

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: Water and mineral salts. Metabolism of calcium and phosphorus. Microelements

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

Minerals are among the essential nutritional factors. The regulation of water-salt metabolism is an important part of the molecular mechanisms of regulation of metabolism in the norm, taking into account ontogenesis, the violation of which underlies the development of pathogenesis of various etiologies. Biochemical indicators of water-salt metabolism are widely used in evidence-based medicine not only for diagnosis, but also for monitoring treatment.

Purpose of the class: to consolidate ideas about the biological role of water and minerals, their participation in the metabolism of a living organism, individual tissues and organs, as well as the molecular mechanisms of regulation of water-salt metabolism, the violation of which is the cause and effect of various pathologies, which is necessary for the formation of social, personal and professional competencies, as well as educating students in a conscious attitude to their own health.

Class objectives: to form ideas about the role of water and mineral salts in metabolism, the mechanisms of their absorption in the gastrointestinal tract, the mechanisms of regulation of transport through the membrane, the role of Na^+/K^+ -ATP-ase in active ion transport, the significance of secondary sodium ion transport and glucose phosphorylation. During the lesson, students will master unified methods for determining calcium ions in biological fluids.

The student must know:

- 1.1. Classification of minerals;
- 1.2. Mechanisms of absorption of food components in the gastrointestinal tract;
- 1.3. Molecular mechanisms of transport of substances through biological membranes.

The student must be able to:

- 1.4. Work with automatic micropipettes;
- 1.5. Conduct research on a semi-automatic spectrophotometer;
- 1.6. Interpret the obtained biochemical parameters.

2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS

- 2.1. Electrolyte composition of blood, buffer systems of blood. Acid-base state (general chemistry).
- 2.2. Molecular mechanisms of transport of substances through membranes. Fundamentals of spectrophotometry (biology, medical biophysics).

3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

- 3.1. Minerals as essential nutritional factors. Classification, routes of entry of minerals into the body, absorption mechanisms and functions of minerals.
- 3.2. Electrolyte composition of biological fluids. Mechanisms of regulation of volume, electrolyte composition and pH of body fluids.
- 3.3. The role of the kidneys, gastrointestinal tract, skin and lungs in the regulation of water-salt metabolism. 3.2. Conditions and mechanisms for the occurrence of acidosis, alkalosis, dehydration and edema.
- 3.4. Features of distribution, regulation of metabolism and role in the body of sodium and potassium, calcium and phosphorus.

3.5. Biological role, mechanisms of absorption, transport and deposition of iron. Iron deficiency anemia, their diagnosis.

3.6 Microelements. The biological role and metabolism of copper, cobalt, iodine, magnesium, zinc, manganese, fluorine, selenium and chromium in the body.

4. PRACTICAL PART OF THE LESSON

4.1. Laboratory work No. 1 "Determination of calcium in urine by the Sulkovich method" is performed according to the publication "Biological Chemistry: Workbook" (in 2 parts, part 2) / A.N. Koval [and others]. - Gomel: GomSMU, 2020. - 88 p.

5. PROCEDURE OF THE LESSON

5.1. Introduction.

5.2. Theoretical part of the lesson: control questions are considered, an oral survey of students is conducted, the tasks of the SSART are analyzed.

5.3. Practical part of the lesson: laboratory work No. 1 "Determination of calcium in urine by the Sulkovich method" is performed according to the publication "Biological Chemistry: Workbook" (in 2 parts, part 2) / A.N. Koval et al. - Gomel: GomSMU, 2020. - Part 2 - 88 p.

5.4. The control of mastering the topic.

5.5. The final part of the lesson. Summing up, checking the protocols, announcement of tasks (as well as the topics of the abstract messages of the SSART) for the next lesson.

SSART to the topic Final lesson No. 4 in the sections: "Biochemistry of proteins and nucleic acids", "Biochemistry of nutrition".

6. QUESTIONS FOR SELF-CHECKING OF KNOWLEDGE

Self-control of knowledge on the topic "Water and mineral salts" is carried out by computer testing using the Moodle platform, Access mode: <https://dl.gsmu.by/course/view.php?id=81> or using the educational and methodological manual "Collection of test tasks in biological chemistry. 2 parts." Part 1: study method. allowance for independent work of 2nd year students of all faculty. honey. universities / Ministry of Health of the Republic of Belarus, EE "GomSMU";, Department. general, bioorganic and biological chemistry; A. I. Gritsuk [i dr.]. - Gomel: GomGMU, 2019. - pp. 55-78, Access mode: <https://elib.gsmu.by/handle/GomSMU/3658>

7. LITERATURE

1. Biochemistry: textbook / ed. E.S. Severin. - 5th ed., Rev. and additional - M.: GEOTAR-Media, 2020. - pp. 304-312. - Access mode:

<http://www.studmedlib.ru/book/ISBN9785970433126.html> – Access date: 01/12/22.

2. Schemes and reactions of the main metabolic pathways: textbook.-method. allowance for students of institutions of higher education. education, students in the specialties 1-79 01 01 "Medical business", 1-79 01 04 "Med.-diagnostic business" / Ministry of Health of the Republic of Belarus, Educational institution "GomSMU", Department. general, bioorganic and biological chemistry; A.I. Gritsuk [i dr.]. - Gomel: GomSMU, 2018. - 127 p. – Rec.

UMO on higher. med., pharmacist education. Page 101-102, 107-109, 113, 115-117, 121-123. - Access mode:<http://elib.gsmu.by/handle/GomSMU/9190>– Access date: 01/12/22.

3. Collection of test tasks in biological chemistry. 2 parts:

study method. allowance for independent work of 2nd year students of all faculty. honey. universities / Ministry of Health of the Republic of Belarus, EE "GomSMU", Department. general, bioorganic and biological chemistry; A. I. Gritsuk [i dr.]. - Gomel: GomSMU, Ch.1 2017, Ch.2 2019. - Ch.1 pp. 82-83, Ch.2 pp. 30-72. - Access mode:<https://elib.gsmu.by/handle/GomSMU/3658> – Access date: 05/15/2021.