

**National Pirogov Memorial Medical University, Vinnytsya**

**"APPROVE"**

Vice Rector of from scientific and pedagogical work  
and international relations

 Inna ANDRUSHKO

" 30 " *сентября* 2024

**"AGREED "**

Head of the Department of Biochemistry  
n. a. Professor O.O. Pentiuk

 Prof. of HEI Nataliia ZAICHKO

" 29 " *сентября* 2024

**SYLLABUS**  
**of academic discipline**  
**"BIOLOGICAL CHEMISTRY"**

Specialty	221 Stomatology
Educational level	the second (master`s) level
Educational programme	EPP Stomatology, 2022
Academic year	2024-2025
Department	biological and general chemistry
Lecturers	Associated professor, PhD, MD D.O. Filchukov Associated professor, PhD, MD V.M. Istoshyn
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Syllabus compiler	Professor, MD, PhD, DSc N. V. Zaichko Associated professor, PhD, MD D.O. Filchukov

## 1. Status and structure of the discipline

Discipline status	Compulsory
Discipline code in EPP/ discipline place in EPP	14 / the discipline of natural and scientific (fundamental) training
Course / semester	2nd year (III-IV semesters)
The amount of discipline ( the total number of hours / number of credits ECTS)	150 hours / 5,0 credits ECTS
Number of content modules	4 modules
The structure of the discipline	Lectures – 30 hours Practical classes - 60 hours Independent work - 60 hours
Language of study	English
Form of study	Full-time (or remote according to the order)

## 2. Description of the discipline

**Short annotation of the course, relevance.** The main focus is to gain knowledge in biological and bioorganic chemistry. Its study is necessary for the successful mastering of a number of clinical disciplines. The subject allows to gain knowledge about the chemical composition of living organisms, structural organization and properties of bioorganic compounds – components of cells, tissues and organs of the human body, patterns of metabolism and energy at the molecular level in healthy and diseased organisms, the formation of practical skills: biochemical research to identify normal and pathological components in biological fluids (blood, saliva, urine); interpret the results of biochemical studies for the diagnosis of the most common human diseases, congenital and acquired disorders of metabolic processes (enzymopathies, dysvitaminosis, dyslipidemia, etc.); to analyze biochemical processes and their regulation at different stages of metabolism and energy, and to understand their importance in ensuring the functioning of organs and systems of the human body.

**Prerequisites.** The study of the discipline is based on students' knowledge of basic natural sciences: medical biology, biophysics, medical chemistry (bioinorganic, physical and colloid chemistry), morphological disciplines (anatomy, histology) and integrates with these disciplines. Assimilation of the course occurs simultaneously with the study of normal physiology and intersects at the level of functional biochemistry.

**The purpose of the course and its significance for professional activities.** The discipline aims to train specialists – stomatologists who have a significant amount of theoretical and practical knowledge about the chemical composition of living organisms, structural organization and properties of bioorganic compounds - components of cells, tissues and organs of the human body, patterns of metabolism and energy at the molecular level in healthy and diseased organisms. This will allow you to master the knowledge and skills to conduct biochemical studies to identify normal and pathological components in biological fluids (blood, saliva, urine); interpret the results of biochemical studies for the diagnosis of the most common human diseases, congenital and acquired disorders of metabolic processes (enzymopathies, dysvitaminosis, dyslipidemia, etc.); to analyze biochemical processes and their regulation at different stages of metabolism and energy, and to

understand their importance in ensuring the functioning of organs and systems of the human body.

**Postrequisites.** The subject 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 application of knowledge in further education 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. Learning outcomes.

Know 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; general biochemical mechanisms of pathological processes in the human body.

To apply the received theoretical knowledge about features of diagnostics of a physiological condition of an organism and development of pathological processes on the basis of laboratory 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 in professional activity.

Apply practical skills of analysis of norms and changes in biochemical and enzymatic parameters used to diagnose the most common human diseases; the importance of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.

Conduct clinical, categorical diagnosis by assessing the peculiarities of the body's metabolism and the development of pathological processes based on laboratory tests, interpretation of laboratory diagnostic methods, interpret the structure and transformations of bioorganic compounds in the body 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.

Analyze the functioning of enzymatic processes occurring in membranes and organelles to integrate metabolism in individual cells with the definition of a complete functional diagnosis.

Explain the main mechanisms of biochemical action and the principles of targeted use of different classes of pharmacological agents in order to optimally prescribe drug treatment.

