

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

Department of Biological Chemistry

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**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:** Control class No. 2 on partition: "Biochemistry of carbohydrates"

Duration 4 hours

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

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

Monitoring educational activities allows you to evaluate the knowledge, skills and abilities acquired, get the necessary help on time and achieve the set learning goals, which creates favorable conditions for the development of cognitive abilities and the activation of independent work in the classroom.

### **The purpose of the class:**

Preview and systematize the material covered.

### **Class objectives:**

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

1. the main questions of the passed section “Biochemistry of carbohydrates”.

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

1. systematize the material covered.

## 2. CHECKLIST OF QUESTIONS FROM RELATED SUBJECTS (none)

## 3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

3.1 Digestion and absorption of carbohydrates in GIT. Types of digestion, their characteristics. Characterization of enzymes. The concept of the digestive-transport conveyor. The structure of fiber and its role in digestion.

3.2 Mechanisms of absorption of carbohydrates in the gastrointestinal tract. Role of  $\text{Na}^+/\text{K}^+$ -ATPase and transport proteins (GLUT and SGLT). Impairment of carbohydrate digestion and absorption, malabsorption syndrome: causes, pathogenesis and clinical manifestations.

3.3 Mechanisms of monosaccharides transport into cell: role of transporters (GLUTs, SGLTs),  $\text{Na}^+/\text{K}^+$ -ATPase, and hormones. Importance of glucose phosphorylation. Characteristics of glucokinase and hexokinase (plots). Ways of glucose-6-phosphate metabolism.

3.4 Galactose metabolism in normal and pathological conditions.

3.5 Fructose metabolism in normal and pathological conditions.

3.6 Glycogen structure and metabolism (glycogenesis and glycogenolysis): intracellular and organ localization, reactions, enzymes (classes), energy balance, biological value. Hormonal regulation of glycogen metabolism (role of hormones, cAMP,  $\text{Ca}^{2+}$ ). Hereditary glycogen metabolism disorders (glycogen storage diseases and aglycogenesis).

3.7 Anaerobic glycolysis: lactic fermentation. Intracellular and tissue localization, reactions, enzymes (classes), regulation, energy balance, biological value. The role of kinase reactions of glycolysis and glycolytic oxidoreduction.

3.8 Anaerobic glycolysis: alcohol fermentation. Localization, reactions, enzymes (classes), energy balance. Similarities and differences with lactic fermentation.

3.9 Ethanol metabolism in the body (characteristics of ADH, MEOS and catalase pathways). The mechanism of toxic effect of ethanol and formation of addiction.

3.10 Scheme of aerobic glycolysis. Pyruvate decarboxylation: organ and intracellular localization, enzymes (classes), coenzymes, reactions, regulation, biological role, energy

balance. The structure of the pyruvate dehydrogenase complex (PDC): enzymes, coenzymes, vitamins Pasteur and Crabtree effects.

3.11 Interorgan substrate cycles (Cori and Felig cycles). Role of gluconeogenesis (GNG) in interorgan cycles. Intracellular and tissue localization, regulation, biological value. GNG substrate and energy supply, intracellular and organ localization, regulation, biological value. GNG bypass reactions (scheme).

3.12 Glucose biosynthesis from alanine: reactions, enzymes (classes), energy balance, and biological value.

3.13 Glucose biosynthesis from aspartate: reactions, enzymes (classes), energy balance, and biological value.

3.14 Glucose biosynthesis from lactate: reactions, enzymes (classes), energy balance, and biological value.

3.15 Characteristics of pentose phosphate pathway (PPP). Intracellular and tissue localization, reactions, enzymes (classes), regulation, biological value.

3.16 Proteoglycans: structure, biological value. Synthesis (scheme of biosynthesis) and utilization of GAGs, their biological value. Mucopolysaccharidoses: classification, diagnosis, treatment.

3.17 Insulin: regulation of secretion, processing. insulin receptor. Mechanism of action and biological role of insulin. Normo-, hypo- and hyperglycemia. Causes, mechanism of occurrence and clinical manifestations.

3.18 Urgent mechanism of blood glucose level regulation. Liver glycogen mobilization (reactions, enzymes) under the influence of adrenaline action (scheme of signal transduction through  $\alpha$ - and  $\beta$ -adrenergic receptors), its significance.

3.19 Constant mechanism of blood glucose level regulation. Role of GNG, its substrate-level regulation. Glucose biosynthesis from glycerol: reactions, enzymes (classes), energy balance.

3.20 Mechanism of action and biological value of insulin. Mechanism of biochemical impairments development, metabolic disorders, clinical manifestation and complications at insular deficiency.

3.21 Diabetes mellitus: types, causes of absolute and relative insular deficiency, biochemical impairments and clinical manifestation.

3.22 Complications of diabetes mellitus, its diagnostics by clinical manifestations and laboratory parameters. Glycemic curve plotting. The principles of diabetes mellitus treatment.

**3.23 The third question of the variant includes norms, clinical and diagnostic value of blood plasma indicators, which tests were carried out in laboratory and practical classes: amylase activity, LDH, creatine kinase (CK) and  $\gamma$ -glutamyl transferase, as well as the concentration of total protein, glucose, lactate and iron.**

3.24 QUESTIONS FOR SELF STUDY AND ADDITIONAL RESEARCH TASKS (SSART) (none).

4. PRACTICAL PART OF THE LESSON (none)

5. PROCESS OF THE LESSON.

5.1 Introduction

5.2. Conducting a written test on the topics covered

5.3. Verification of laboratory protocols, SSART assignments.

5.4 The final part of the lesson. Summing up, announcement of assignments (as well as topics of abstracts of SSART) for the next class.

SSART to the topic "Lipids-1" are carried out according to the list of the topics.

Control questions on the topic "Lipids-1" include knowledge of the reactions of the following metabolic pathways: synthesis of TAG, synthesis of phosphatidylserine and phosphatidylcholine, synthesis of phosphatidylinositol and cardiolipin, synthesis of eicosanoids.

## 6. QUESTIONS FOR KNOWLEDGE SELF-CONTROL (none)

## 7. LIST OF REFERENCES:

The references are reproduced in the relevant sections of the manuals for the students on the topics of the section "Biochemistry of carbohydrates".