

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

Topic: Carbohydrates 4. Pathology of carbohydrate metabolism.

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

The state of carbohydrate metabolism is assessed by the content of glucose in the blood. Pathologies of carbohydrate metabolism can occur as a result of congenital insufficiency of enzymes of carbohydrate metabolism or be associated with defects in membrane transport systems. Diabetes mellitus is a disease characterized by absolute or relative insulin deficiency. According to the World Health Organization, diabetes mellitus is classified, taking into account the pathogenesis and clinical course, into two main forms: type I diabetes - insulin-dependent (IDDM) and type II diabetes - non-insulin dependent (NIDDM).

The purpose of the class: to form an understanding of the molecular mechanisms of the main disorders of carbohydrate metabolism, to study the causes of diabetes mellitus, biochemical changes and mechanisms of their development, methods of clinical and laboratory diagnosis of type I diabetes. Learn to apply the technique for determining the concentration of glucose in saliva by the glucose oxidase method to build a glycemic curve. 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. The role of glucose homeostasis in the vital activity of the body.
2. Causes, mechanism of occurrence and clinical manifestations of hypo- and hyperglycemia.
3. The role of insulin in tissue glucose metabolism, the structure of the insulin receptor.
4. The causes of type I diabetes mellitus.
5. Biochemical changes in insular insufficiency.
6. The main clinical manifestations of diabetes and their relationship with metabolic disorders.
7. Methods of clinical and laboratory diagnosis of diabetes mellitus.

The student should be able to:

1. build a glycemic curve and carry out its diagnostic assessment.

2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS.

- 2.1. Pathology of carbohydrate metabolism (pathological physiology)
- 2.2. Laboratory diagnostics of diabetes mellitus (clinical laboratory diagnostics)

3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

3.1 Impaired digestion and absorption of carbohydrates in the gastrointestinal tract, disaccharidase deficiency, the mechanism of development of diarrhea, ketoacidosis and hyperosmolarity, the main clinical manifestations.

3.2 Galactosemia, fructosuria. Causes of occurrence. Mechanisms for the development of complications. The main clinical manifestations.

3.3 The role of glucose homeostasis in the vital activity of the body. Regulation of blood glucose levels. Normo-, hypo- and hyperglycemia. Characteristics, causes,

mechanism of occurrence, their clinical manifestations. The role of insulin in tissue glucose metabolism. Stimulating and inhibiting insulin effects. Hyperinsulinism.

3.4 Diabetes mellitus type I (insulin-dependent diabetes mellitus of young people, IDDM). The reasons for its occurrence (absolute or relative deficit of insular effects). Biochemical changes in insular insufficiency, the mechanism of their occurrence and metabolic consequences:

- a. activation of glycogenolysis and GNG, hyperglycemia, glucosuria;
- b. lipolysis activation - hyperlipemia, ketonemia, ketonuria, ketoacidosis, hypercholesterolemia, dyslipoproteinemia;
- c. activation of proteolysis - hyperaminoacidemia, hyperammonemia;
- d. hyperosmolarity - violation of the water-electrolyte and acid-base state.

3.3 The main clinical manifestations of diabetes and their relationship with metabolic disorders (polydipsia, polyuria, polyphagia), complications of diabetes - impaired tissue regeneration, decreased barrier functions of the skin and mucous membranes, caries, atherosclerosis, angiopathy, neuropathy, blindness, etc. Comparative characteristics of diabetes mellitus type I and II.

3.4 Diagnosis of diabetes mellitus:

- a. clinical diagnostics - changes in water and electrolyte balance, appetite, multiple caries, etc.
- b. laboratory diagnostics: - determination of the level of glucose, ketone bodies in blood and urine on an empty stomach; - analysis of glycemic curves, construction technique and interpretation; - determination of the content of glycosylated hemoglobin, insulin, C-peptide in the blood.

3.5 Glycogenoses: the main types, causes and clinical manifestations.

3.6 Mucopolysaccharidoses: causes and main clinical manifestations.

3.7 Stimulating and inhibitory effects of insulin. Comparative characteristics of type I and type II diabetes.

4. PRACTICAL PART OF THE LESSON

Laboratory work No. 1 "Glycemic curve plotting" 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 "Glycemic curve plotting" 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 protocols.

6 QUESTIONS FOR KNOWLEDGE SELF-CONTROL

Self-control of knowledge on the topic "Pathology of carbohydrate metabolism" is carried out by computer testing using the Moodle platform, mode access: <https://dl.gsmu.by/mod/quiz/view.php?id=5032>

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.