions, physiological significance. Regulation of glycogen synthetase activity. The phospholytic pathway of glycogen breakdown in the liver and muscles. Regulation of glycogen phosphorylase activity. The mechanism of reciprocal regulation of glycogenolysis and glycogenesis due to cascade cAMP-dependent phosphorylation of enzyme proteins. The role of epinephrine, glucagon, and insulin in the hormonal regulation of glycogen metabolism in muscle and liver. Genetic disorders of glycogen metabolism (glycogenesis and aglycogenesis). Gluconeogenesis: substrates, enzymes, reactions and physiological significance of the process. Relationship between glycolysis and gluconeogenesis (Cori cycle). Glucose-lactate, glucose-alanine cycles.	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-3</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-2</i>	According to the time-table
P-10	Studies on mechanisms of metabolic and humoral regulation of carbohydrate metabolism. Diabetes mellitus.	Biochemical processes that ensure a stable level of glucose in the blood. The role of different pathways of carbohydrate metabolism in the regulation of blood glucose levels. Hormonal regulation of carbohydrate metabolism (insulin - structure, mechanism of action, role in carbohydrate metabolism; adrenaline and glucagon - mechanisms of their regulatory action on carbohydrate metabolism).	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i>	According to the time-table

		<p>Characteristics of normo-, hyper-, hypoglycemia and glucosuria.</p> <p>Insulin-dependent and non-insulin-dependent forms of diabetes.</p> <p>Characteristics of biochemical disorders in diabetes.</p> <p>Biochemical tests for the assessment of diabetes mellitus.</p> <p>Violation of carbohydrate metabolism during fasting.</p>	<p><i>Sk-9</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i></p>	
P-11	<p>Catabolism and biosynthesis of triacylglycerols and phospholipids.</p> <p>Intracellular lipolysis and molecular mechanisms of its regulation.</p>	<p>Digestion of lipids in the digestive tract: lipolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of lipid hydrolysis products in the small intestine.</p> <p>Disorders of lipid digestion in the digestive tract (steatorrhea, its types).</p> <p>Biological functions of simple and complex lipids in the human body (spare, energy, participation in thermoregulation, biosynthetic).</p> <p>Participation of lipids in the construction and operation of cell membranes. Liquid-mosaic model of biomembranes. Liposomes, their use in medicine.</p> <p>Circulatory transport and deposition of lipids in adipose tissue.</p> <p>Lipoproteinlipase of endothelial tissue.</p> <p>Catabolism of triacylglycerols in adipocytes, the sequence of reactions, the mechanisms regulating the activity triacylglycerol lipase. Biosynthesis of triacylglycerols. Neurohumoral regulation of lipolysis: role of epinephrine, norepinephrine, glucagone, insulin.</p> <p>Metabolism of sphingolipids. Genetic anomalies of sphingolipid metabolism - sphingolipidoses. Lysosomal diseases.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-3</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-2</i></p>	According to the time-table
P-12	<p>Beta-oxidation and biosynthesis of fatty acids.</p> <p>Metabolism of ketone bodies.</p>	<p>Reactions of beta-oxidation of fatty acids: localization of the process; activation of fatty acids; the role of carnitine in the transport of fatty acids in mitochondria; sequence of enzymatic reactions and energy cost of beta-oxidation of fatty acids.</p> <p>Glycerol oxidation: enzymatic reactions, bioenergetics.</p> <p>Biosynthesis of higher fatty acids: localization of the process; metabolic sources of fatty acid synthesis; stages of synthesis of saturated fatty acids;</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-9</i></p>	According to the time-table

		<p>characteristics of the FA-synthetase, the value of acyl-transporting protein, biotin; sources of NADPH; sequence of enzymatic reactions of biosynthesis of higher fatty acids; regulation of the biosynthesis process at the level of acetyl-CoA-carboxylase and fatty acid synthetase; elongation of saturated fatty acids; biosynthesis of mono- and polyunsaturated fatty acids in the human body. Metabolism of ketone bodies: enzymatic reactions of ketone body biosynthesis; reactions of utilization of ketone bodies, energy value; metabolism of ketone bodies in conditions of pathology; mechanisms of excessive increase in the content of ketone bodies in diabetes and starvation; concepts - ketoacidosis, ketonemia, ketonuria.</p>	<p><i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i></p>	
P-13	<p>Biosynthesis and biotransformation of cholesterol. Disorders of lipid metabolism</p>	<p>Cholesterol biosynthesis in the human body: localization of this process, significance; stages of cholesterol synthesis; enzyme - positive reactions of mevalonic acid synthesis; regulation of cholesterol synthesis. Ways of biotransformation of cholesterol - Roll (esterification, the formation of bile acids and steroid hormones, synthesis of vitamin D₃, excretion from the body). Atherosclerosis: mechanisms of development, the role of genetic factors. Hypercholesterolemia, classification according to WHO rules. Disorders of lipid metabolism in diabetes. Pathological processes of lipid metabolism that lead to the development of obesity. Fatty hepatosis, lipotropic factors. Plasma lipoproteins: lipid and protein (apoproteins) composition.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-9</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i></p>	<p>According to the time-table</p>
P-14	<p>General ways of transformation of amino acids in tissues.</p>	<p>Digestion of proteins in the digestive tract. Chemical composition of gastric juice; biochemical mechanisms of stimulating the release and action of enzymes (pepsin, gastrin, renin). Formation mechanism and role of hydrochloric acid. Acidity of gastric juice and forms of its expression. Quantitative indicators in normality and pathology by the pH-metry method. Mechanisms of stimulation of release of hydrochloric acid. Digestion of proteins in the small intestine:</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-3</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i></p>	<p>According to the time-table</p>

		<p>proteolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of protein hydrolysis products in the small intestine.</p> <p>Decay of proteins in the large intestine.</p> <p>Ways of formation and maintenance of the pool of free amino acids in the human body. General ways of conversion of free amino acids. Types of amino acid deamination reactions and their final products. Mechanism of oxidative deamination of amino acids. L- and D-amino acid oxidases. Their enzymatic activity, specificity of action.</p> <p>Glutamate dehydrogenase: structure of the enzyme, mechanism of the glutamate dehydrogenase reaction, biological significance.</p> <p>Transamination of amino acids, substrates for transamination reactions. The mechanism of the transamination reaction. Transaminases. Localization of transaminases in organs and tissues. The clinical and diagnostic value of determining the activity of transaminases. Decarboxylation of amino acids. Decarboxylases. Formation of biogenic amines (\square-aminobutyric acid, histamine, serotonin, dopamine). Decarboxylation of amino acids in the process of protein decay in the intestine. Oxidation of biogenic amines.</p>	<p>AR-5 AR-6 GC-1 GC-2 GC-6 GC-7 GC-11 PC-2</p>	
P-15	<p>Detoxification of ammonia and urea biosynthesis. Biosynthesis of glutathione and creatine.</p>	<p>Ways of ammonia formation. Ammonia toxicity and mechanisms of its neutralization. Circulatory transport of ammonia (glutamine, alanine).</p> <p>Urea biosynthesis: localization of the ornithine cycle; enzymatic reactions; sources of ammonia; energy supply.</p> <p>Genetic defects of enzymes (enzymopathy) of urea synthesis.</p> <p>Glutathione: structure, biosynthesis, biological functions, role in the exchange of organic peroxides.</p> <p>Biosynthesis and biological role of creatine and creatine phosphate, formation of creatinine, clinical and biochemical significance of disorders of their metabolism.</p>	<p>Kn-1 Kn-2 Kn-7 Kn-8 Kn-9 Kn-10 Sk-1 Sk-2 Sk-3 Sk-5 Sk-7 Sk-8 Sk-9 Sk-10 GC-1 GC-2 GC-6 GC-7 GC-11</p>	<p>According to the time-table</p>

