

**Odessa National Medical University**  
Faculty Medical  
Department Clinical Chemistry and Laboratory Diagnostics

Syllabus course

**“BIOLOGICAL AND BIOORGANIC CHEMISTRY”**

<b>Amount</b>	285 hours /9,5 ECTS
<b>Semester, year of study</b>	Bioorganic Chemistry - 1 year of study, 2 semesters. Biological Chemistry - 2 years of study, 3-4 semesters
<b>Days, time, place</b>	Venue: Odessa, st. Olgiivska, 4a (Main building of ONMedU), Department of Clinical Chemistry and Laboratory Diagnostics. Days and times of classes: According to the schedule of the educational department
<b>Teacher (s)</b>	Bioorganic Chemistry: <ol style="list-style-type: none"> <li>1. Docent Burdina Ianina Fedorovna</li> <li>2. Docent Sidelnykova Tetiana Andriivna</li> <li>3. Docent Shcherbakov Serhii Vasylevich</li> <li>4. Docent Shyrykalova Anzhela Olexiiivna</li> <li>5. Assistant Mraian Nataliia Volodumirivna</li> <li>6. Assistant Gridina Inna Rodionivna</li> <li>7. Assistant Kosinskaya Anna Pavlivna</li> </ol> Biological chemistry: <ol style="list-style-type: none"> <li>1. Docent Yasinenko Nina Yevhenivna</li> <li>2. Docent Storchylo Olha Vyacheslavivna</li> <li>3. Senior Lecturer Oliynyk Kathryn Victorovna</li> <li>4. Senior Lecturer Vasylieva Antonina Georhiivna</li> <li>5. Senior Lecturer Maryniuk Ganna Serhiivna</li> <li>6. Assistant Kostina Alina Anatoliivna</li> <li>7. Assistant Poplavska Nataly Andriivna</li> <li>8. Assistant Davydenko Veronika Leonidivna</li> </ol>
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<b>Workplace</b>	Odessa, street Olgiivska, 4a (Main building of ONMedU), Department of Clinical Chemistry and Laboratory Diagnostics.
<b>Consultations</b>	According to the schedule posted on the information stand of the department

## COMMUNICATION

Communication with students will be carried out in the classroom.

During distance learning, communication is carried out through the Microsoft Teams platform, as well as through e-mail correspondence, through messengers Viber, Telegram, WhatsApp.

## COURSE ANNOTATION

**The subject of the discipline is** to study the chemical composition of living organisms (human body) and the biochemical transformations of the molecules that are part of them.

**Prerequisites of the course:** To study the course students need basic knowledge of medical biology, biophysics, medical chemistry, morphological disciplines, sufficient for the perception of the categorical apparatus of the subject, understanding the chemical nature of basic substances that are part of living organisms and biochemical processes occurring in them.

**Post requisites of the course:** Mastering the material of the discipline "Biological and Bioorganic Chemistry" allows you to acquire knowledge and skills in courses of molecular biology, genetics, physiology, pathology, general and molecular pharmacology, toxicology and propaedeutic of clinical disciplines, which integrates teaching with these disciplines and skills to apply knowledge of the biological and bioorganic chemistry, primarily biochemical processes that take place in the body of a healthy and sick person, in the process of further training and professional activities.

**The purpose of the course:** To study the features of biomolecules and molecular organization of cellular structures, general laws of enzymatic catalysis and biochemical dynamics of transformation of basic classes of biomolecules (amino acids, carbohydrates, lipids, nucleotides, porphyrins, etc.), molecular biology and genetics of information macromolecules, proteins, molecules and realization of genetic information, hormonal regulation of metabolism and biological functions of cells, biochemistry of special physiological functions.

### **Tasks of the discipline:**

- to analyze the results of biochemical studies to diagnose the most common human diseases;
- to analyze the biochemical processes of metabolism and its regulation in ensuring the functioning of organs and systems of the human body;
- to apply knowledge of biochemical properties and metabolism of basic biomolecules in the human body in normal and pathological conditions;
- to conduct biochemical studies in biological fluids and evaluate the results with the interpretation of clinical and diagnostic value.

### **Expected results**

As a result of studying the discipline the student must know:

- The structure of bioorganic compounds and the functions performed by them in the human body.
  - Reactivity of the main classes of biomolecules, which provides their functional properties and metabolic transformations in the body.
  - The biochemical mechanisms of pathological processes in the human body.
  - The features of diagnosis of the physiological state of the organism and the development of pathological processes on the basis of biochemical studies.
  - The connection between the peculiarities of the structure and transformations in the body of bioorganic compounds as the basis of their pharmacological action as drugs.
  - The basic mechanisms of biochemical action and principles of targeted use of different classes of pharmacological agents.
  - The biochemical and molecular basis 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.
  - The standards and changes in biochemical 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.

Student should be able to:

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

## **COURSE DESCRIPTION**

### ***Forms and methods of teaching***

The course will be presented in the form of lectures (40 hours), practical classes (130 hours), organization of independent work of students (115 hours).

