

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: Biochemistry of liver. Xenobiotics 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. EDUCATIONAL AND UPBRINGING GOALS, MOTIVATION FOR MASTERING THE TOPIC, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE:

The liver plays an extremely important role not only in maintaining homeostasis, but also in general in ensuring the survival of the organism, since about 70% of all biochemical reactions occurring in the human body are localized in hepatocytes, and some of these reactions have strictly hepatic localized. Therefore, the study of the biochemical features of hepatocyte metabolism occupies an extremely important place in the structure of knowledge of future doctors.

The purpose of the class: to form ideas about metabolic heterogeneity of hepatocytes; expand concept of role of the liver in nitrogen, lipid, and carbohydrate metabolism; systematize ideas about role of the liver in hormonal homeostasis – hormone metabolism; to acquaint with the main ways of xenobiotics metabolism; to continue to acquaint with enzyme diagnostics of liver diseases; to form the skills and abilities to determine activity of alkaline phosphatase in blood plasma.

Class goals:

1.1 The student should know:

- Cellular composition of the liver, hepatocyte structure and functions.
- Features of the liver and hepatic beam blood supply.
- Metabolism of carbohydrates, lipids, and proteins.
- Microsomal oxidation.
- Vitamins and hormones metabolism and mechanism of action.
- Mechanisms of blood glucose level regulation.
- Mechanisms of homeostasis regulation.
- Principles of enzymodiagnosics.

1.2 The student must be able to:

- Work with micropipettes.
- Work with a semi-automatic biochemical analyzer.

2. CONTROL QUESTIONS FROM RELATED DISCIPLINES:

2.1 The cellular composition of the liver, the structure and functions of the hepatocyte. Features of the blood supply to the liver and hepatic beam (normal anatomy, histology).

2.2 Functional heterogeneity of hepatocytes. Mechanisms of hemostasis regulation. Metabolism and mechanism of action of vitamins and hormones. Mechanisms of regulation of blood glucose levels (physiology).

2.3 Metabolism of carbohydrates, lipids and amino acids. microsomal oxidation. Principles of enzyme diagnostics (bioorganic chemistry, normal physiology).

2.4 Conducting colorimetric analysis (general chemistry, medical and biological physics).

3. CONTROL QUESTIONS ON THE TOPIC OF THE CLASS.

3.1 Metabolic heterogeneity of hepatocytes (pericentral and periportal cells).

3.2 The role of the liver in carbohydrate metabolism (synthesis and breakdown of glycogen, gluconeogenesis), functional tests characterizing the role of the liver in carbohydrate metabolism (fructose and galactose tolerance tests, etc.).

3.3 The role of the liver in lipid metabolism (digestion and absorption of lipids, synthesis of

TG, PL, cholesterol, LP, ketone bodies). Functional tests characterizing the role of the liver in lipid metabolism (determination of Cholesterol and Cholesterol esters levels, etc.).

3.4 The role of the liver in nitrogen and pigment metabolism (plasma protein synthesis, urea synthesis, bilirubin metabolism). Functional tests characterizing the role of the liver in nitrogen metabolism (direct and indirect bilirubin, prothrombin index, determination of ammonia levels, etc.).

3.5 The role of the liver in hormonal homeostasis – metabolism of hormones in the liver.

3.6 The role of the liver in the metabolism of xenobiotics: biotransformation (microsomal oxidation, etc.) and conjugation (the role of PAPS, UDPGA, AA, etc.).

3.7 Enzymodiagnosics of liver diseases (diagnostical value of determining the AST, ALT, alkaline phosphatase, 5'-nucleotidase, cholinesterase, LAP, LDH, GGTP, aldolase activity, etc.). Biochemical mechanisms of development of hepatocellular insufficiency and hepatic coma. Biochemical methods for diagnosing liver dysfunction.

3.8 Hepatocellular insufficiency: pathogenesis and biochemical disorders.

3.9 Non-alcoholic fatty liver disease: biochemical mechanisms of development.

3.10 Detoxification of alcohol by the liver and biochemical mechanisms of the development of alcoholic liver disease.

4. PRACTICAL PART OF THE CLASS:

Laboratory work No. 1 "Determination of the activity of alkaline phosphatase in blood serum", Laboratory work No. 2 "Determination of the enzymatic activity of alkaline phosphatase in blood serum".

Laboratory work is performed according to the publication "Biological Chemistry: Workbook" (in 2 hours, part 2) / Koval A.N. [and etc.]. – Gomel: GomGMU, 2020, Part 2. – 88 p.

5. PROCESS OF THE CLASS:

5.1 Introduction

5.2 Theoretical part of the lesson: control questions are considered, the tasks of the UIRS are analyzed.

5.3 Practical part of the lesson: laboratory work is performed using a workbook in biological chemistry.

5.4 The control of mastering the topic.

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

6. QUESTIONS FOR SELF-CONTROL OF KNOWLEDGE:

Self-control of knowledge on the topic "Hormones-2" 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.