			<i>PC-1</i> <i>PC-2</i>	
P-16	Specialized pathways of amino acid metabolism in tissues.	<p>General pathways of metabolism of carbon skeletons of amino acids in the human body. Glucogenic and ketogenic amino acids.</p> <p>Exchange of glycine and serine; the role of tetrahydrofolate (H4-folate) in the transfer of one-carbon fragments, dihydrofolate reductase inhibitors as antitumor agents.</p> <p>Features of the exchange of amino acids with branched chains; participation of coenzyme forms of vitamin B12 in the metabolism of amino acids.</p> <p>Exchange of sulfur-containing amino acids; methylation reactions</p> <p>Arginine exchange; biological role of nitric oxide, NO-synthase.</p> <p>Tryptophan metabolism: kynurenine and serotonin pathways. Hereditary enzymopathies.</p> <p>Specialized metabolic pathways of cyclic amino acids phenylalanine and tyrosine, sequence of enzymatic reactions. Hereditary enzymopathies.</p>	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-9</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i>	According to the time-table
P-17	Biosynthesis and catabolism of purine and pyrimidine nucleotides, determination of end products of their metabolism. Hereditary disorders of nucleotide metabolism.	<p>Purine nucleotide biosynthesis: scheme of IMP synthesis reactions; formation of AMP and GMF. Regulation of purine nucleotide biosynthesis by the principle of negative feedback (retroinhibition).</p> <p>Biosynthesis of pyrimidine nucleotides: reaction scheme, regulation of synthesis. Biosynthesis of deoxyribonucleotides. Formation of thymidyl nucleotides; inhibitors of dTMP biosynthesis as antitumor agents.</p> <p>Catabolism of purine nucleotides. Hereditary disorders of uric acid metabolism. Clinical and biochemical characteristics of hyperuricemia, gout, Lesch-Nihan syndrome.</p> <p>Scheme catabolism of pyrimidine nucleotides.</p>	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-9</i> <i>Sk-10</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i>	According to the time-table
P-18	Replication of DNA and transcription of RNA. Analysis of the mechanisms of mutations,	<p>DNA replication: biological significance, semi-conservative mechanism of replication.</p> <p>Sequence of stages and enzymes of DNA replication in prokaryotes and eukaryotes. RNA transcription: RNA</p>	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i>	According to the time-table

	<p>reparation of DNA. Protein biosynthesis in ribosomes, investigation of initiation, elongation and termination stages in synthesis of polypeptide chain.</p>	<p>polymerases of prokaryotes and eukaryotes, transcription signals (promoter, initiator and terminator regions of the genome). Processing - posttranscriptional modification of mRNA. tRNA and activation of amino acids. Aminoacyl-tRNA synthetase. Stages and mechanisms of translation (protein biosynthesis) in ribosomes: initiation, elongation and termination. Posttranslational modification of peptide chains. Regulation. Inhibitors of transcription and translation in prokaryotes and eukaryotes: antibiotics and interferons - their use in medicine; diphtheria toxin. Regulation of prokaryotic gene expression: regulatory and structural regions of lactose (Lac-) operon (regulatory gene, promoter, operator). Gene (point) mutations: role in the occurrence of enzymopathies and hereditary human diseases. Biochemical mechanisms of action of chemical mutagens.</p>	<p><i>Sk-1</i> <i>Sk-3</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-6</i> <i>GC-7</i> <i>GC-11</i> <i>PC-2</i></p>	
P-19	<p>Investigation of molecular and cellular mechanisms of action of protein and peptide hormones on target cells. Mechanism of hormonal action of amino acid derivatives and biogenic amines.</p>	<p>Hormones: general characteristics; the role of hormones and other bioregulators in the system of intercellular integration of human body functions. Classification of hormones and biomodulator; compliance with the structure and mechanisms of action of hormones. The reaction of target cells to the action of hormones. Membrane (ionotropic, metabotropic) and cytosolic receptors. Biochemical systems of intracellular transmission of hormonal signals: G-proteins, secondary mediators (cAMP, Ca²⁺/ calmodulin, IF₃, DAG, protein kinase C, A), their role. Hypothalamic hormones - liberins and statins. Functional connection between the hypothalamus and the pituitary gland. Anterior pituitary hormones: somatotropin (STG), prolactin. Pathological processes associated with dysfunction of these hormones. Hormones of the posterior pituitary gland. Vasopressin and oxytocin: structure, biological functions. Pancreatic hormones. Insulin - structure, biosynthesis and secretion; effects on the metabolism of</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-4</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	<p>According to the time-table</p>

		carbohydrates, lipids, amino acids and proteins. Growth-stimulating effects of insulin. Glucagon. Chemical nature and biological action of the hormone. Catecholamines (epinephrine, norepinephrine, dopamine): structure, biosynthesis, biological effects, biochemical mechanisms of action.		
P-20	Molecular and cellular mechanisms of action of steroid and thyroid hormones upon target cells. Eicosanoids.	<p>Steroid hormones nomenclature classification. Mechanism of action of steroid hormones.</p> <p>Steroid hormones of the adrenal cortex (C₂₁-steroids) - cortisol, corticosterone. Biochemical effects of corticosteroids. Glucocorticoids; the role of cortisol in the regulation of gluconeogenesis; anti-inflammatory properties of glucocorticoids. Itsenko-Cushing's disease.</p> <p>Mineralocorticoids; the role of aldosterone in the regulation of water-salt metabolism; aldosteronism. Steroid hormones of the gonads. Female sex hormones: estrogens - estradiol, estrone (C₁₈-steroids), progesterone (C₂₁-steroids); biochemical effects; connection with the phases of the menstrual cycle; regulation of synthesis and secretion. Male sex hormones (androgens) - testosterone, dihydrotestosterone (C₁₉-steroids); physiological and biochemical effects, regulation of synthesis and secretion. Thyroid hormones. Structure and biosynthesis of thyroid hormones. Biological effects of T₄ and T₃. Pathology of the thyroid gland; features of metabolic disorders in conditions of hyper- and hypothyroidism. Mechanisms of endemic goiter and its prevention. Eicosanoids: structure, biological and pharmacological properties. Aspirin and other nonsteroidal anti-inflammatory drugs as inhibitors of prostaglandin synthesis.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-4</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	According to the time-table
P-21	Intermediate products of heme biosynthesis and their accumulation in porphyrias. The structure and properties of	<p>Porphyryns: nomenclature; structure of hemoglobin and myoglobin. Reactions of heme biosynthesis. Regulation of the process.</p> <p>Hereditary disorders of porphyrin metabolism (porphyria). Hemoglobin: properties, types of hemoglobin. Hemoglobin derivatives. Mechanisms</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i></p>	