### 4. Content and logistic of the discipline

Module 1. (General patterns of metabolism. Metabolism of carbohydrates and lipids)	III semester 44 hours / 1,5 credits	Lectures № 1-5 Practical classes №№ 1 -8 Topics for self- study №№ 1-7
Module 2. (Metabolism of simple proteins Molecular biology. Functional biochemistry)	III semester 76 hours / 2,5 credits	Lectures № 6-15 Practical classes №№ 9-25 Topics for self- study №№ 8-19

The course includes 25 topics, which are divided into 2 thematic modules.

**Module 1.** General patterns of metabolism. Metabolism of carbohydrates and lipids.

*Thematic module 1.* Introduction to biochemistry. Biomolecules and cellular structures.

Topic 1. Introduction to biochemistry. Biomolecules and cellular structures. Nomenclature, classification and structure of enzymes. Coenzymes. Properties of enzymes. Kinetics and energy of enzymatic reactions.

*Thematic module 2. Enzymes. Metabolism regulation.*

Topic 2. Enzymes activities regulation. Activators and inhibitors of enzymes. Isoenzymes. Multienzyme complexes. Medical enzymology.

*Thematic module 3. General patterns of metabolism. Molecular basics of bioenergy.*

Topic 3. Common metabolic pathway. Oxidative decarboxylation of pyruvate. Citric Acid Cycle. Biological oxidation. Tissue respiration. Oxidative phosphorylation.

*Thematic module 4. Carbohydrate metabolism and its regulation.*

Topic 4. Digestion, absorption and transport of carbohydrates. Anaerobic and aerobic oxidation of glucose. Pentose phosphate cycle.

Topic 5. Glycogen metabolism. Gluconeogenesis. Regulation and pathology of carbohydrate metabolism.

*Thematic module 5. Lipid metabolism and its regulation.*

Topic 6. Digestion, absorption and transport of lipids. Lipolysis: catabolism of triglycerides, oxidation of glycerol and fatty acids.

Topic 7. Lipogenesis: biosynthesis of fatty acids, triglycerides and phosphoglycerides. Metabolism of ketone bodies and cholesterol. Regulation and pathology of lipid metabolism.

**Module 2. Metabolism of simple proteins. Molecular biology. Functional biochemistry**

*Thematic module 6. Metabolism of simple proteins*

Topic 1. Proteins digestion. Nutritional value of proteins. Decarboxylation of amino acids.

Topic 2. Transamination and deamination of amino acids. Ammonia neutralization. Urea synthesis.

*Thematic module 7. Basics of molecular biology*

Topic 3. Metabolism of nucleotides. Genetic code. Replication. DNA reparation.

*Thematic module 8. Basics of molecular genetics*

Topic 4. Transcription. Translation. Inhibitors of matrix processes. Regulation of genes expression. PCR. Genetic engineering.

*Thematic module 9. Molecular mechanisms of hormones action on target cells. Biochemistry of metabolism hormonal regulation.*

Topic 5. Chemical nature of hormones and mechanisms of their action. Hormones of central and peripheral endocrine glands. Hormones of endoexocrine glands.

*Thematic module 10. Biochemistry of human nutrition. Vitamins as food components.*

Topic 6. Vitaminology. Vitamins C and P. Water-soluble vitamins of B group. Lipid soluble vitamins.

*Thematic module 11. Blood biochemistry.*

Topic 7. Blood biochemistry. Chemical composition and physicochemical constants. Proteins and enzymes of blood.

*Thematic module 12. Functional biochemistry of organs and tissues.*

Topic 8. Biochemistry of liver. Pigmentary metabolism. Jaundices. Detoxificational function of liver. Metabolism of xenobiotics.

Topic 9. Biochemistry of kidneys and urine. Water-mineral metabolism.

Topic 10. Biochemistry of connective tissue. Biochemistry of tooth and saliva. Endocrine control of Ca and P homeostasis.

The topics of the lecture course reveal the problematic issues of the relevant sections of the discipline. Practical classes provide a theoretical justification of the main issues of the topic and the acquisition of the following practical skills:

- 1) to analyze the compliance of the structure of bioorganic compounds with the biological functions they perform in the human body;
- 2) interpret the peculiarities of the body's metabolism and the development of

- pathological processes on the basis of laboratory tests;
- 3) analyze the contribution of carbohydrates, lipids, amino acids in ensuring metabolic transformations in different functional states in the body;
  - 4) to interpret the features of the structure and transformations in the body of bioorganic compounds as the basis of their pharmacological action as drugs;
  - 5) interpret the biochemical mechanisms of pathological processes in the human body and the principles of their correction;.
  - 6) explain the basic mechanisms of biochemical action and the principles of targeted use of different classes of pharmacological agents;
  - 7) explain the biochemical and molecular basis of physiological functions of cells, organs and systems of the human body;
  - 8) analyze the functioning of enzymatic processes occurring in membranes and organelles to integrate metabolism in individual cells;
  - 9) classify the results of biochemical studies and changes in biochemical and enzymatic parameters used to diagnose the most common human diseases;
  - 10) to interpret the importance of biochemical processes of metabolism and its regulation in ensuring the functioning of organs, systems and the whole human body.

