

Ministry of Health of the Republic of Belarus
Educational institution
"Gomel State Medical University"

Department of Biological Chemistry

Authors:

O.S. Logvinovich, Head of the Department, PhD (Biol. Sci.), Associate Professor

A.N. Koval, Associate Professor (position and title), PhD (Biol. Sci.)

A.V. Litvinchuk, Associate Professor (position and title), PhD (Biol. Sci.)

M.V. Gromyko, Senior Lecturer

METHODOLOGICAL RECOMMENDATIONS

for a practical lesson in the academic discipline "Biological Chemistry"
for 2nd year **students** of the Faculty of Foreign Students
majoring in 1-79 01 04 "Medical Care"

Topic: Structure and functions of proteins.

Duration 4 hours

Approved at the meeting of the Department of Biological Chemistry
(Protocol No. 10 dated 29.08.2025)

Gomel, 2025

1. TRAINING AND EDUCATIONAL OBJECTIVES, MOTIVATION FOR COMPLETION OF THE TOPIC, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE

Proteins are essential for the structure and function of cells. They play a crucial role in determining the specific features and functioning of cells. In fact, more than half of the dry substance inside a cell is made up of proteins. In the human body alone, there are over 50,000 different proteins, each contributing to individual specificity and the morphological and functional characteristics of different cell types.

The purpose of the class:

Study the structure and physicochemical properties of proteins, consolidate knowledge of reactions to amino acids and peptides. To consolidate students' knowledge of protein structures, to form the concept of “folding”, “misfolding”, “chaperones”; to form students' ideas about conformational structural changes as the basis of protein functioning, to acquaint with the types of natural ligands and the mechanisms of their interaction with proteins. To foster in students a sense of pride in their chosen profession and to form in them a culture of respect for their health.

Class objectives:

The student should know:

1. The structure and physicochemical properties of proteins,
2. Basic reactions to amino acids and peptides,
3. Types of natural ligands and mechanisms of their interaction with proteins, concepts of “folding”, “misfolding”, “chaperones”.

The student should be able to:

1. Build peptides and determine the charge of a polypeptide at different pH values,
2. Carry out qualitative reactions to proteins and individual amino acids.

2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS.

2.1 Structure and general properties of proteins (biology).

2.2 Levels of structural organization of a protein molecule, characteristic of bonds in a protein molecule (bioorganic chemistry).

2.3. The structure and classification of amino acids. Basic reactions to functional groups (bioorganic chemistry)

3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON.

3.1 Proteins are the most important components of the organism. Protein structure. Species specificity of proteins. Protein polymorphism.

3.2 Biological functions and classification of proteins. Molecular weight of proteins. The shape and size of the protein molecule.

3.3 Methods for the qualitative detection and quantification of protein. Protein isolation and purification methods.

- Study of the spatial structure of a protein molecule (secondary, tertiary, quaternary structures):
- X-ray structural analysis.
- Study of three-dimensional protein models (Protein Data Bank).

3.4 Characteristics of the levels of the structural organization of the protein molecule (primary, secondary, tertiary, quaternary structures) and the bonds that hold it.

3.5 Conformational structural changes as the basis for protein functioning. Protein denaturation and renaturation. Types of natural ligands and mechanisms of their interaction with proteins.

3.6 Protein folding, folding pathology. Chaperones. The concept of conformational diseases. Concept of natively unfolded proteins - the functionally active form of proteins in the cell.

4. PRACTICAL PART OF THE LESSON

Laboratory work No. Determining of total protein concentration in blood plasma by biuretic method.

Laboratory work is performed according to the publication "Biological Chemistry: Workbook" (in 2 parts, part 1) / Gritsuk A.I. [and etc.]. - Gomel: GomGMU, 2021 .- 76 p.

5. PROCESS OF THE LESSON

5.1 Introduction.

5.2 Solving problems by the interval method (independent work)

5.3 The theoretical part of the lesson: control questions are considered.

5.4 Practical part of the lesson: laboratory work is performed using a workbook on biological chemistry.

5.5 Control of mastering the topic, solving situational problems.

5.6 The final part of the lesson. Summing up, checking the protocols, announcing assignments for the next lesson.

6 QUESTIONS FOR KNOWLEDGE SELF-CONTROL

Self-control of knowledge on the topic "Structure and function of proteins" is carried out by computer testing using the Moodle platform, access mode: <https://dl.gsmu.by/mod/quiz/view.php?id=4622>

7. LIST OF REFERENCES:

1. Harper's Illustrated Biochemistry / Victor W. Rodwell [and oth.]. — 30th edit. -New York[and oth.] : McGraw-Hill Education, 2015. — 817 p.

2. Meisenberg, G. Principles of medical biochemistry / G. Meisenberg, W. H. Simmons. — 4th ed. -Philadelphia: Elsevier, [2017]. — xii, 617 p.

3. Vasudevan, D. M. Textbook of biochemistry for medical students / DM Vasudevan, S Sreekumari. — 5th ed. — New Delhi : Jaypee brothers medical publishers, 2009. — xvi, 535 p.

4. Gritsuk, A. I. Biochemistry. P. 1 : lectures, notes / A. I. Gritsuk, A. N. Koval ; Gomel state medical University, Department of biochemistry. — Gomel, 2016. — 380 p.