	hemoglobin and its derivatives. Pathological forms of hemoglobin - hemoglobinopathy, thalassemia.	of hemoglobin participation in the transport of oxygen and carbon dioxide. The participation of hemoglobin in the regulation of the acid-base state of the blood. Pathological forms of human hemoglobins. Hemoglobinoses: hemoglobinopathy and thalassemia.	<i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	
P-22	Proteins and non-protein nitrogen-containing blood components. Blood buffer systems.	<p>General characteristics of the protein composition of blood. Factors influencing the content of proteins in blood plasma: hyper-, hypo- and dysproteinemia, paraproteinemia. Albumins and globulins. Electrophoresis of blood plasma proteins. Proteins of the acute phase of inflammation and their clinical and biochemical characteristics.</p> <p>Enzymes of blood plasma: value in enzymodiagnosis of diseases of organs and tissues. Kallikrein-kinin system of blood and tissues. Medicines are antagonists of kinin formation.</p> <p>Non-protein organic compounds of blood plasma. Inorganic components of blood plasma. Blood buffer systems. Violation of the acid-base balance in the body (metabolic and respiratory acidosis, alkalosis).</p>	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-4</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i> <i>PC-13</i>	According to the time-table
P-23	Blood coagulation, anticoagulant and fibrinolytic systems of blood. Biochemistry of	Functional and biochemical characteristics of the hemostasis system in the human body; vascular-platelet and coagulation hemostasis. Blood coagulation system; characteristics of coagulation factors.	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i>	According to the time-table

	<p>immune reactions. Immunodeficiency.</p>	<p>Cascade mechanism of activation and function of blood coagulation; intrinsic and extrinsic blood coagulation pathways. Role of vitamin K in reactions of hemocoagulation (carboxylation of glutamic acid residues, its role in Ca binding). Medical preparations as vitamin K agonists and antagonists. Hereditary and acquired disorders of vascular-platelet and coagulation hemostasis. Anticoagulation system of blood, functional characteristics of its components. Fibrinolytic system of blood: stages and factors of fibrinolysis. Medicinal influencing fibrinolytic process. Activators and inhibitors of plasmin. Drugs that affect the processes of fibrinolysis. Plasminogen activators and plasmin inhibitors.</p> <p>Immunoglobulins: structure, biological functions, mechanisms of regulation of immunoglobulin synthesis. Biochemical characteristics of distinct immunoglobulin classes of human blood. Mediators and hormones of immune system: interleukins, interferons, protein and peptide factors of cell growth and proliferation. Factors of complement system. Classical and alternative pathways of complement activation Biochemical mechanisms of immunodeficiencies: primary (hereditary) and secondary immunodeficiencies.</p>	<p><i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-24	<p>Investigation of end products of heme catabolism. Pathobiochemistry of jaundices.</p>	<p>The role of the liver in the metabolism of bile pigments. Hemoglobin catabolism, bilirubin conversion. Pathobiochemistry of jaundices; hemolytic (prehepatic), parenchymatous (hepatic), occlusive (posthepatic). Enzymatic congenital jaundices: • Crigler-Najjar syndrome as a consequence of insufficient activity of UDP-glucuronyl-transferase. • Gilbert disease – pathology caused by combined disorder of synthesis of bilirubin diglucuronide and absorption of bilirubin from blood by liver cells (“absorption jaundice”). • Dubin-Johnson syndrome – jaundice caused by disorder of transport of bilirubin</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i></p>	<p>According to the time-table</p>

		<p>diglucuronide from liver cells to bile (“excretory jaundice”). Enzymatic jaundices of neonates and methods of their prevention.</p> <p>Porphyryns: nomenclature, reactions of biosynthesis of prothoporphyrin IX; heme production. Regulations of porphyryns synthesis. Hereditary disorders of porphyryn metabolism (porphyria).</p>	<p><i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-25	Biotransformation of xenobiotics and endogenous toxins.	<p>Homeostatic role of the liver in the metabolism of the whole organism. Biochemical functions of hepatocytes. Detoxification function of liver; biotransformation of xenobiotics and endogenous toxins. Reactions of microsomal oxidation; inducers and inhibitors of microsomal monooxygenases. Biological role of cytochrome P-450. Electron transport chains in the membranes of the endoplasmic reticulum of hepatocytes. Conjugation reactions in hepatocytes: biochemical mechanisms, functional significance.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-4</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i></p>	According to the time-table
P-26	Water and mineral metabolism. Normal and pathological constituents of urine.	<p>Water-salt metabolism in the body. Intra-cellular and extracellular water. Metabolism of water, sodium, potassium. The role of the kidneys in the regulation of volume, electrolyte composition and pH of body fluids. Biochemical mechanisms of urinary renal function (filtration, reabsorption, secretion and excretion). Biochemical characteristics of renal clearance and renal threshold, their diagnostic value. Renin-angiotensin system of the kidneys. Biochemical mechanisms of renal hypertension. Antihypertensive drugs are angiotensin-converting enzyme inhibitors. Physico-chemical properties of urine: quantity, color, odor, transparency, reaction (pH), its dependence on the composition of</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i></p>	According to the time-table

