

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 2<sup>nd</sup> year **students** of the Faculty of Foreign Students  
majoring in 1-79 01 04 "Medical Care"

**Topic:** Carbohydrates 3. Tissue carbohydrate metabolism. Gluconeogenesis. Pentose phosphate pathway. Blood glucose level regulation.

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

The content of glucose in the blood is the most important biochemical indicator of the state of carbohydrate metabolism. Regulation of blood glucose levels is carried out by a complex set of mechanisms that ensure the constancy of energy homeostasis for vital organs: the brain, retina, medulla of the kidneys and erythrocytes. The maintenance of normoglycemia is an example of one of the most perfect mechanisms for regulating homeostasis, in the functioning of which the liver, extrahepatic tissues and some hormones are involved.

**The purpose of the class:** to form an idea of the pathways of glucose metabolism in the cells of the body, the molecular and physiological mechanisms of regulation of the level of glucose in the blood. To master the technique of determining the concentration of glucose in saliva by the glucose oxidase method. Contribute to fostering a sense of pride in their chosen profession and to form a culture of respect for their health.

### **Class objectives:**

#### ***The student should know:***

1. Ways of glucose-6-phosphate metabolism in body tissues
2. tissue and intracellular localization, biological role, regulation of the pentose phosphate pathway
3. gluconeogenesis, intracellular and tissue localization of reactions and enzymes, hormonal regulation of GNG and its biological significance
4. "futile" cycles, their role in the regulation of metabolism
5. structure, role and synthesis of the main classes of glucosaminoglycans
6. mechanisms of regulation of blood glucose levels.

#### ***The student should be able to:***

1. determine the concentration of glucose in saliva by the glucose oxidase method and evaluate the diagnostic significance of the result obtained.

## 2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS

- 2.1 Metabolism and energy. Nutrition (human physiology)
- 2.2 The role of hypothalamic-pituitary regulation (physiology, endocrinology).

## 3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

3.1 Pentose phosphate pathway (PPP): intracellular and tissue localization of reactions and enzymes. Biological significance and regulation of PPP. Functions of PPP products.

3.2 Gluconeogenesis (GNG). Intracellular and tissue localization of reactions and enzymes. Substrate support of GNG. Glucose-lactate (Cori cycle) and glucose-alanine (Felig cycle) interorgan cycles. Substrate and hormonal regulation of GNG. "Futile" cycles, their role in regulation. The biological significance of GNG. Comparative characteristics of glycolysis and GNG.

3.3 Mechanisms of regulation of blood glucose levels. Urgent mechanism, ways of its implementation, the role of the central nervous system, hormones, substrates. The biological significance of the urgent mechanism.

3.4 Constant mechanism, the role of the hypothalamic-pituitary regulation, hormones

and substrates in its implementation. The value of GNG in its implementation. The biological significance of this mechanism.

3.5 Scheme of biosynthesis of the main classes of GAG, its regulation.

3.6 Functions of products of the pentose phosphate pathway.

3.7 Comparative characteristics of glycolysis and gluconeogenesis

#### 4. PRACTICAL PART OF THE LESSON

Laboratory work No. 1 "Analysis of saliva glucose level by enzymatic colorimetric method with glucose oxidase" is performed using a set of reagents for determining glucose in human serum without deproteinization (Glucose-Vital).

Laboratory work No. 2 "Determination of the concentration of pyruvic acid in urine" is carried out 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 The theoretical part of the lesson: control questions are considered, an oral survey of students is carried out, the tasks of the SSART are analyzed.

5.3 Practical part of the lesson: laboratory work No. 1 "Analysis of saliva glucose level by enzymatic colorimetric method with glucose oxidase" is performed experimentally according to the instructions. Laboratory work No. 2 "Determination of the concentration of pyruvic acid in urine" is performed using a workbook on biological chemistry.

5.4 Control of mastering the topic.

5.5 The final part of the lesson. Summing up, checking the protocols, announcing marks for the next lesson.

Control questions on the topic "Carbohydrates-4" include knowledge of the reactions of the pentose phosphate pathway.

#### 6 QUESTIONS FOR KNOWLEDGE SELF-CONTROL

Self-control of knowledge on the topic "Tissue metabolism of carbohydrates. Gluconeogenesis. Pentose phosphate pathway. Regulation of blood glucose levels" is carried out by computer testing using the Moodle platform. Access mode: <https://dl.gsmu.by/mod/quiz/view.php?id=5031>

#### 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.

5. Da Poian, A / Integrative Human Biochemistry. A Textbook for Medical Biochemistry (Second Edition) // A. T. Da Poian, M. A. R. B. Castanho. - Springer Nature Switzerland AG. - 2021. - 669 p.