


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, 222 Medicine, second (master's) level of the higher education, daily form
Academic year	2021-2022
Name of the discipline, code (<i>electronic address is on the website of the Danylo Halysky Lviv National Medical University</i>)	Biological chemistry Code OK 12 https://new.meduniv.lviv.ua/kafedry/kafedra-biologicchnoyi-himiyi/
Department (<i>name, address, tel, e-mail</i>)	Department of Biological Chemistry 79010, Lviv, 69, Pekarska Street tel. +38 (032) 275 76 02 Kaf_biochemistry@meduniv.lviv.ua
Head of the Department (<i>e-mail</i>)	Olexandr Sklyarov, MD, PhD, Dr. med. Sci., professor O.Y.Sklyarov@gmail.com
Year of training (when the discipline is taught)	Second year of training (2)
Semester (when the discipline is taught)	III-IV
Type	Mandatory
Staff (<i>names, scholar degrees, e-mail</i>)	Olexandr Sklyarov, MD, PhD, Dr. med. Sci. O.Y.Sklyarov@gmail.com Iryna Fomenko, PhD, Dr. biol. Sci., professor irynafomenkolviv@gmail.com Lesya Kobylinska, PhD, Dr. biol. Sci., associate professor Christina Nasadyuk, MD, PhD, associate professor nasadyukch@gmail.com Natalya Denysenko, PhD, assistant professor denysenko.natalka@gmail.com Iryna Lozynska, PhD, assistant professor ira9ilkiv@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)	PhD, Assoc. Prof. Bondarchuk T.I. tbondarchuk@meta.ua
Number of ECTS credits	5
Number of hours (<i>lectures/practical classes/students independent work</i>)	Total 150 h (20 lectures / 70 practical classes / 60 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

General characteristics, short course description, peculiarities, advantages

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 of the discipline "Biological Chemistry" is the chemical composition of living organisms (human body) and biochemical transformations to which the molecules that are part of them are subject. Biological chemistry is based on the study by students of medical biology, biophysics, medical chemistry (bioorganic, bioinorganic, physical and colloid chemistry), morphological disciplines and is 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 integrates teaching with these disciplines and the formation of skills to apply knowledge of biological and bioorganic chemistry, especially biochemical processes. the body of a healthy and sick person, in the process of further training and professional activities; lays the foundations for clinical diagnosis of the most common diseases, monitoring the course of the disease, monitoring the effectiveness of drugs 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*):

GC 1. - Ability to abstract thinking, analysis and synthesis.

GC 2.- Knowledge and understanding of the subject area and understanding of professional activity.

GC 3. - Ability to apply knowledge in practice.

GC 4. - Skills in the use of information and communication technologies.

GC 5. - Ability to search, process and analyze information from various sources

GC 6. - Ability to identify, pose and solve problems.

GC 7. - Ability to be critical and self-critical.

GC 8. - Ability to work in a team.

GC 9. - Ability to act socially responsibly and consciously.

Program results of learning:

PRL 1. - Ability to collect medical information about the patient and analyze clinical data.

PRL 2. - Ability to interpret the results of laboratory and instrumental research.

PRL 3. - Ability to diagnose: determine the preliminary, clinical, final, concomitant diagnosis, emergencies.

PRL 4. - **The** ability to determine the rational mode of work, rest, diet in patients in the treatment of diseases of organs and tissues of the oral cavity and maxillofacial region.

PRL 5. - Ability to determine the tactics of management of patients with diseases of organs and tissues of the oral cavity and maxillofacial region with concomitant somatic diseases.

PRL 6. - Ability to assess the impact of the environment on the health of the population (individual, family, population).

PRL 7. - Processing of state, social and medical information.

4. Prerequisites of the course

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	<i>PL-3</i>

	functional properties and metabolic transformations in the body.	
<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>C-1</i>	Ability to abstract thinking, analysis and synthesis.	
<i>C-2</i>	Knowledge and understanding of the subject area and understanding of professional activity.	
<i>C-3</i>	Ability to apply knowledge in practice.	
<i>C-6</i>	Skills in the use of information and communication technologies.	
<i>C-7</i>	Ability to search, process and analyze information from various sources.	
<i>C-9</i>	Ability to identify, pose and solve problems.	
<i>C-10</i>	The ability to be critical and self-critical.	

<i>C-11</i>	Ability to work in a team.	
<i>C-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>	Ability to interpret the results of laboratory and instrumental research.	
<i>PC-3</i>	Ability to diagnose: determine the preliminary, clinical, final, concomitant diagnosis, emergencies.	
<i>PC-6</i>	Ability to determine the rational mode of work, rest, diet in patients in the treatment of diseases of organs and tissues of the oral cavity and maxillofacial region.	
<i>PC-7</i>	Ability to determine the tactics of management of patients with diseases of organs and tissues of the oral cavity and maxillofacial region with concomitant somatic diseases.	
<i>PC-13</i>	Ability to assess the impact of the environment on the health of the population (individual, family, population).	
<i>PC-15</i>	Processing of state, social and medical information.	

