

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: Lipids 1. Structure, classification, and biological functions of lipids. Digestion and absorption. Lipoprotein 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

Lipids perform many important functions in the body: they are a direct and reserve source of energy, participate in thermoregulation, act as good electrical insulators, and together with proteins provide the formation of biological membranes. They are an important part of food and some of them are indispensable in nutrition.

Purpose of the class: to consolidate knowledge about the structure, functions and biological role of lipids, to form ideas about the molecular mechanisms of digestion and absorption of lipids in the gastrointestinal tract, as well as the chemical structure and metabolism of lipoproteins. To master the method of determining the concentration of high-density lipoproteins (HDL) in blood plasma. To promote the development of a sense of pride in the chosen profession and to form a culture of caring for one's health.

Class objectives:

The student must know:

- 1.1. Mechanisms of digestion and absorption of lipids in the gastrointestinal tract.
- 1.2. The sequence of reactions and the mechanism of resynthesis of phospholipids and triglycerides.
- 1.3. Structure, classification and chemical composition of lipoproteins (LP).
- 1.4. LP metabolism is normal. Exogenous and endogenous pathways of lipid transport in the body.
- 1.5. The role of LP receptors in lipid metabolism.

The student must be able to:

- 1.6. Analyse the concentration of high-density lipoproteins (HDL) in blood plasma and evaluate the diagnostic significance of the result.

2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS

- 2.1 Metabolism. Lipid digestion (human physiology).
- 2.2 Features of the structure and properties of lipids (bioorganic chemistry).

3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

- 3.1 Lipids - their structure, classification and biological role.
 - 3.1.1 Fatty acids and their derivatives (PG, LT, TxA), as well as:
 - 3.1.1.1 simple lipids: waxes, diols, triacylglycerols (TAGs);
 - 3.1.1.2 complex lipids: phosphoglycerides - phospholipids (PL) (phosphatides: cephalins, lecithins, serine phosphatides, inositol phosphatides, cardiolipins, plasmalogens); sphingolipids (sphingomyelins, cerebroside and gangliosides); glycolipids, sulfolipids, lipoproteins.
 - Isoprene derivatives;
 - steroids (sterols and sterides);
 - carotenoids (plant pigments, vitamins);
 - terpenes.
 - 3.2 The role of lipids in the construction of membranes. Modern models of membranes, their biological role.
 - 3.3 Digestion and absorption of lipids in the gastrointestinal tract. The structure and

function of bile acids. Fat emulsification mechanism. Hepato-intestinal cycle of bile acids. The value of lipases. Peculiarities of lipid digestion in infants.

3.4 Resynthesis of TAG and PL in enterocytes.

3.5 Lipoproteins (LP) - structure, classification, chemical composition, functional role of chylomicrons (HM), very low density LP (VLDL), intermediate density (LDL), low density (LDL), high density (HDL). LP metabolism is normal. Exogenous and endogenous pathways of lipid transport in the body.

3.6 The role of LP receptors in lipid metabolism.

4. PRACTICAL PART OF THE LESSON

Laboratory work No. 1 “Analysis of the concentration of high-density lipoproteins (HDL) in blood plasma” is performed practically using a set of reagents (Vital).

Laboratory work No. 2 “The effect of bile on lipase activity”, laboratory work No. 3 “Fat emulsification” and laboratory work No. 4 “Qualitative reaction to bile acids” are performed according to the publication “Biological Chemistry: Workbook” (in 2 parts, part 1) / Gritsuk A.I. [et al.]. - Gomel: GomSMU, 2021. - 76 p.

5. STUDY PROCESS

5.1 Introduction

5.2 Theoretical part of the lesson: control questions are considered, an oral survey of students is conducted, the tasks of the SSART are analyzed.

5.3 Practical part of the lesson: laboratory work No. 1 “Determining the concentration of high-density lipoproteins (HDL) in blood plasma” is performed experimentally according to the instructions; laboratory work No. 2 “The effect of bile on lipase activity”, laboratory work No. 3 “Fat emulsification”, laboratory work No. 4 “Qualitative reaction to bile acids” are 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 for the next lesson.

Control questions on the topic "Lipids-2" include knowledge of the reactions of the following metabolic pathways: catabolism of triacylglycerols, glycerol oxidation, β -oxidation of fatty acids (3 options), metabolism of ketone bodies.

6. QUESTIONS FOR SELF-CHECKING KNOWLEDGE

Self-control of knowledge on the topic “Lipids-1. Structure, classification and biological functions of lipids. Digestion and absorption. Lipoprotein metabolism” is carried out by computer testing using the Moodle platform. Access mode: <https://dl.gsmu.by/mod/quiz/view.php?id=5033>

7. LIST OF REFERENCES:

1. Harper's Illustrated Biochemistry / Victor W. Rodwell [et al.]. — 30th edit. -New York[et al.] : 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.