The student's independent work provides preparation for practical classes and intermediate tests, study of topics for independent extracurricular work, writing essays, preparation of presentations, tables. The control of mastering the topics of independent extracurricular work is carried out at the intermediate control classes and the final control of the discipline.

Individual work includes the study of scientific literature, preparation of reviews on the topics provided for presentation at the meetings of the student scientific circle, the implementation of scientific and practical researches, participation in specialized competitions, scientific and practical conferences and organization of students' research works.

Thematic plans of lectures, calendar plans of practical classes, thematic plan of independent extracurricular work, volume and directions of individual work are published on the website of the department.

The route for obtaining materials: Department biological and general chemistry / for students / Full-time education / (Stomatology) / 1 or 2 course / Educational materials / or through the link <https://www.vnmu.edu.ua/> department biological and general chemistry. Access to the materials is carried out through the student's corporate account [s000XXX@vnmu.edu.ua](mailto:s000XXX@vnmu.edu.ua).

### **5. Forms and methods of monitoring academic performance**

Current control in practical studies	Methods: oral or written survey, testing, electronic survey, solving situational problems, conducting laboratory studies, interpreting them and evaluating their results (drawing up a protocol in a workbook)
Control of mastering the thematic section of the discipline at intermediate control lessons	Methods: oral or written survey, electronic testing, situational problem solving, control of practical skills
Final semester control (credit) at the end of the II semester	According to the Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <a href="https://www.vnmu.edu.ua/Generalinformation">https://www.vnmu.edu.ua/Generalinformation</a> ).
Final control of the discipline - exam	Methods: pre-examination testing, oral questioning (according to the Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <a href="https://www.vnmu.edu.ua/Generalinformation">https://www.vnmu.edu.ua/Generalinformation</a> )).

	<a href="#">information</a> ).
Learning success diagnostic tools	Theoretical questions, tests, clinically-oriented situational tasks, practical tasks, practical skills, demonstration.

## 6. Assessment criteria

Knowledge assessment is carried out in accordance with the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmu.edu.ua/en/general-regulations> )

Continuous assessment	On a four point system of traditional assessments: 5 «excellent», 4 «good», 3 «satisfactory», 2 «unsatisfactory»
Midpoint separation assessment	On a four-point system of traditional assessments
Control of practical skills	According to the four-point system of traditional assessments
Pass-fail exam	On a 200-point scale (the arithmetic average grade for the semester is converted into points) Credited: 120 to 200 points Not credited: less than 120 points (See Grading Scale)
Final control of the discipline	Sum of points for pre-examination testing (12-20 points) and oral questioning (38-60 points) (for disciplines included in Step 1,2) Exam grade: 71-80 points - "excellent" 61-70 points - "good" 50-60 points - "satisfactory" Less than 50 points - "unsatisfactory" / did not pass
Discipline assessments:	Current academic assessment - from 72 to 120 points (conversion of the average traditional assessment of practical class on a 120-point scale): 60% of the grade for the discipline Final control - from 50 to 80 points: 40% of the grade for the discipline Individual work - from 1 to 12 points From 122 to 200 points in total.

### Discipline Score Scale: National and ECTS

The sum of grades for all types of educational activities	Score ECTS	Score on a national scale	
		For exam, course project (work), practice	for credit test
180-200	<b>A</b>	excellent	credited
170-179,9	<b>B</b>	good	
160-169,9	<b>C</b>		
141-159,9	<b>D</b>	satisfactory	
122-140,99	<b>E</b>	satisfactory	-
0-121,99	<b>FX</b>	unsatisfactory with the	is not credited with the

		possibility of reassembly	possibility of reassembling
	<b>F</b>	unsatisfactory with a mandatory reexamination of discipline	is not credited with mandatory reexamination of discipline

## 7. Policy of discipline / course

The student has the right to receive high-quality educational services, access to contemporary scientific and educational information, qualified advisory assistance during the study of discipline and mastering practical skills. The policy of the department during the providing of educational services is a student-centered, based on normative documents of the Ministry of Education and the Ministry of Health of Ukraine, the Statute of the University and the Procedure for the Providing of Educational Services regulated by the main principles of the organization of the educational process in National Pirogov Memorial Medical University, Vinnytsya and the principles of academic integrity.