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	20	9
practical	70	9
seminars	-	
individual student work	60	9

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>C-1</i> <i>C-6</i>	Prof. Fomenko I.S.
L-2	Molecular basis of bioenergetics:	Metabolism (metabolism). Cycle of tricarboxylic acids (CTC). Types of	<i>Kn-1</i> <i>Kn-3</i>	Prof. Fomenko

	enzymes of biological oxidation; molecular organization of electron transport in mitochondria.	biological oxidation reactions; their biological significance. Tissue respiration. Definition, localization in the cell. Respiratory chain of mitochondria. Chemiosmotic theory of oxidative phosphorylation. Electron transport inhibitors and oxidative phosphorylation disconnectors.	<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>C-1</i> <i>C-6</i>	I.S.
L-3	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>C-1</i> <i>C-6</i>	Prof. Fomenko I.S.
L-4	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 process of oxidation and synthesis of fatty acids, pathological processes - obesity, steatosis, atherosclerosis, hyper	<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>AB-1</i> <i>AR-2</i> <i>C-1</i> <i>C-6</i>	Assoc. Prof. Kobylinska L.I.
L-5	Metabolism of amino acids. General pathways of amino acid turnover. Metabolism of ammonia: urea synthesis and its disorders. Hereditary enzymopathias of distinct amino acids.	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> <i>Kn-10</i> <i>Sk-3</i> <i>Sk-5</i> <i>AR-1</i> <i>AR-2</i> <i>C-1</i> <i>C-6</i>	Assoc. Prof. Nasadyuk C.M.

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>C-1</i> <i>C-6</i>	Prof. O.Y. Sklyarov
L-7	Functional role of water- and fat-soluble vitamins in metabolic pathways.	To characterize the digestion and absorption of proteins, carbohydrates and lipids in the digestive tract, to characterize different classifications of vitamins, the effects of each vitamin on metabolic processes in the human body, to acquaint students with pathological processes arising from excess or deficiency of certain vitamins in humans.	<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>C-1</i>	Prof. O.Y. Sklyarov
L-8	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>C-1</i> <i>C-6</i>	Prof. Fomenko I.S.
L-9	Biochemical functions of liver. Biochemistry of jaundices; biotransformation of foreign substances in liver.	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. Clean chemistry reactions con ' yuhatsiyi 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> <i>Sk-6</i> <i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>C-1</i> <i>C-6</i>	Assoc. Prof. Kobylinska L.I.
L-10	Biochemistry of tooth. Amelogenesis	Describe the features of the structure of connective tissue, types of collagen and non-collagenous proteins, the mechanism of synthesis and breakdown of collagen. Describe the	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Sk-1</i> <i>Sk-7</i>	Assoc. Prof. Nasadyuk C.M.

		features of the structure and metabolism of glycosaminoglycans of connective tissue. To acquaint students with collagenosis and mucopolysaccharidosis.	<i>AR-1</i> <i>AR-2</i> <i>AR-5</i> <i>C-1</i> <i>C-6</i>	
P-1	Objectives and assignments of biochemistry. Aims and methods of biochemical investigations.	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 Biochem - mia. Biochemical laboratory diagnostics. Structural and functional components of cells, their biochemical functions. Classes of biomolecules. Their hierarchy and origin. Basic and methods of biochemical research.	<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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-11</i>	According to the time-table
P-2	Physico-chemical properties and structure of enzymes-proteins. Classification of enzymes	Enzymes as biological catalysts rehovyn. Fyzyko exchange reactions and chemical properties of proteins, enzymes, verhnevyy in charge of the molecule, solution-ness, the thermodynamic stability of protein molecules, enzymes, sediment - TION, denaturation, interaction with ligands and its functional values-tion. Simple and complex proteins-enzymes, prosthetic groups of complex proteins-enzymes (cofactors, coenzymes). The structure of enzymes: active regulator (aloste - Hexadecimal) centers. Levels of structural organization of enzymes. Multyfer - mentni complexes, enzyme ensembles, multifunctional Farms - ls their advantage. Nomenclature and classification of enzymes. Types of reactions that catalyze certain classes of enzymes.	<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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i>	According to the time-table
P-3	Study of mechanisms and kinetics of enzymatic reactions	Mechanism of action and kinetics of enzymatic reactions: dependence of reaction rate on temperature, pH of medium, substrate concentration. Specificity of enzyme action. Intracellular localization of enzymes, tissue (organ) specificity of	<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>	According to the time-table

		enzymes. Salivary enzymes. Isoenzymes, multiple molecular forms of enzymes. Principles and methods of enzyme detection in biological objects. Units assay and the number of enzymes.	<i>AR-6</i> <i>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i>	
P-4	The role of cofactors, vitamins and their coenzyme forms in enzyme catalysis	Classification of coenzymes by chemical nature and type of reaction they catalyze. Coenzymes - carriers of hydrogen atoms and electrons (consider specific reactions): NAD ⁺ , NADP ⁺ - coenzymes - derivatives of vitamin PP (nicotinamide), FAD, FMN - coenzymes - derivatives of vitamin B ₂ (riboflavin), vitamin C role in redox reactions metaloporfiryny. Kofer - cops - carriers of chemical groups (consider specific reaction), pyridoxal kofermen - thou HS-CoA - acylation coenzyme, lipoic acid, THFK - derivatives of folic acid. Kofer - cops isomerization, synthesis and cleavage of C - C bonds (consider specific reaction): tiamindyfosfat - a derivative of vitamin B ₁ , carboxy - biotin - biologically active form of vitamin H, metylkobalamin and death - oksyadenozylkobalamin - derivatives of vitamin B ₁₂ .	<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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i>	According to the time-table
P-5	Regulation of enzymatic reactions and mechanisms of enzymopathias appearance. Medical enzymology	Enzyme activators and inhibitors: examples and mechanisms of their action. Types of enzyme inhibition: reversible (competitive, non-competitive) and irreversible. Regulation of enzymatic processes. Ways and mechanisms of regulation: allosteric enzymes, covalent modification of enzymes, proteolytic activation of enzymes (limited proteolysis). Cyclic nucleotides (cAMP, cGMP) as regulators of enzymatic reactions and biological functions of the cell. Enzymopathy - congenital (hereditary) defects in the metabolism of carbohydrates, amino acids, porphyrins, purines. Enzymodiagnosics of pathological processes and diseases. Enzymotherapy - use of enzymes, their activators and inhibitors	<i>Kn-2</i> <i>Kn-4</i> <i>Kn-8</i> <i>Kn-9</i> <i>Kn-10</i> <i>Sk-2</i> <i>Sk-5</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>AR-6</i> <i>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-11</i> <i>PC-2</i>	According to the time-table