The main forms of teaching the discipline are: lectures, practical classes, seminar classes, independent work of students. The following teaching methods are used in teaching the discipline: lectures, explanations, conversations, multimedia presentations, laboratory work, problem solving, oral questioning, testing, etc.

Students' independent work is to study the material of lectures, as well as to prepare for and defend practical work, prepare for current and final control, perform training tests, search for information from literature and the Internet and conduct elements of scientific work.

Students' scientific work is carried out in the work of circles, preparation and speeches at scientific student conferences, writing articles.

### ***The content of the discipline***

Bioorganic chemistry.

Topic 1. Theoretical foundations of the structure and reactivity of bioorganic compounds.

Topic 2. Structure and functions of carbohydrates.

Topic 3.  $\alpha$ -Amino acids, peptides, proteins.

Topic 4. Biologically active heterocyclic compounds. Nucleosides, nucleotides, nucleic acids.

Biological chemistry.

Topic 5. Membranology

Topic 6. General characteristics of enzymes.

Topic 7. Specific and general ways of catabolism.

Topic 8. Mechanisms of the tissue respiration.

Topic 9. Carbohydrate catabolism.

Topic 10. Carbohydrate anabolism

Topic 11. Characteristics and intracellular lipid metabolism.

Topic 12. Cholesterol metabolism. Ketone bodies.

Topic 13. General pathways of amino acid metabolism.

Topic 14. Transamination and exchange of ammonia.

Topic 15. Specific pathways of amino acid metabolism.

Topic 16. Nucleotide exchange.

Topic 17. Nucleic acid metabolism. Protein synthesis.

Topic 18. Fundamentals of molecular genetics.

Topic 19. Mechanisms of hormonal action. Thyroid and parathyroid hormones.

Topic 20. Mechanisms of the steroid hormones action.

Topic 21. Hormonal regulation of metabolism.

Topic 22. Biochemistry of nutrition and general characteristics of vitamins.  
Topic 23. General characteristics of blood.  
Topic 24. Mechanisms of gas exchange.  
Topic 25. Characteristics of the hemostasis system and immune processes  
Topic 26. Functional and clinical biochemistry of the liver.  
Topic 27. Mechanisms of urination. Pathological components of urine.  
Topic 28. Functional and clinical biochemistry of muscles, nerve and connective tissues.

***The list of recommended textbooks:***

1. Mardashko, O. O.; Yasinenko, N. Ye. Biochemistry. The Odessa State Medical University. Odessa. 2003.
2. Mardashko, O. O.; Mironovich, L. M.; Stepanov, G. F.; Storchilo, O. V. Biological and Bioorganic Chemistry. Caravela. Kyiv. 2010.
3. Satyanarayana U. Biochemistry. 4th edition. India 2014.
4. Lehninger. Principles of Biochemistry. 7th edition. NY, United States. 2017.
5. Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto. Biochemistry. 8th Revised edition. 2015.
6. Lippincott Illustrated Reviews: Biochemistry. Philadelphia :Wolters Kluwer, 2017.
7. Baynes J., Dominiczak M. Medical Biochemistry. 5th Edition. Elsevier, 2018. [https://info.odmu.edu.ua/chair/medicinal\\_chemistry/](https://info.odmu.edu.ua/chair/medicinal_chemistry/)

**EVALUATION**

The results of students' academic performance are presented in the form of assessment on the national scale, 200-point and ECTS scale and have standardized generalized criteria for assessing knowledge:

national scale:

- “Excellent” (5) rating is awarded to a student, who is fluent in material of questionnaire, participates in discussion of debated questions, is able to write basic biochemical reactions occurring in the body, to identify key biochemical parameters in biologic objects and give them medical and biological assessment. He who realized the relationship of certain sections of the discipline, their importance for the future profession, showed creative abilities in understanding and using the curriculum, showed the ability to independently update and replenish knowledge; level of competence - high (creative).
- “Good” (4) rating is awarded to a student, who is fluent in material of questionnaire, able to write basic biochemical reactions occurring in the body, to identify key biochemical parameters in biologic objects and give them medical and biological assessment, but makes some minor errors in answers to questions and is capable of their independent updating and renewal in the course of further training and professional activity; level of competence - sufficient (constructive-variable);

- “Satisfactory” (3) rating is awarded to a student who is familiar with all questions of program and learned the themes of mandatory qualification minima, is able to identify key biochemical parameters in biological objects and give them medical and biological evaluation. One who has made some mistakes in answering the exam and in performing exam tasks, but has the necessary knowledge to overcome mistakes under the guidance of a researcher; level of competence - average (reproductive);

- “Unsatisfactory” (2) rating is awarded to a student who has significant gaps in knowledge of the program material, makes fundamental errors in explaining the laws of metabolism in humans; does not have the necessary practical skills; the level of competence is low (receptive-productive).