### **Adherence to the rules of VNMU, safety techniques in practical classes.**

**Requirements for preparation for practical classes.** Student should be present at the practical lesson on time, theoretically prepared according to the topic. Delay is not allowed (according to the Rules of Procedure for persons studying at VNMU). The student must follow the rules of clothing culture and look according to the situation. In communication with teachers, staff, comrades and other persons studying at VNMU to observe politeness, friendliness, friendliness. Students must observe peace, tranquility, noble behavior in the department. While working in the chemical laboratory, students follow safety rules (published on the website of the department <https://www.vnmue.edu.ua/> Department of Biological and General Chemistry ).

**Usage of mobile phones and other electronic devices.** Students should turn off their mobile phones during classes and other activities provided for in the work plans (according to the Rules of Procedure for students at VNMU). It is allowed to use the specified devices with the permission of the teacher, if it is related to the learning process.

**Academic integrity.** When studying the discipline, the student must be guided by the Code of Academic Integrity and Corporate Ethics of National Pirogov Memorial Medical University, Vinnytsya (link: <https://www.vnmue.edu.ua/en/general-regulations/> Code of Academic Integrity). In case of violation of the norms of academic integrity during the current and final controls student receives a grade of "2" and must work it out to his teacher in the prescribed manner within two weeks after receiving an unsatisfactory assessment.

**Missed classes.** Missed classes are working out in the manner prescribed by Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmue.edu.ua/en/general-regulations/>) at the time of work out schedule (published on the website of the department <https://www.vnmue.edu.ua/> department of biological and general chemistry) to the teacher on duty. To work out missed lesson student should provide a completed workbook protocol on the relevant topic, take a test and answer questions in writing or orally to the topic of the lesson. The practice of missed lectures is carried out after providing a synopsis of lecture material, or writing an abstract, or preparing your own presentation on the topic of missed lectures.

**The procedure for admission to the discipline final control** is given in the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link

<https://www.vnmdu.edu.ua/en/general-regulations> ). To the final control allowed students who do not have missed practical classes and lectures and received an average traditional grade of at least "3".

**Additional points.** Individual points in the discipline (from 1 to 12) that student can receive for individual work, the amount of which is published on the website of the department in the educational methodical materials of the discipline, the number of points is determined by the results of IRS according to Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmdu.edu.ua/en/general-regulations> ).

**Conflict resolution.** In case of misunderstandings and complaints to the teacher because of the quality of educational services, knowledge assessment and other conflict situations, student should submit his / her claims to the teacher. If the issue is not resolved, the student has the right to apply to the head of the department according to Complaints Consideration Procedure in VNMU named after M.I. Pirogov (link <https://www.vnmdu.edu.ua/en/general-regulations> )

**Politics in terms of remote learning.** Distance learning regulated by the Regulations of the elements of remote learning in National Pirogov Memorial Medical University, Vinnytsya (<https://www.vnmdu.edu.ua/> General information). The main training platforms for studying are Microsoft Team and Google Meets. Practical classes and lectures, exercises and consultations during distance learning is published on the website of the department ([https://www.vnmdu.edu.ua/en/ Department of Biological and General Chemistry / to Students](https://www.vnmdu.edu.ua/en/Department%20of%20Biological%20and%20General%20Chemistry%20to%20Students) or [https://www.vnmdu.edu.ua/en/Department of Microbiology / News](https://www.vnmdu.edu.ua/en/Department%20of%20Microbiology%20News)).

Feedback from teachers is via messengers (Viber, Telegram, WhatsApp) or e-mail (at the teacher's choice) during working hours.

1. **Educational resources.**

Educational and methodological support of the discipline is published on the website of the department ([https://www.vnmdu.edu.ua/ en/ department of biological and general chemistry / for students](https://www.vnmdu.edu.ua/en/department%20of%20biological%20and%20general%20chemistry%20for%20students)). Consultations are held twice a week according to the schedule.

2. **The timetable and distribution of groups** with assigned teachers are published on the web page of the department (([https://www.vnmdu.edu.ua /en/ department of biological and general chemistry / for students](https://www.vnmdu.edu.ua/en/department%20of%20biological%20and%20general%20chemistry%20for%20students))).
3. Questions to the intermediate and final semester control (credit) of the discipline are published on the web page of the department ([https://www.vnmdu.edu.ua / en/ department of biological and general chemistry / for students](https://www.vnmdu.edu.ua/en/department%20of%20biological%20and%20general%20chemistry%20for%20students)).

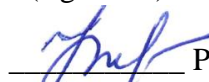
The syllabus of the discipline "Biological chemistry" was discussed and approved at the meeting of the department of biological and general chemistry (record № 1, dated "30" August 2024)

Responsible for the academic  
discipline

  
(signature)

As. prof. of HEI Denis FILCHUKOV

Head of the department

  
(signature)

Prof. of HEI Nataliia ZAICHKO