		in medicine.		
P-6	Metabolic pathways and bioenergetics. Tricarboxylic acid cycle and its regulation and energetic balance	<p>The concept of metabolism and energy. Characteristics katabo - been visible, and amfibolichnyh anabolic metabolic pathways and their significance.</p> <p>Exergonic and endergonic biochemical reactions; the role of ATP and other macroergic phosphates in their conjugation.</p> <p>Intracellular Loka - ation metabolic pathways kompartmen - tion of metabolic processes in the cell. The purpose - di studying metabolism. Catabolic metabolic pathways of biomolecules: proteins, carbohydrates, lipids, their characteristics.</p> <p>Citric acid cycle (intra - cellular localization of enzymes CCTV, CCTV sequence of reactions; characterization of enzymes and nucleotides CTC, substrate phosphorylation reaction to CCTV, the impact of allosteric modulators on the regulation of CCTV, energy balance Citric acid cycle).</p> <p>Anaplerotic and amphibolic reactions of CTC.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i></p>	According to the time-table
P-7	Molecular basis of bioenergetics: enzymes of biological oxidation, molecular organization of respiratory chain in mitochondria. Biological oxidation and mechanisms of ATP synthesis	<p>Biological oxidation reactions; types of reactions (dehydrogenase, oxidase, oxygenase) and their biological significance. Tissue respiration. Feathers - dinza - dependent dehydrogenases. The structure of NAD⁺ and NADP⁺. Their importance in oxidation and reduction reactions. Flavine dehydrogenase. Structure 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. The sequence of components of the respiratory chain of mitochondria. Molecular complexes of mitochondrial inner membranes.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i></p>	According to the time-table
P-8	Oxidative phopshorylation, its regulation. Microsomal oxidation	<p>Oxidative phosphorylation: points of interface of electron transport and phosphorylation, the coefficient - to patients oxidative phospho - ryluvannya. Hemiosmotic theory of oxidative phosphorylation , ATP-</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></p>	According to the time-table

		<p>synthesis in mitochondria. Inhibitors electron transport in the mitochondrial respiratory chain.</p> <p>Disconnectors of electron transport and oxidative phosphorylation in the respiratory chain of mitochondria.</p>	<p><i>Sk-1</i> <i>Sk-10</i> <i>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i></p>	
P-9	<p>Studies on glycolysis – oxidation of carbohydrates under anaerobic conditions</p>	<p>Glucose as an important metabolite of carbohydrate metabolism: a general scheme of sources and ways of conversion of glucose in the body. Anaerobic oxidation of glucose. Reaction sequence and enzymes of glycolysis.</p> <p>Glycolytic oksydore - control, phosphorylation of substrates and shuttle arrangements 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-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>AB-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i></p>	<p>According to the time-table</p>
P-10	<p>Aerobic oxidation of glucose. Biosynthesis of glucose – gluconeogenesis</p>	<p>Stages of aerobic oxidation of glucose. Oxidative decar - pyruvate boxing. Enzymes, coenzymes and sequence of reactions in multienzyme pyruvate dehydrogenase complex. Comparative characteristics of bio - energy of aerobic and anaerobic oxidation of glucose. Gluconeogenesis: substrates, enzymes, reactions and physiological significance of the process.</p> <p>Relationship between glycolysis and gluconeogenesis (Corey cycle). Glucose-lactate cycle</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i></p>	<p>According to the time-table</p>
P-11	<p>Breakdown and biosynthesis of glycogen. Regulation of glycogen metabolism</p>	<p>Glycogen biosynthesis: enzymatic reactions, physiological significance. Regulation of glycogen synthetase activity. Phospho - a rolytic pathway of glycogen breakdown in the liver and muscles. Regulation of</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></p>	<p>According to the time-table</p>

		<p>hlikohenfosfo - rylazy. The mechanism of reciprocal regulation of glycogenolysis and glikogeneza by cAMP-dependent cascade fosforyluwannya enzyme proteins. The role of epinephrine, glucagon and insulin metabolism hormonal regulation of glycogen in the muscles and pechintsi. Hene - cal metabolism of glycogen (glycogen storage disease and ahlikohenozy).</p>	<p><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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i></p>	
P-12	<p>Studies on mechanisms of metabolic and humoral regulation of carbohydrate metabolism. Diabetes mellitus.</p>	<p>Pentose phosphate pathway of glucose oxidation; process scheme and biological significance. Metabolic pathways of fructose and galactose conversion; hereditary enzymopathy of their metabolism. Biochemical process, providing a stable blood glucose levels. 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). Characteristics of normo-, hyper-, hypoglycemia and glucosuria. And nsulinzalezhna and insulin-dependent form of diabetes diabetu. Harak - terystyka biochemical disorders in diabetes. Biochemical tests to assess diabetes. Disorders of carbohydrate metabolism during starvation.</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i></p>	<p>According to the time-table</p>
P-13	<p>Catabolism and biosynthesis of triacylglycerols and phospholipids. Intracellular lipolysis and molecular mechanisms of its regulation.</p>	<p>Biological functions of simple and complex lipids in the human body (spare, energy, participation in thermoregulation, biosynthetic). Participation of lipids in the construction and operation of biology - tech cell membranes. Liquid-mosaic model of biomembranes. Liposomes, their use in medicine. Circulatory transport and deposition of lipids in adipose tissue. Lipo is an</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></p>	<p>According to the time-table</p>