		<p>food. The role of the kidneys and lungs in maintaining the acid-base state of the body. Ammonium genesis.</p> <p>The biochemical composition of human urine is normal and under conditions of pathological processes. Clinical and diagnostic value of urine composition analysis.</p>	<p><i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-27	Investigation of biochemical components of connective tissue.	<p>General characteristics of morphology and biochemical composition of connective tissue. Biochemical features of intercellular substance of connective tissue. Proteins of connective tissue fibers - collagen. Proteins of connective tissue fibers – collagens. Biosynthesis of collagen and formation of fibrillar structures. Breakdown of collagen. Structure and properties of non-collagen proteins (elastin, large and small proteoglycans). Noncollagen proteins with specific properties (fibronectin, integrins, laminin, vitronektn, tenastyn, thrombospondin). Complex carbohydrates of the main amorphous matrix of connective tissue - glycosaminoglycans (mucopolysaccharides). Mechanisms of participation of glycosaminoglycan molecules (hyaluronic acid, chondroitin-, dermatan-, keratan sulfates) in the construction of the main substance of connective tissue. Distribution of various glycosaminoglycans in human organs and tissues. Biochemical mechanisms of mucopolysaccharidosis and collagenosis, their clinical and biochemical diagnosis.</p> <p>Organization and chemical structure of bone tissue. Biochemical mechanisms of bone formation and physiological regeneration. Regulation of metabolism in bone tissue: systemic and local factors, markers of bone metabolism. Bone tissue response to dental implants.</p>	<p><i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	According to the time-table
P-28	The biochemical composition and functions of saliva.	<p>Regulation of salivation. The mechanism of saliva formation. Functions of human saliva (digesting, protective, anticaries)Quantity indexes of saliva secretion in health and pathology. Density and viscosity of the saliva, pH in health and pathology.</p>	<p><i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Kn-7</i></p>	According to the time-table

		<p>Organic substances of saliva - proteins and enzymes, their role in ensuring the functions of saliva. Changes in the pathology of the oral cavity and the body as a whole. Nonprotein nitrogenous components of saliva, carbohydrates and lipids.</p> <p>Hormones of the saliva, their role in regulation of metabolic processes in oral cavity and human organism in general.</p> <p>Inorganic constituents of the saliva (trace and macroelements), changes in disorders of the oral cavity. Protective mechanisms of saliva in smoking.</p>	<p><i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-4</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-29	Biochemical composition of tooth tissues: organic and mineral components. Amelogenesis.	<p>General characteristics of the chemical composition of tooth tissues (enamel, dentin, cement, pulp). Inorganic compounds of enamel; apatites, their properties and biological role. Organic substances of enamel (specific proteins, peptides, carbohydrates, lipids). Special features of dentine composition, its structure and functional organization. Cementum. Pulp - features of biochemical composition and metabolism. Amelogenesis. The processes of mineralization - demineralization - the basis of mineral metabolism of tooth tissues. Enamel permeability. The role of vitamins A, D, E, K, C in the regulation of mineralization of tooth tissues. Hormonal regulation of tooth tissue mineralization processes.</p> <p>Superficial formations on the teeth under normal conditions (cuticle, pellicle) and pathology (plaque and tartar). Biochemical changes in tooth tissues during caries. The value of fluoride for caries and fluorosis. The composition of gingival fluid and its changes in periodontal pathology.</p>	<p><i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-6</i> <i>Sk-7</i> <i>Sk-9</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>GC-6</i> <i>GC-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i> <i>PC-7</i> <i>PC-13</i></p>	According to the time-table
SIW-1	History of biochemistry; development of biochemical	Make a periodic table of stages of development of biochemistry in Ukraine	<p><i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i></p>	According to the time-table

	research in Ukraine.		<i>GC-6</i> <i>GC-7</i>	
SIW-2	Connection of biochemistry with other biomedical sciences. Medical biochemistry. Clinical biochemistry. Biochemical laboratory diagnostics.	Give examples of the relation between biochemistry and other biomedical sciences. List the tasks of medical and clinical biochemistry, as well as laboratory diagnostics	<i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-3	The contribution of scientists of the Department of Biochemistry, Lviv National Medical University in the development of biological chemistry.	To compile a periodic table of development of the Department of Biochemistry and describe the activities of the heads of the department in these periods	<i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-4	Principles of collection and storage of material for laboratory research. Errors in research.	Describe the principles of collecting material for laboratory tests, describe their use for diagnostic purposes. List and systematize mistakes that are allowed for research	<i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-5	Salivary enzymes: their specificity and role.	Make a table of enzymes that are in saliva, indicating their functions and type of specificity	<i>Kn-7</i> <i>Kn-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-6	Levels of structural organization of enzymes. Multienzyme complexes, enzymatic ensembles, multifunctional enzymes, their advantages.	Describe the primary, secondary, tertiary and quaternary structure of enzymes, name the characteristic types of bonds. Define the concepts of multienzyme complexes, enzymatic ensembles, multifunctional enzymes, give examples	<i>Kn-7</i> <i>Kn-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-7	Principles and methods of detecting enzymes in biological objects. Units of activity	Describe the main methods of enzyme detection. Name the main principles of determining the activity of enzymes. Define the concepts of calor, international unit, specific activity, molar activity	<i>Kn-2</i> <i>Kn-8</i> <i>Sk-1</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i>	According to the timetable

	and amount of enzymes.		<i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	
SIW-8	Vitamins as irreplaceable biologically active components necessary for the human body. The history of the discovery of vitamins. Development of vitaminology in Ukraine.	Provide a chronological table of the development of vitaminology in the world and in Ukraine	<i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-9	Causes of exo- and endogenous hypo- and vitamin deficiency.	List the factors that lead to the occurrence of hypovitaminosis, hypervitaminosis, avitaminosis	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-9</i> <i>Sk-2</i> <i>Sk-4</i> <i>Sk-5</i> <i>AR-2</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-3</i> <i>PC-1</i>	According to the timetable
SIW-10	Use of water- and fat-soluble vitamins in dental practice.	Fill in the vitamin application table, indicating the name of the vitamin and the pathochemical process in the oral cavity that it affects	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i> <i>Sk-4</i> <i>Sk-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-11	Provitamins, antivitamin. Mechanism of action and application in practical medicine.	Define the key terms: provitamins and antivitamin. Give examples and describe the mechanism of action.	<i>Kn-1</i> <i>Kn-5</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-4</i> <i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>GC-3</i> <i>GC-7</i> <i>PC-1</i>	According to the timetable
SIW-12	Vitamin-like substances, their	Define the term "vitamin-like substance". Write the structure of	<i>Kn-1</i> <i>Kn-5</i>	According to the time-

	structure and role.	vitamin-like substances, indicate the mechanism of action and the biological role of each	<i>Kn-8</i> <i>Kn-9</i> <i>Sk-1</i> <i>Sk-4</i> <i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>GC-3</i> <i>GC-7</i> <i>PC-1</i>	table
SIW-13	Methods of studying metabolism.	Present a table of subcellular structures isolated under the conditions of fractionation of tissue homogenates by the method of differential centrifugation	<i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i>	According to the timetable
SIW-14	Intracellular localization of metabolic pathways, compartmentalization of metabolic processes in the cell.	Make a table of the location of certain metabolic pathways in cell organelles, indicating the enzymes that provide these pathways.	<i>Kn-2</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-15	The structure of NAD ⁺ and NADPH ⁺ . Their importance in oxidation and reduction reactions. Building of FAD and FMN. Their role in oxidation and reduction reactions.	Write the structural formulas of NAD ⁺ and NADPH ⁺ , FAD, FMN. Specify the oxidized and reduced forms of active structures and explain the mechanism of transfer of reducing equivalents.	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-5</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-4</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-5</i> <i>GC-7</i>	According to the timetable
SIW-16	Hereditary enzymopathies of digestive processes (insufficiency of disaccharidases, violation of membrane	Indicate the relationship between the protein (apoenzyme) and the non-protein part in the composition of dehydrogenases.	<i>Kn-3</i> <i>Kn-4</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-9</i> <i>AR-1</i> <i>AR-5</i> <i>GC-6</i>	According to the timetable