### **Ongoing control**

Ongoing monitoring is done at each practical class through oral examination or written controls. After studying each section based on control of theoretical knowledge, skills and abilities the control of practical skills is carried out. The current educational activity of the student is evaluated in practical and seminar classes on a 4-point (traditional) scale.

Additional (bonus) points can be received for individual tasks:

- Participation and report in the student scientific conference;
- Participation in the subject Olympiad in biochemistry, report on the student scientific circle;
- Preparation of multimedia slides and tests;
- Translations of scientific articles from foreign languages;
- Abstract work on a particular topic.

The number of points accrued for different types of individual tasks depends on their scope and significance, and is determined by the standard and working programs of the discipline and is added to the sum of points scored by students for current academic activities for a particular section. Grades for individual tasks are given to the student only if they are successfully completed and defended. The grade is added to the current performance.

At the end of the study, the current performance is calculated - the average current score (the arithmetic mean of all current grades on a traditional scale, rounded to two decimal places).

### **The final control**

The form of final control is the exam. The exam is conducted in the form of an oral examination of 4 questions in the examination paper. The student is given up to 30 minutes to prepare for the oral answer.

The student is admitted to the exam if he attended all classes, received a positive assessment of the practical skills control, pass final control test, has no academic debt and has an average score for current educational activities of at least 3.00.

The results of the exams are evaluated on a 4-point national scale ("excellent", "good", "satisfactory", "unsatisfactory") and 200-point scale, whereupon are entered in the examination record paper and student record book.

Assessment of the discipline consists of two components:

- 50% - the current success (average of all student assessments);
- 50% score on the exam.

Conversion of the traditional grade from the discipline to 200-point is performed by the information and computer center of the university program "Contingent" according to the formula:

average grade point (current / discipline) x 40.

national scale:	points
«5»	185-200
«4»	151-184
«3»	120-150

According to the scores, students are evaluated on the ECTS rating scale. Students enrolled in one specialty are ranked on the ECTS scale on the basis of the number of points scored in the discipline as follows:

ECTS assessment	Statistical index
«A»	The best 10% of students
«B»	The next 25% of students
«C»	The next 30% of students
«D»	The next 25% of students
«E»	The next 10% of students

### **Individual independent work (IIInW)**

Tasks for independent work are the general obligatory tasks highlighted in workbooks, which student should prepare for each class; making notes, filling out a workbook, learning vocabulary, studying subtopics that do not require explanation.

Students' independent work, which is provided by the topic of the lesson along with the classroom work, is assessed during the current control of the topic in the relevant lesson. Learning topics submitted only on independent work is checked during the exam.

## **COURSE POLICY**

### **Deadline and exam re-taking policy:**

It is expected that students will attend all lectures and practical classes. If they missed a class, it is necessary to re-work it (according to the schedule posted on the

information stand of the department and according to the permission of the dean's office, if necessary).

Re-work of practical skills mastering controls is carried out during a semester individually with the decision of re-work time.

Unsatisfactory grades re-work is carried out in the last month of discipline study if the average score for the current educational activity is less than 3.00 (conducted according to the schedule posted on the department's information stand).

### **Academic Integrity Policy:**

Adherence to academic integrity by students involves:

- Independent performance of educational tasks, tasks of current and final control (current controls and exam in the discipline), and learning outcomes (for persons with special educational needs this requirement is applied according to their individual needs and capabilities);
- Links to sources of information in case of the use of ideas, developments, statements, information;
- Providing reliable information about the results of their own (scientific, creative) activities, used research methods and sources of information.

The following is unacceptable in educational activities for participants in the educational process: use of prohibited auxiliary materials or technical means (cheat sheets, abstracts, headphones, telephones, smart phones, tablets, etc.) during control measures.

For violation of academic integrity, students may be held liable for the following academic liability:

- Reduction of results of assessment of control work, examination, credit, etc.;
- Re-taking the assessment (test, exam, test, etc.);
- Appointment of additional control measures (additional individual tasks, controls, tests, etc.).

### **Attendance and lateness policy:**

Attendance at lectures and practical classes is mandatory. If you are more than 15 minutes late, the lesson is considered missed and needs to be re-worked.

### **Mobile devices:**

During practical classes, the use of a smart phone, tablet or other device is allowed for storing and processing information only with the permission of the teacher.

The use of mobile devices and their accessories is strictly prohibited during any control.

### **Classroom behavior:**

The following is allowed during classes: leaving the classroom for a short time if necessary and with the teacher's permission; taking photos of presentation slides; taking an active part in the class.

The following is not allowed during classes: eating (except for persons whose special medical condition requires so; then medical confirmation is required); smoking,



drinking alcohol and low-alcohol beverages or taking drugs; using obscene language or words that offend the honor and dignity of colleagues and faculty; playing games; damaging the materials and technical base of the university (inventory, equipment; furniture, walls, and floors damage, littering the premises and territories); crying, shouting or listening to loud music in classrooms and even in corridors during classes.