		<p>endothelial protein lipase. Catabolism tryatsylhlitse - rolls fat in adipocytes, the sequence of reactions, the mechanisms regulating the activity tryhlitserydlipazy. Biosynthesis triatsylhli - tseroliv. Neyrohumoralna regulation of lipolysis involving adrenaline, Mr. oradrenalinu, glucagon and insulin.</p>	<p><i>AR-4</i> <i>AR-5</i> <i>AR-6</i> <i>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i></p>	
P-14	Metabolism of complex lipids and ketone bodies	<p>Biosynthesis of phospholipids, the value of phosphatidic acid. Metabolism of sphingolipids. Genetic abnormalities of sphingolipid metabolism - sphingolipidosis. Lysoso - small diseases. The goal - bolizm ketone bodies, enzymatic reactions biosynthesis of ketone bodies; ketone body utilization reactions, energy value; metabolism of ketone bodies in the conditions of pathology; mechanisms of excessive growth of ketone bodies in diabetes and starvation; concepts - ketoacidosis, ketonemia, ketonuria.</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i></p>	According to the time-table
P-15	β -Oxidation and biosynthesis of fatty acids. Metabolism of fatty acids and ketone bodies	<p>Reactions of β-oxidation of fatty acids: localization of the process; activation of fatty acids; the role of carnitine in the transport of fatty acids in the mitochondria; Litter - ness enzymatic reactions and energy cost-oxidation of fatty acids. Oxidized - tion glycerol, enzymatic reactions, bioenergetics. Biosynthesis of higher fatty acids: localization of the process; metabolic sources of fatty acid synthesis; stages of synthesis of saturated fatty acids; characteristics of FFA synthetase, values of acyltransporting 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</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i></p>	According to the time-table

		polyunsaturated fatty acids in the human body.		
P-16	Biosynthesis and biotransformation of cholesterol. Disorders of lipid metabolism	<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).</p> <p>Atherosclerosis: mechanisms of development, the role of genetic factors hiperholestery - Nemi, WHO classification.</p> <p>Disorders of lipid metabolism in diabetes. Pathological processes of lipid metabolism that lead to the development of obesity. Fatty hepatosis, lipotropic factors.</p> <p>Plasma lipoproteins: lipid and protein (apoproteins) composition. Hyperlipoproteins - dumb.</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i></p>	According to the time-table
P-17	Studies on amino acid metabolism (deamination, transamination, decarboxylation). Biogenic amines.	<p>Ways of formation and maintenance of a pool of free amino acids in the human body. General ways of conversion of free amino acids. Types of amino acid deamination reactions - lot and their final products. Mechanism of oxidative deamination of amino acids - lot. Oxidases of L- and D-amino acids. Their enzymatic active - ness, the specificity of action.</p> <p>Hlutamatdehidrohenaza: the structure of the enzyme mechanism hlutamatedhidr - ohenaKnoyi reaction, biological meaning.</p> <p>Transamination of amino acids, substrates for transamination reactions. The mechanism of the transamination reaction. Transaminases. Localization of transaminases in organs and tissues. Clinical and diagnostic value of determining the activity of transaminases. Decarbok - amino acid amplification. Decarboxylases. Utvo - Rennes biogenic amines (γ -</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i></p>	According to the time-table

		aminomaslyana acid, histamine, serotonin, dopamine). Dekarboksyl - tion of amino acids during protein rotting in the gut. Oxidation of biogenic amines.		
P-18	Detoxification of ammonia and urea biosynthesis. Metabolism of individual amino acids.	<p>Ways of ammonia formation. Ammonia toxicity and mechanisms of its neutralization. Circus - ammonia transport (glutamine, alanine). Urea biosynthesis: localization of the ornithine cycle; enzymatic reactions; ammonia sources; energy supply.</p> <p>Genetic defects of enzymes (enzymopathy) of urea synthesis.</p> <p>Common pathways of carbon metabolism of amino acids in the human body. Glucogenic and ketogenic amino acids.</p> <p>Specialized ways of acyclic amino acid metabolism. Glycine and serine metabolism; the role of tetrahydrofolate (H₄-folate) in the transfer of single-carbon fragments, dihydrofolate reductase inhibitors as antitumor agents.</p> <p>Metabolism of sulfur-containing amino acids; methylation reactions. Especially big - Vost exchange of branched chain amino acids; participation of coenzyme forms of vitamin B₁₂ in amino acid metabolism.</p> <p>Arginine metabolism; biological role of nitric oxide, NO-synthase.</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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i></p>	According to the time-table
P-19	Metabolism of cyclic amino acids. Biosynthesis of creatine and glutathione.	<p>Specialized ways of metabolism of cyclic amino acids phenylalanine and tyrosine, sequence of enzymatic reactions.</p> <p>Hereditary enzymopathy of cyclic amino acids phenylalanine and tyrosine - phenylketonuria, alkaptonuria, albinism.</p> <p>Tryptophan metabolism: kinurenin and serotonin pathways. Hereditary enzymopathy.</p> <p>Glutathione: structure, biosynthesis, biological functions, role in the metabolism of organic peroxides.</p> <p>Biosynthesis and biological role of creatine and creatine phosphate to</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>C-1</i> <i>C-2</i></p>	According to the time-table