	transport of hexoses, absorption of glucose and galactose).		<i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	
SIW-17	The Pasteur effect.	Give examples of metabolic processes in which they participate.	<i>Kn-2</i> <i>Kn-8</i> <i>Sk-1</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the time-table
SIW-18	Glucose-alanine cycle.	Introduce a diagram of the glucose-alanine cycle with a description of the principle of its operation	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-8</i> <i>Kn-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the time-table
SIW-19	Pentose phosphate pathway of glucose oxidation: process reaction scheme	Present the scheme of the pentose phosphate pathway of glucose use in the human body (describe the oxidation stage and the stage of isomeric transformations with the indication of metabolites and enzymes). Specify the biological significance of the pentose phosphate pathway of glucose use in the human body. Hereditary deficiency of glucose-6-phosphate dehydrogenase. Describe the clinical manifestations of enzymopathy and describe the biochemical causes of their occurrence.	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i> <i>PC-3</i>	According to the time-table
SIW-20	The role of adrenaline, glucagon and insulin in the hormonal regulation of glycogen metabolism in muscles	Make a table of the mechanisms of action of these hormones on specific enzymes of glycogen metabolism	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-8</i> <i>Kn-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the time-table
SIW-	Characteristics of	Define concepts, describe the reasons	<i>Kn-2</i>	According

21	normo-, hyper-, hypoglycemia and glucosuria, causes of their occurrence.	for their occurrence	<i>Kn-3</i> <i>Kn-4</i> <i>Sk-1</i> <i>Sk-2</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	to the timetable
SIW-22	Biological functions of simple and complex lipids in the human body (spare, energy, participation in thermoregulation, biosynthetic).	Describe the functions of lipids, indicate which compounds are provided.	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-8</i> <i>Kn-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-23	Participation of lipids in the construction and functioning of biological membranes of cells. Liquid-mosaic model of biomembranes.	Recreate the classification of lipids.	<i>Kn-7</i> <i>Kn-8</i> <i>Sk-3</i> <i>Sk-7</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>GC-1</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-24	Disorders of lipid digestion in the digestive tract (steatorrhea, its types).	Schematically characterize the biological functions of simple and complex lipids in the human body. To characterize the structural organization of biomembranes, to schematically depict the liquid-mosaic structure of the membrane. Describe the main functions of membranes.	<i>Kn-3</i> <i>Kn-4</i> <i>Sk-2</i> <i>Sk-3</i> <i>Sk-5</i> <i>Sk-9</i> <i>AR-1</i> <i>AR-5</i> <i>GC-1</i> <i>GC-6</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	According to the timetable
SIW-25	Liposomes, their structure and vectors of use in medicine.	Describe the structure of liposomes, explain their vector action in the process of use	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-5</i> <i>Kn-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i>	According to the timetable

			AR-5 GC-6 GC-7	
SIW-26	Lysosomal diseases: causes, clinical and biochemical characteristics.	Make a table of lysosomal diseases, indicating the name, enzyme and clinical manifestations.	Kn-3 Kn-4 AR-1 AR-2 AR-4 AR-5 GC-6 GC-7	According to the time-table
SIW-27	Pathological processes of lipid metabolism that lead to the development of obesity.	Describe the causes, clinical and biochemical characteristics of obesity.	Kn-3 Kn-4 AR-1 AR-2 AR-4 AR-5 GC-6 GC-7	According to the time-table
SIW-28	Disorders of lipid metabolism in diabetes.	To define the term "diabetes mellitus", to name the causes of lipid metabolism disorders in diabetes mellitus and their manifestations.	Kn-3 Kn-4 AR-2 AR-4 AR-5 GC-6 GC-7 PC-1 PC-2 PC-3	According to the time-table
SIW-29	Formation mechanism and role of hydrochloric acid. Acidity of gastric juice and forms of its expression. Quantitative indicators in normality and pathology by the pH-metry method. Mechanisms of stimulation of release of hydrochloric acid.	Show the chemistry of the reactions of the formation of hydrochloric acid, indicate the enzymes. Describe the types of acidity, its quantitative indicators. Name the drugs that are used to stimulate the release of hydrochloric acid	Kn-6 Kn-8 Sk-4 Sk-6 Sk-9 AR-1 AR-2 AR-4 AR-5 GC-6 GC-7 PC-1 PC-2 PC-3	According to the time-table
SIW-30	Decay of proteins in the large intestine.	Define the concept of "decay of proteins in the large intestine". Write reactions for the formation of indole, skatole, cresol, putrescine, cadaverine.	Kn-1 Kn-2 Kn-3 Sk-3 AR-1 AR-2 AR-5 GC-1	According to the time-table

			<i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i> <i>PC-2</i>	
SIW-31	Transaminases. Localization of transaminases in organs and tissues. Clinical and diagnostic value of determining the activity of transaminases.	Describe transaminases, indicating the name, function, localization in the organs. Describe the clinical and diagnostic value based on the determination of the de Ritis coefficient	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-32	Genetic defects of enzymes (enzymopathy) of urea synthesis.	In the form of a table to describe the genetic defects of the ornithine cycle, indicating the name of the pathology, enzyme, clinical and biochemical characteristics	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-8</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-33	The role of tetrahydrofolate (H ⁴ -folate) in the transfer of single-carbon fragments, dihydrofolate reductase inhibitors as antitumor agents.	Write the chemistry of reactions, describe the role of tetrahydrofolate, explain the mechanism of action of dihydrofolate reductase and the effect of inhibitors on it. Name them.	<i>Kn-8</i> <i>Kn-9</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-34	Participation of coenzyme forms of vitamin B ₁₂ in amino acid metabolism.	Give the chemistry of reactions, indicate the role of vitamin B ₁₂	<i>Kn-8</i> <i>Kn-9</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-35	Clinical and biochemical significance of creatine and creatine phosphate metabolism disorders.	Give the chemistry of the formation reactions, indicate the pathochemical changes in violation of the formation of creatine and creatine phosphate	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-8</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i>	According to the timetable

