

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: Blood biochemistry 2. Features of erythrocytes, leukocytes, and platelets metabolism.

Duration 4 hours

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

Gomel, 2025

1. LEARNING AND EDUCATIONAL GOALS, MOTIVATION FOR MASTERING THE THEME, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE:

Blood is a liquid consisting of two main components: plasma and cells (shaped elements). Formed elements are represented by three types of cells - erythrocytes, leukocytes, platelets. Blood plasma is a solution of proteins, electrolytes, monosaccharides, nitrogen-containing compounds, lipids. During blood coagulation, part of the proteins responsible for this process loses solubility and, together with formed elements, forms a clot.

Purpose of the class:

To form ideas about erythrocyte metabolism and regulation of the degree of Hb affinity for oxygen, the role of 2,3-BPG; to acquaint with the reactions of biosynthesis and degradation of heme; to systematize knowledge about the diagnostic value of the determination of bilirubin in various types of jaundice (hemolytic, parenchymal, obstructive); expand the concept of the features of the metabolism of leukocytes and platelets; to consolidate the material on the metabolism of iron and the mechanisms of its absorption, transport and deposition; to form the skills and abilities of determining the content of hemoglobin in the blood by the colorimetric method. To instill in students a sense of pride in their chosen profession and to form in them a culture of caring for their health.

Class objectives:

The student must know:

1. blood composition; structure and functions of shaped elements; basic physical and chemical constants of blood.
2. structure and properties of hemoglobin.
3. dissociation curves of oxymyoglobin and myoglobin.
4. features of glycolysis, pentose phosphate pathway and TCA in erythrocytes.
5. causes of peroxide processes and the role of antioxidant protection in erythrocytes.

The student must be able to:

1. determine the content of hemoglobin in the blood by colorimetric method.

2. CONTROL QUESTIONS FROM RELATED DISCIPLINES.

- 2.1. The structure of hemoglobin, its types and functions of blood, the hemostasis system (physiology).
- 2.2. Structure and properties of oligomeric proteins (bioorganic chemistry, molecular biology).

3. CONTROL QUESTIONS ON THE TOPIC OF THE CLASS:

3.1. Erythrocytes: general characteristics, structure, features of metabolism. Antioxidant protection of erythrocytes. Glutathione, its structure and functions.

3.2. Hemoglobin: structure, functions, allosteric properties, physiological and pathological forms. Comparative characteristics of Hb and myoglobin. The role of 2,3-BPG. Thalassemia, hemoglobinopathies.

3.3. Heme biosynthesis: reactions, enzymes, localization, regulation and biological role. Porphyria.

3.4. Hb degradation in RES cells. The exchange of bilirubin in the liver and further transformation in the gastrointestinal tract. Causes of occurrence and laboratory diagnosis of jaundice (hemolytic, parenchymal and obstructive).

3.5. Fe metabolism: absorption, transport in the blood, deposition, entry into tissues. Fe metabolism disorders: hemochromatosis, anemia (iron deficiency, sideroblastic, etc.).

3.6. Features of the metabolism of phagocytes. Biochemical basis of phagocytosis, respiratory burst. Features of the structure and metabolism of platelets, role in hemostasis.

3.7. Hypoxia, anoxia, types. Metabolic disorders during hypoxia.

3.8. General scheme of hemostasis.

4. PRACTICAL PART OF THE CLASS

Laboratory work No. 1 "Determination of hemoglobin content in the blood by a unified colorimetric method." Laboratory work No. 2 "Determination of the concentration of total bilirubin in blood serum by the unified Jendrassik-Grof method."

5. STUDY PROCEDURE.

5.1 Introduction

5.2 Theoretical part of the class

5.3 Practical part of the class: Laboratory work No. 1 "Determination of hemoglobin content in the blood by a unified colorimetric method." Laboratory work No. 2 "Determination of the concentration of total bilirubin in blood serum by the unified Jendrassik-Grof method." Laboratory work is carried out according to the teaching aid "Biochemistry. Practicum ": textbook. manual for students of institutions of higher education in medical specialties / A.I. Gritsuk, V.T. Svergun, A.N. Koval. - Gomel: GomGMU, 2014. - P. 143 - 145.

5.4 The control of mastering the topic.

5.5 The final part of the class. Summing up, checking the protocols, announcing tasks (as well as the topics of the SIWS abstract messages) for the next class.

6. QUESTIONS FOR SELF-CHECKING KNOWLEDGE

Self-control of knowledge on the topic "Blood-2.Hemoglobin exchange" is carried out by computer testing using the Moodle platform access mode:<https://dl.gsmu.by/course/view.php?id=81>

7. LITERATURE

1. Биохимия : учебник / под ред. Е.С. Северина. – 5-е изд., испр. и доп. – М.: ГЭОТАР-Медиа, 2020. – 768 с.: ил.
2. Схемы и реакции основных метаболических путей : учеб.-метод. пособие для студентов учреждений высш. образования, обучающихся по специальностям 1-79 01 01 "Лечеб. дело", 1-79 01 04 "Мед.-диагност. дело" / М-во здравоохранения РБ, УО "ГомГМУ", Каф. общей, биоорганической и биологической химии ; А.И. Грицук [и др.]. – Гомель: ГомГМУ, 2018. – 127 с. – Рек. УМО по высш. мед., фармацевт. образованию.
3. Baynes, J. W. Medical biochemistry / J.W. Baynes, M. H. Dominiczak ; ELSEVIER . – 2019. – 682 p.

4. Ferrier, D. R. Lippincott's Illustrated Reviews: Biochemistry / D. R. Ferrier ; Wolters Kluwer . – 2014. – 552 p.
5. Chatterjea, M. N. Textbook of Medical Biochemistry / M. N. Chatterjea, R. Shinde ; Jitendar P Vij. – 2012. – 876 p.
6. Vasudevan, D. M. Textbook of Biochemistry for Medical Students / D. M. Vasudevan, S. Sreekumari, K. Vaidyanathan ; Jitendar P Vij. – 2011. – 657 p.
7. Marks, D. B. Board Review Series: Biochemistry / D. B. Marks ; Harwal Publishing . – 1994. – 337 p.