		form - ting creatinine, clinical and biochemical disturbances value of their exchange.	<i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i>	
P-20	Biosynthesis and catabolism of purine and pyrimidine nucleotides, determination of end products of their metabolism. Hereditary disorders of nucleotide metabolism.	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). Biosynthesis of pyrimidine nucleotides: reaction scheme, regulation of synthesis. Biosynthesis of deoxyribonucleotides. Formation of thymidyl nucleotides; inhibitors of dTMP biosynthesis as antitumor agents. Catabolism of purine nucleotides. Hereditary disorders of uric acid metabolism. Clinical and biochemical characteristics of hyperuricemia, gout, Lesch-Nihan syndrome. Scheme catabolism of pyrimidine nucleoside - tydiv. O rotaciduria.	<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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i>	According to the time-table
P-21	Replication of DNA and transcription of RNA. Analysis of the mechanisms of mutations, reparation of DNA. Protein biosynthesis in ribosomes, investigation of initiation, elongation and termination stages in synthesis of polypeptide chain.	DNA replication: biological significance, semi-conservative mechanism of replication. Sequence of stages and enzymes of DNA replication in prokaryotes and eukaryotes. RNA transcription: RNA polymerases of prokaryotes and eukaryotes, transcription signals (promoter, initiator and terminator regions of the genome). Processing - posttranscriptional modification novosynte - zovanyh mRNK. Transport - no activation of tRNA and amino acids. Aminoacyl-tRNA synthetase. Stages and mechanisms of translation (protein biosynthesis) in ribosomes: initiation, elongation and termination. Posttranslational modification of peptide chains. Broadcast 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	<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>C-1</i> <i>C-2</i> <i>C-6</i> <i>C-7</i> <i>C-11</i> <i>PC-2</i>	According to the time-table

		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-22	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.	Hormones: general characteristics; the role of hormones and other bioregulators in the system of intercellular integration of human body functions. Classification of hormones and biorehu - modulator; 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, Ca ²⁺ / calmodulin, IF ₃ , 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 carbohydrates, lipids, amino acids and proteins. Growth-stimulating effects of insulin. Glucagon. Chemical nature and biological action of the hormone. Catecholamines (adrenaline, noradrenaline, dopamine): structure, biosynthesis, biological effects, biochemical mechanisms of action.	<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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	According to the time-table
P-23	Investigation of molecular and cellular mechanisms of action of steroid and thyroid	Steroid hormones nomenclature classification. Mechanism of action of steroid hormones. Steroid hormones of the adrenal cortex (C ₂₁ -steroids) - cortisol, corticosterone. Biochemical effects of	<i>Kn-1</i> <i>Kn-2</i> <i>Kn-3</i> <i>Kn-4</i> <i>Kn-5</i> <i>Kn-6</i>	According to the time-table

	<p>hormones upon target cells. Hormonal regulation of calcium homeostasis. Eicosanoids.</p>	<p>corticosteroids. Glucocorticoids; the role of cortisol in the regulation of gluconeogenesis; anti-inflammatory properties of glucocorticoids. Itsenko-Cushing's disease. 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. Regulation of phosphate-calcium metabolism by parathyroid hormone and calcitonin. Parathyroid hormone - structure, mechanism of hypercalcemic action. Calcitriol: biosynthesis; effect on the absorption of Ca²⁺ and phosphates in the intestine. Calcitonin - structure, effect on the metabolism of calcium and phosphates. Clinical and biochemical characteristics of disorders of calcium homeostasis (rickets, osteoporosis). Hyperparathyroidism and hypoparathyroidism. Eicosanoids: structure, biological and pharmacological properties - aspirin and other nonsteroidal anti-inflammatory drugs as inhibitors of prostaglandin synthesis.</p>	<p><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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-24	<p>Biochemistry of chemical composition and content of saliva.</p>	<p>P regulation of salivation. The mechanism of saliva formation. Functions of human saliva (digestive, protective, mineralization against caries). Factors influencing saliva secretion in normal and pathological conditions.</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>	<p>According to the time-table</p>