			<i>GC-6</i> <i>GC-7</i>	
SIW-36	Orotaciduria: causes, types, clinical and biochemical characteristics.	Define the concept, indicate the causes of orotaciduria type 1 and 2, clinical manifestations and pathochemical changes	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-8</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-37	Inhibitors of transcription and translation in prokaryotes and eukaryotes: antibiotics and interferons - their use in medicine; diphtheria toxin.	In the form of a table to give a description of antibiotics, indicating the name and the specific process that is inhibited. Describe interferons and diphtheria toxin, indicating the origin and mechanism of action	<i>Kn-5</i> <i>Kn-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-38	Gene (point) mutations: role in the occurrence of enzymopathies and hereditary human diseases. Biochemical mechanisms of action of chemical mutagens.	Describe the role of point mutations in the occurrence of enzymopathies. Give examples of such pathologies. Give examples of chemical mutagens	<i>Kn-3</i> <i>Kn-4</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-39	The reaction of target cells to the action of hormones. Membrane (ionotropic, metabotropic) and cytosolic receptors.	Define the concept of hormone and target cell Describe the features of the structure and localization of membrane and cytosolic receptors	<i>Kn-2</i> <i>Kn-10</i> <i>Sk-1</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-40	Aspirin and other nonsteroidal anti-inflammatory drugs as inhibitors of prostaglandin synthesis.	To give the mechanism of influence of aspirin on formation of proinflammatory postaglandins. Give examples of other NSAIDs	<i>Kn-3</i> <i>Kn-5</i> <i>Kn-6</i> <i>Sk-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable

SIW-41	Blood plasma enzymes: importance in enzymatic diagnosis of diseases of organs and tissues.	Fill in the table, indicating the pathological processes and enzymes that can be used to diagnose	<i>Kn-9</i> <i>Kn-10</i> <i>Sk-2</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-42	Immunoglobulins : structure, biological functions, mechanisms of regulation of immunoglobulin synthesis. Biochemical characteristics of certain classes of human immunoglobulins.	Fill a table indicating the structure of , biological functions, mechanisms of regulation of the synthesis of antibodies , their localization.	<i>Kn-2</i> <i>Sk-1</i> <i>Sk-7</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-43	Biochemical mechanisms of urinary renal function (filtration, reabsorption, secretion and excretion).	Describe in detail the stages of urine formation, indicating the location of each	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-4</i> <i>Kn-7</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-44	Physico-chemical properties of urine: quantity, color, odor, transparency, reaction (pH), its dependence on the composition of food.	Describe the quantity, color, odor, clarity, reaction (pH) of urine, its dependence on the food	<i>Kn-4</i> <i>Sk-2</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable

SIW-45	Bone tissue response to dental implants.	Describe the stages of bone changes in response to dental implants	<i>Kn-4</i> <i>Sk-1</i> <i>Sk-5</i> <i>Sk-7</i> <i>Sk-8</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-46	Protective mechanisms of saliva when smoking.	Describe the protective mechanisms that occur in the oral cavity during smoking and in chronic smokers	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-47	The value of fluoride for caries and fluorosis.	Describe the mechanism of caries under conditions of insufficient fluoride intake and the mechanism of fluorosis under conditions of excess fluoride. Submit the chemistry of the reactions	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-10</i> <i>Sk-5</i> <i>Sk-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>C-6</i> <i>C-7</i>	According to the timetable
SIW-48	Myofibril proteins: myosin, actin, tropomyosin, troponin. Molecular organization of thick and thin filaments of muscle tissue.	Fill in the table. Giving a comparative description of thick and thin filaments of muscle tissue.	<i>Kn-1</i> <i>Sk-1</i> <i>Sk-7</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-49	Muscle extractives, nitrogenous and non-nitrogenous, their chemical nature and role.	To characterize the extractive substances of muscles, nitrogenous and non-nitrogenous, their chemical nature and significance. Write the structure of anserine and carnosine, indicate their role.	<i>Kn-1</i> <i>Kn-2</i> <i>Sk-1</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>Ar-6</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i>	According to the timetable

			<i>GC-6</i> <i>GC-7</i>	
SIW-50	Molecular mechanisms of muscle contraction: modern ideas about the interaction of muscle filaments. The role of Ca ²⁺ ions in the regulation of contraction and relaxation of skeletal and smooth muscles.	Schematically depict and describe the molecular mechanisms of skeletal and smooth muscle fiber contraction. Explain the role of Ca ²⁺ ions in the regulation of the contraction-relaxation process.	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-51	Bioenergetics of muscle tissue. Macroergic compounds of muscles. Structure, formation and role of ATP, creatine phosphate, creatine phosphokinase, sources of ATP in muscles; the role of creatine phosphate in providing energy for muscle contraction.	Draw the structural formula of ATP, describe the mechanisms of ATP formation in muscles and its role in the bioenergetics of muscle tissue. Draw the structural formula of creatine phosphate, write the creatine kinase reaction and explain their role in the bioenergetics of muscle tissue. Explain the peculiarities of bioenergetic processes in the myocardium.	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-52	Biochemical changes in muscles during pathology.	Explain the biochemical changes in the heart muscle during myocardial infarction. Describe biochemical changes in muscles in myopathies, muscular dystrophies and metabolic disorders in skeletal muscles during aging.	<i>Kn-3</i> <i>Kn-4</i> <i>Kn-8</i> <i>Kn-9</i> <i>Sk-2</i> <i>Sk-5</i> <i>Sk-8</i> <i>Sk-9</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i>	According to the timetable

			<i>GC-6</i> <i>GC-7</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	
SIW-53	<p>Features of the biochemical composition and metabolism of the brain: chemical composition of the brain, neurospecific proteins and lipids (gangliosides, cerebroside, cholesterol), features of the amino acid composition of the brain, the role of the glutamic acid system.</p>	<p>Describe the chemical composition of the brain. Describe neurospecific proteins (neuroalbumins, neuroglobulins, neuroscleroproteins, etc.) and lipids (gangliosides, cerebroside, cholesterol). To describe the amino acid composition of the brain; the role of the glutamic acid system; GABA - shunt.</p>	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-8</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-54	<p>Energy exchange in the human brain.</p>	<p>Explain the meaning of aerobic oxidation of glucose; to describe the changes in energy metabolism in the conditions of physiological sleep and anesthesia.</p>	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the timetable
SIW-55	<p>Biochemistry of neurotransmitters (acetylcholine, norepinephrine, dopamine, serotonin, excitatory and inhibitory amino acids), their role in the transmission of nerve impulses and memory</p>	<p>Give the characteristics and biological role of each neurotransmitter. Name the excitatory and inhibitory amino acids and explain their role in the transmission of nerve impulses. Describe receptors for neurotransmitters and physiologically active compounds. 8.1. Describe the molecular organization and functioning of receptors for the neurotransmitters acetylcholine, serotonin, dopamine, norepinephrine, and amino acids</p>	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i>	According to the timetable