		<p>G mouth, viscosity and pH of saliva are normal and in pathology. O 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. N protein nitrogenous components of saliva, carbohydrates and lipids.</p> <p>G salivary hormones, their role in the regulation of metabolic processes in the oral cavity and the body as a whole. MR. eorhanichni saliva components (micro and macro), their change in the pathology of the oral cavity. Protective mechanisms of saliva when 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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-25	Nutrition of proteins, carbohydrates and lipids in digestive tract.	<p>The needs of the human body in nutrients - carbohydrates, lipids (fats, phospholipids), proteins. Biological value of some nutrients. The content of nutrients in common foods. M mikroelementy in human nutrition. Biological functions of iodine, bromine, fluorine, copper, manganese, zinc, cobalt, selenium; iron. Manifestations of microelements insufficiency - ness. Characteristics of the digestive process in the stomach: the chemical composition of gastric juice; mechanism of action of enzymes (pepsin, gastrin, renin). Biochemical mechanisms of stimulation of enzyme secretion and action. The mechanism of formation and the role of hydrochloric acid. Acidity of gastric juice and forms of its expression. Quantitative indicators in normal and pathology by the method of pH-metry. Mechanisms of stimulation of hydrochloric acid release.</p> <p>MR eretravlennya proteins in the small intestine, proteolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of protein hydrolysis products in the small intestine. Decay of proteins in the colon.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-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>MR eretravlennya carbohydrates in the small intestine, glycolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of hydrolysis products of carbohydrates in the small intestine.</p> <p>MR eretravlennya lipids in the small intestine, lipolytic enzymes of the pancreas and small intestine, their mechanism of action. Absorption of lipid hydrolysis products in the small intestine. Hormonal regulation of digestive processes (hormones of the HEP system). Disorders of digestion of certain nutrients in the intestines (clinical and biochemical characteristics of disorders of the secretory function of the pancreas in acute and chronic pancreatitis). WITH greedy enzymopathies digestive processes (lack disaccharidases, violation of membrane transport of hexoses, glucose and galactose absorption).</p>		
P-26	Functional role of water soluble vitamins.	<p>Vitamins, as indispensable biologically active components - nutrition, which is necessary for the human body. History of the discovery of vitamins. Development of vitaminology in Ukraine.</p> <p>Causes of exogenous and endogenous hypo- and avitaminosis. Vitamins B₁ and B₂, their structure, biological role, sources for humans, daily requirement. Signs of hypovitaminosis. Structure, properties of vitamin H and pantothe - a new acid. Their participation in metabolism, the main sources, daily needs. The role of CoA in metabolic processes. Antianemic vitamins (B₁₂, folic acid), their structure, participation in metabolism, sources for humans, daily requirement, signs of hypovitaminosis. Vitamins B₆ and PP, their structure, biological role, sources for humans, daily requirement, signs of hypovitaminosis. Vitamins C and P, their b widow, biological role, sources for humans, daily requirement. Functional connection between vitamin P and vitamin C. Manifestations of insufficiency in the human body.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-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-27	Functional role of fat soluble vitamins.	<p>Vitamins of group D, structure, biological role, daily requirement, sources for a person, signs of hypo- and hypervitaminosis, avitaminosis. Vitamin A, structure, biological role, daily requirement, sources for humans, signs of hypohypervitaminosis. Vitamins E, F, structure, biological role, sources for humans, mechanism of action, the daily requirement, signs failure Applying in medicine. Antihemorrhagic vitamins (K₂, K₃) and their soluble form, structure, biological role, sources for humans, mechanism of action, the daily need, features deficiency applications - tion in medicine. Provitamins, antivitamins. Mechanism of action and application in practical medicine. Vitamin-like substances, their structure and role.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-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-28	<p>Proteins of blood plasma: proteins of acute phase, genuine and indicative enzymes. Nonprotein nitrogen containing and nitrogen free components of blood</p>	<p>Biochemical and physiological functions of blood in the human body. Respiratory function of erythrocytes. Hemoglobin: mechanisms of participation in the transport of oxygen and carbon dioxide. Variants and pathological forms of human hemoglobin. Blood buffer systems. Violation of acid-base balance in the body (metabolic and respiratory acidosis, alkalosis). Biochemical composition of human blood. Blood plasma proteins and their clinical and biochemical characteristics - joints. Blood plasma enzymes: importance in enzymatic diagnosis of diseases of organs and tissues. Kallikrein-kinin system of blood and tissues. Drugs - antagonists kininoutvoren - ting. Non-protein organic compounds of blood plasma. Inorganic components of blood plasma.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i></p>	According to the time-table

			<i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i> <i>PC-13</i>	
P-29	<p>Blood coagulation, anticoagulant and fibrinolytic systems of blood. Biochemistry of immune reactions. Immunodeficiency.</p>	<p>Functional and biochemical characteristics of the hemostasis system in the human body; vascular-platelet and coagulation hemostasis. Blood coagulation system; characteristics of individual components (coagulation factors). The mechanisms of activation and function - nuvannya cascade of blood coagulation; internal and external coagulation pathways. The role of vitamin K in coagulation reactions (carboxylation of glutamic acid to γ-carboxyglutamic acid, role in calcium binding). Drugs - agonists and antagonists of vitamin K. Hereditary and acquired disorders of vascular-platelet and coagulation hemostasis. Antyzhor - Talne blood system, the characteristic antique - ahulyantiv. Fibrinolytic blood system: stages and components of fibrinolysis. Drugs that affect the processes of fibrinolysis. Plasminogen activators and plasmin inhibitors. Immunoglobulins: structure, biological functions, mechanisms of regulation of immunoglobulin synthesis. Biochem - nomic characteristics of certain classes of human immunoglobulins. Neurotransmitters and hormones of the immune system: interleukins, ui - Rhone protein-peptide factors regulating the growth and proliferation of cells. Biochemical components of the human complement system; classical and alternative (proper - dyn) activation mechanisms. Biochemical mechanisms imunodefi - tsytnyh states: primary (hereditary) and secondary immunodeficiencies.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i>	According to the time-table
P-30	<p>Biotransformation of xenobiotics and endogenous toxins.</p>	<p>Homeostatic role of the liver in the metabolism of the whole organism. Biochemical functions of hepatocytes. Carbohydrate (glycogenic), lipid - shrinkage, protein-synthesizing, urea - forming, pigment,</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>	According to the time-table

		<p>bile - forming functions of the liver. Biochemical composition of bile. Detoxification function of the liver. The concept of alien biochemistry compounds - "ksenobiohimiyu": mechanisms biotransformation of xenobiotics and endogenous toxins. Types of biotransformation reactions of foreign chemical compounds in the liver. Reactions of microsomal oxidizing; 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-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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i></p>	
P-31	<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 jaundice; hereditary (enzymatic) and acquired jaundice. Porphyria: nomenclature; protoporphyrin IX biosynthesis reactions; heme formation. Regulation of porphyrin synthesis. Hereditary disorders of porphyrin metabolism (porphyria).</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> <i>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	<p>According to the time-table</p>
P-32	<p>Investigation of water and mineral metabolism. Normal and pathological constituents of</p>	<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</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></p>	<p>According to the time-table</p>

	urine.	<p>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 food. The role of the kidneys and lungs in maintaining the acid-base state of the body. Ammonium genesis. 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>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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
P-33	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. Biosynthesis and breakdown of collagen. Structure and properties of non-collagen proteins (elastin, large and small proteoglycans). Nekola - Genova proteins with specific characteristic - styamy (fibronectin, integrins, laminin, vitronektyn, 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. Organization and chemical structure of bone tissue.</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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	According to the time-table

		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-34	Biochemistry of mineralization of tooth enamel. Biochemical events in process of demineralization and tooth decay	General characteristics of the chemical composition of tooth tissues (enamel, dentin, cement, pulp). MR. eorhanichni enamel substance: the concept of the enamel prisms, apatite types, their properties and biological role. O organic substances of enamel (specific proteins, peptides, carbohydrates, lipids). Features dentine chemical composition, its structural and functional bodies - tion. Tooth cement. 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. 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.	<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>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i> <i>PC-7</i> <i>PC-13</i>	According to the time-table
P-35	Biochemistry of nervous and muscle tissues. Pathochemistry of psychotic disorders.	Biochemical composition of myocytes. Myofibril proteins: myosin, actin, tropomyosin, troponin. Molecular organization of thick and thin filaments. Extractives of muscles, nitrogenous and nitrogen-free, their chemical nature and role. 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. Bioenergy of muscle tissue. Macroergic muscle	<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>	According to the time-table

		<p>compounds. The structure, formation and role of ATP, creatine - phosphate for reatynfosfo - kinases sources of ATP in the muscle; the role of creatine - phosphate to provide energy muscle contraction. Biochemical changes in muscles in pathology. Features biochemical composition and metabolism of the brain, the chemical composition of the brain, neurospecific proteins and lipids (gangliosides, cerebrosides, cholesterol), especially aminokys - lotnoho part of the brain, role of glutamic acid. Energy metabolism in the human brain. Biochemistry of neurotransmitters (acetyl - choline, norepinephrine, dopamine, serotonin, excitatory and brake - mivnyh amino acids) and their role in the transmission of nerve impulses, and the regulation of memory. Receptors for neurotransmitters and physiologically active compounds. Peptidergic system of the brain.</p> <p>Opioid peptides (enkephalins, endorphins, dinorphins) and their receptors. Disorders of metARolism of mediators and modulators of the brain in mental disorders.</p>	<p><i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>C-1</i> <i>C-2</i> <i>C-3</i> <i>C-6</i> <i>C-11</i> <i>PC-1</i> <i>PC-2</i> <i>PC-3</i></p>	
SIW-1	History of biochemistry; development of biochemical research in Ukraine.	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> <i>C-6</i> <i>C-7</i></p>	According to the time-table
SIW -2	The contribution of scientists of the Department of Biochemistry of 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	<p><i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>C-6</i> <i>C-7</i></p>	According to the time-table
SIW-3	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. Give pomtlki that are allowed for research	<p><i>AR-1</i> <i>AR-2</i> <i>AR-4</i> <i>AR-5</i> <i>C-6</i> <i>C-7</i></p>	According to the time-table

SIW-4	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-5	Intracellular localization of metabolic pathways, compartmentalization of metabolic processes in the cell.	Make a table of the location of certain metabolic pathways in the organelles of the cell, 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>C-6</i> <i>C-7</i>	According to the timetable
SIW-6	Pasteur effect.	Define the concept, describe the mechanism of its occurrence.	<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>C-6</i> <i>C-7</i>	According to the timetable
SIW-7	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-8	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-9	Pentose phosphate	Define the process, schematically display the transformation with the	<i>Kn-1</i> <i>Kn-2</i>	According to the time-

	pathway of glucose oxidation: process reaction scheme	indication of enzymes	<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>C-6</i> <i>C-7</i>	table
SIW-10	Characteristics of normo-, hyper-, hypoglycemia and glucosuria, causes of their occurrence.	Define concepts, describe the reasons for their occurrence	<i>Kn-2</i> <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>C-6</i> <i>C-7</i>	According to the timetable
SIW-11	Biological functions of simple and complex lipids in the human body (store, 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>C-6</i> <i>C-7</i>	According to the timetable
SIW-12	Liposomes, their structure and vectors of use in medicine.	Display 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> <i>AR-5</i> <i>C-6</i> <i>C-7</i>	According to the timetable
SIW-13	Lysosomal diseases: causes, clinical and biochemical characteristics.	Make a table of lysosomal diseases, indicating the name, enzyme and clinical manifestations	<i>Kn-3</i> <i>Kn-4</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-14	Pathological processes of lipid	Describe the causes, clinical and biochemical characteristics of obesity	<i>Kn-3</i> <i>Kn-4</i>	According to the time-