	regulation.	(excitatory and inhibitory).	<i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	
SIW-56	Receptors for neurotransmitters and physiologically active compounds.	Describe the molecular organization and functioning of receptors for the neurotransmitters acetylcholine, serotonin, dopamine, norepinephrine, and amino acids (excitatory and inhibitory).	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the time-table
SIW-57	Peptidergic system of the brain.	Name the representatives of opioid peptides, indicate the immediate predecessors, give the functional characteristics of enkephalins, endorphins, dynorphins.	<i>Kn-1</i> <i>Kn-7</i> <i>Kn-8</i> <i>Kn-10</i> <i>Sk-1</i> <i>Sk-7</i> <i>Sk-10</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-1</i> <i>GC-2</i> <i>GC-4</i> <i>GC-5</i> <i>GC-6</i> <i>GC-7</i>	According to the time-table
SIW-58	Disruption of the exchange of brain mediators and modulators in mental disorders.	List the receptors of opioid peptides and indicate the biochemical mechanisms of their functioning.	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Sk-2</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>GC-6</i> <i>GC-7</i> <i>PC-2</i>	According to the time-table
SIW-58	Biochemical mechanisms underlying human neuropsychiatric	Describe the clinical and biochemical characteristics of alcoholism, drug addicts, Alzheimer's disease, multiplesclerosis, Parkinson's disease,	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Sk-2</i>	According to the time-table

	diseases (alcoholism, drug addiction, Alzheimer's disease, multiple sclerosis, Parkinson's disease, epilepsy).	epilepsy. Submit in the form of a table, indicating the name of the pathology, pathochemical causes, manifestations	Sk-5 AR-1 AR-2 AR-4 AR-5 GC-6 GC-7 PC-2	
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It is necessary to provide the system of the classes organization, the use of interactive methods, educational technologies that are used for the transfer of knowledge and skills.

8. Verification of learning results

Current control

is carried out during training sessions and aims to check the assimilation of students of educational material (it is necessary to describe the forms of current control during training sessions). Forms of assessment of current educational activities should be standardized and include control of theoretical and practical training. The final grade for the current educational activity is set on a 4-point (national) scale.

Code of the learning result	Code of the learning result	Code of the learning result	Code of the learning result
Kn-1 Kn-2 Kn-3 Kn-4 Kn-5 Kn-6 Kn-7 Kn-8 Kn-9 Kn-10 Sk-1 Sk-2 Sk-3 Sk-4 Sk-5 Sk-6 Sk-7 Sk-10 A B -1	L-1, L-2, L-3, L-4, L-5, L-6, L-7, L-8, L-9, L-10	<p>Types of educational activities of students are:</p> <p>a) lectures b) practical classes c) individual work of students (SIW)</p> <p>Thematic plans of lectures, practical classes, SIW ensure the implementation in the educational process of all topics included in the content of the program.</p> <p>The lecture course consists of 8 lectures. The topics of the lecture course reveal the problematic issues of the relevant sections of medical biology and parasitology. During the lectures, the students formed the theoretical basic knowledge will ensure there is a motivational component of general and tentative stage mastering scientific knowledge during independent work. In the lecture course maximum used various teaching tools – multimedia presentations,</p>	<p>A grade of "excellent" is given to a student who took an active part in discussing the most difficult questions on the topic of the lesson, gave at least 19-20 correct answers to standardized test tasks, answered written tasks without errors, completed practical work and drew up a protocol.</p> <p>A grade of "good" is given to a student who took part in the discussion of the most difficult questions on the topic, gave at least 17-18 correct answers to standardized test tasks, made some minor mistakes in answering written tasks, did practical work and drew up a protocol.</p> <p>A student who did not participate in the discussion of the most</p>

AR-2 GC-1 GC-2 GC-3 Kn-1 Kn-2 Kn-3 Kn-4 Kn-5 Kn-6 Kn-7 Kn-8 Kn-9 Kn-10 Sk-1 Sk-2 Sk-3 Sk-4 Sk-5 Sk-6 Sk-7 Sk-8 Sk-9 Sk-10 AR-1 AR-2 AR-3 AR-4 AR-5 AR-6 GC-1 GC-2 GC-3 GC-6 GC-7 GC-9 GC-10 GC-11 GC-13 PC-1 PC-2 PC-3	P-1, P-2, P-3, P-4, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28, P-29, P-30, P-31, P-32, P-33, P-34, P-35	video lectures, educational films, slides. Practical classes are aimed at controlling the assimilation of theoretical material, the formation of practical skills and abilities, as well as the ability to analyze and apply the acquired knowledge to solve practical problems. Each session begins with a test control (20 tests) to assess baseline knowledge and determination with tupenya readiness of students to classes. The teacher determines the purpose of the lesson and creates a positive cognitive motivation; answers questions from students that arose during the VTS on the topic of the lesson. The main stage of the lesson is to perform practical work. At the final stage of the lesson in order to assess the student's mastery of the topic he is asked to answer three theoretical questions. The teacher sums up the lesson gives students tasks for independent work, indicating the main issues the next topic and offers a list of recommended literature. The duration of the practical lesson is 2 academic hours.	difficult questions on the topic, gave at least 14-16 correct answers to standardized test tasks, made significant mistakes in answering written tasks, performed practical work and drew up a protocol received a grade of "satisfactory". A grade of "unsatisfactory" is given to a student who did not participate in the discussion of the most difficult questions on the topic, gave less than 14 correct answers to standardized test tasks, made gross mistakes in answering written tasks or did not answer them at all, did not do practical work and without drawing up a protocol.
Final control			
General evaluation system	Participation in the work during the semester / exam - 60% / 40% on a 200-point scale		
Rating scales	traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale		
Conditions of admission to the final control	All types of work provided by the curriculum must be completed and all topics submitted for current control must be included . The student has received at least 72 point s on current progress		
Type of final control	Exam		Enrollment criteria
Examination	The form of the exam is		The maximum number

	standardized and includes control of theoretical and practical training.	of points is 80. The minimum number of points is 50
Exam evaluation criteria		
Exam	<p>1. written answers to 40 standard test tasks, each of which has one correct answer out of five proposed (format A). 40 minutes are allocated for writing the test control (at the rate of 1 test for 1 min);</p> <p>2. written standardized answers to 5 problems in the form of chains of transformations of bioorganic compounds, the list of certain biochemical indicators, the filled tables, drawing up of schemes, writing of equations of chemical reactions (1 - 4 questions); description of the principles of methods and clinical and diagnostic value of determining biochemical parameters (5 questions). The duration of the exam is 95 minutes.</p>	<p>Criteria for evaluating test tasks: Less than 25 MCQs - "unsatisfactory"; 25 - 30 MCQs - "satisfactory"; 31 - 36 MCQs - "good"; 37 - 40 MCQs - "excellent". The correct answer to 1 test is 1 point. The minimum number of points for 40 tests is 25 points. The maximum number of points for 40 MCQs is 40 points.</p> <p>Criteria for evaluating theoretical tasks: Each of the five theoretical tasks is evaluated from 6 to 8 points: Less than 5 points - "unsatisfactory" - the student made gross mistakes in answering written tasks or did not give answers to them at all; 5 points - "satisfactory" - the student made significant mistakes in answering written theoretical tasks (including practical skills); 7 points - "good" - the student made some minor mistakes in answering written theoretical tasks (including practical skills), or did not fully substantiate them; 8 points - "excellent" - the student has</p>

		<p>comprehensively and deeply mastered the curriculum; has full theoretical knowledge and practical skills.</p> <p>The minimum number of points for 5 theoretical questions is 25 points.</p> <p>The maximum number of points for 5 theoretical questions is 40 points.</p> <p>The maximum number of points that a student can score when taking the exam is 80.</p> <p>The minimum number of points in the exam - not less than 50.</p>
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The maximum number of points that a student can score for the current academic activity for admission to the exam is 120 points.