	metabolism that lead to the development of obesity.		AR-1 AR-2 AR-4 AR-5 C-6 C-7	table
SIW-15	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	Kn-2 Kn-3 Kn-4 Kn-8 Kn-9 Sk-8 AR-1 AR-2 AR-4 AR-5 C-6 C-7	According to the timetable
SIW-16	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	Kn-3 Kn-4 Kn-8 Sk-8 AR-1 AR-2 AR-4 AR-5 C-6 C-7	According to the timetable
SIW-17	The role of tetrahydrofolate (H4-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.	Kn-8 Kn-9 AR-1 AR-2 AR-4 AR-5 C-6 C-7	According to the timetable
SIW-18	Participation of coenzyme forms of vitamin B ₁₂ in amino acid metabolism.	Give the chemistry of reactions, indicate the role of vitamin B ₁₂	Kn-8 Kn-9 AR-1 AR-2 AR-4 AR-5 C-6 C-7	According to the timetable
SIW-19	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	Kn-3 Kn-4 Kn-8 Sk-8 AR-1 AR-2 AR-4 AR-5	According to the timetable

			<i>C-6</i> <i>C-7</i>	
SIW-20	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-21	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-22	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-23	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-24	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>C-6</i> <i>C-7</i>	According to the timetable

SIW-25	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>C-6</i> <i>C-7</i>	According to the timetable
SIW-26	The mechanism of formation and the role of hydrochloric acid. Acidity of gastric juice and forms of its expression. Quantitative indicators in normal and pathology by the method of pH-metry. Mechanisms of stimulation of hydrochloric acid release.	Display the chemistry of reactions of formation of hydrochloric acid, indicate the enzyme. Describe the types of acidity, its quantitative indicators. Name the drugs used to stimulate the release of hydrochloric acid	<i>Kn-6</i> <i>Kn-8</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>C-6</i> <i>C-7</i>	According to the timetable
SIW-27	History of the discovery of vitamins. Development of vitaminology in Ukraine.	Submit 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>C-6</i> <i>C-7</i>	According to the timetable
SIW-28	The use of water and fat-soluble vitamins in dental practice.	Fill in the table of vitamin application, indicating the name of the vitamin and the pathochemical process in the oral cavity, which 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>C-6</i> <i>C-7</i>	According to the timetable
SIW-29	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>C-6</i>	According to the timetable

			<i>C-7</i>	
SIW-30	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>C-6</i> <i>C-7</i>	According to the time-table
SIW-31	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>C-6</i> <i>C-7</i>	According to the time-table
SIW-32	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 yu (pH) 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>C-6</i> <i>C-7</i>	According to the time-table
SIW-33	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>C-6</i> <i>C-7</i>	According to the time-table
SIW-34	The value of fluoride for caries and fluorosis.	Describe the mechanism of caries under conditions of insufficient fluoride intake and the mechanism of	<i>Kn-2</i> <i>Kn-3</i> <i>Kn-10</i>	According to the time-table

		fluorosis under conditions of excess fluoride. Submit the chemistry of the reactions	Sk-5 Sk-6 AR-1 AR-2 AR-4 AR-5 C-6 C-7	
SIW-35	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.	Kn-1 Sk-1 Sk-7 AR-1 AR-2 AR-4 AR-5 C-6 C-7	According to the time-table
SIW-36	Biochemical mechanisms underlying human neuropsychiatric diseases.	Describe the clinical and biochemical characteristics of alcoholism in drug addicts th , disease and Alzheimer's, multiple th sclerosis in , disease and Parkinson's, epilepsy her. Submit in the form of a table, indicating the name of the pathology, pathochemical causes, manifestations	Kn-2 Kn-3 Kn-4 Sk-2 Sk-5 AR-1 AR-2 AR-4 AR-5 C-6 C-7 PC-2	According to the time-table

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
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<p>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 AR-2 C-1 C-2 C-3</p>	<p>L-1, L-2, L-3, L-4, L-5, L-6, L-7, L-8, L-9, L-10</p>	<p>Types of educational activities of students are: a) lectures b) practical classes c) individual work of students (SIW) 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 10 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 maximally used various teaching tools - multimedia presentations, educational films, slides.</p>	
<p>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</p>	<p>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-</p>	<p>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</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. A grade of "good" is given to a student who</p>

<p>Sk-8 Sk-9 Sk-10 AR-1 AR-2 AR-3 AR-4 AR-5 AR-6 C-1 C-2 C-3 C-6 C-7 C-9 C-10 C-11 C-13 PC-1 PC-2 PC-3</p>	<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</p>	<p>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.</p> <p>The duration of the practical lesson is 2 academic hours.</p>	<p>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. A student who did not participate in the discussion of the most 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.</p>
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 points on current progress	
Type of final control	Exam	Enrollment criteria
Examination	The form of the exam is standardized and includes control of theoretical and practical training.	The maximum number 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</p>

		<p>skills), or did not fully substantiate them;</p> <p>8 points - "excellent" - the student has 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' independent 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
AND	The best 10% of students
IN	The next 25% of students
WITH	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. P. 500
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/>

[//testcentr.org.ua/](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, 69, Pekarska Street, Chemical building, ground floor.

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

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