The minimum number of points that a student must score for the current academic activity for admission to the exam is 72 points.

The calculation of the number of points is based on the grades obtained by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted into points on a multi-point scale as follows:

Recalculation of the average grade for current activity in a multi-point scale for disciplines culminating in the exam

4-point scale	200 point scale	4.95	119	4.79	115	4.62	111
		4.91	118	4.75	114	4.58	110
		4.87	117	4.7	113	4.54	109
5	120	4.83	116	4.66	112	4.5	108
4.45	107	3.95	95	3.58	86	3.2	77
4.29	103	3.91	94	3.41	82	3.04	73
4.12	99	3.74	90	3.37	81	3.0	72

Students' individual work is assessed during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is controlled during the final control.

The grade for the discipline that ends with the exam is defined as the sum of the points for current educational activity (not less than 72) and points for the exam (not less than 50).

Points from the discipline are independently converted into both the ECTS scale and the 4-point (national) scale. ECTS scale scores are not converted to a 4-point scale and vice versa.

The scores of students studying in one specialty, taking into account the number of points earned in the discipline are ranked on the ECTS scale as follows:

ECTS assessment	Statistical indicator
A	The best 10% of students
B	The next 25% of students
C	The next 30% of students
D	The next 25% of students
E	The last 10% of students

Ranking with assignments of grades "A", "B", "C", "D", "E" is carried out for students of this course who study in one specialty and have successfully completed the study of the discipline.

Discipline scores for students who have successfully completed the program are converted into a traditional 4-point scale according to the absolute criteria, which are given in the table below:

Points in the discipline	Score on a 4-point scale
From 170 to 200 points	5
From 140 to 169 points	4
From 139 points to the minimum number of points that a student must score	3
Below the minimum number of points that a student must score	2

The ECTS score is not converted to the traditional scale, as the ECTS scale and the four-point scale are independent.

The objectivity of the assessment of students' learning activities is checked by statistical methods (correlation coefficient between ECTS assessment and assessment on a national scale).

**Criteria for assessing the objective structured practical (clinical) exam /
Complex of practice-oriented exam
Master's thesis**

9. Course policy

The policy of the course is determined by the system of requirements for the student in the study of the discipline "Biological Chemistry" and is based on the principles of academic integrity. Students are explained the value of acquiring new knowledge, the need for independent performance of all types of work, tasks provided by the work program of this discipline. Lack of references to used sources, fabrication of sources, writing off, interference in the work of other students are examples of possible academic dishonesty. Detection of signs of academic dishonesty in the student's work is the basis for its non-enrollment by the teacher, regardless of the extent of plagiarism or deception. Literary sources may be provided by the teacher exclusively for educational purposes without the right to transfer to third parties. Students are encouraged to use other literature sources not provided by the recommended list.

10. Literature

Mandatory

Main:

1. Gubsky Yu. Bioorganic and biological chemistry. Book 2. Biological chemistry. Second edition.

Medicine 2021. 500 p.

2. Harper's Illustrated Biochemistry 30th edition / V. W. Rodwell et al.; NY: McGraw-Hill Education, 2015. 817 p.
3. Satyanarayana U., Chakrapani U. Biochemistry. Fifth edition, N.Delhy: Elsevier, co-published with Book and Allied, 2017. 788 p.
4. Gubsky Yu. Biological Chemistry. Nova Knyha, Vinnytsia, 2017. 487 p.
5. Lippincott Illustrated Reviews: Biochemistry. Denise R. Ferrier. Seventh edition. Wolters Kluwer, 2017. 2224 p.
6. MCQs in biochemistry 2nd edition / A. Ya. Sklyarov et al.: Lviv: Danylo Halytsky Lviv National Medical University Press, 2020. 319 p.
7. MCQs in biochemistry / A. Ya. Sklyarov et al.: Lviv: Danylo Halytsky Lviv National Medical University Press, 2012. 308 p.

Optional:

1. Textbook of Biochemistry for Medical Students by Vasudevan D.M., Sreekumari S., Kannan Vaidyanathan. Seventh edition. Jaypee Brothers Medical Pub, 2013. 791 p.
2. Chatterjea M.N., Rana Shinde. Textbook of Medical Biochemistry. Eighth edition. Jaypee Brothers Medical Pub, 2012. 894 p.
3. Nelson D.L., Cox M.M. Lehninger Principles of Biochemistry. Seventh edition. W.H. Freeman and Company, New York, 2017. 1328 p.
4. Trudy McKee, James R. McKee. Biochemistry. The molecular basis of life. Sixth edition. Oxford University Press, 2015. 928 p.
5. Peter Ronner. Netter's Essential Biochemistry. Elsevier, 2018. 482 p.

Information resources:

1. Centre of testing – base of licenced test tasks Krock-1 <http://testcentr.org.ua/>

1. Equipment, material and technical supply

Methodical supply:

1. Working educational program of the discipline;
 2. Multimedia lectures supply;
 3. Lectures theses;
 4. Methodical recommendations for the lecturers;
 5. Educational platform Misa;
 6. Study guides;
 7. Methodical guides to the practical classes for students;
 8. Methodical instruction for the students independent work;
 9. Test and control tasks to practical classes;
 10. Questions and tasks for the summary control (exam);
- Laboratory equipment (PEC, SP, centrifuges, laboratory utensils, biochemical analyzers)

Information resource - <http://misa.meduniv.lviv.ua/>

Testing center - database of licensed test tasks Step– 1 <http://testcentr.org.ua>

12. Additional information

Responsible for the educational work with foreign students – Prof. Iryna Fomenko

Practical classes and lectures are delivered in the Department classrooms at the address: Lviv, 54, Pekarska Street, Chemical building, ground floor.

Web-site of the Department - e-mail: Kaf_biochemistry@meduniv.lviv.ua

Syllabus elaborator

Kobylinska L.I., PhD, Dr.Sci., professor

(Signature)

Head of the Department

Lesya Kobylinska, PhD, DrSci, professor

(Signature)