

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. 3 on partition: "Biochemistry of lipids"

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 EDUCATIONAL OBJECTIVES, MOTIVATION FOR COMPLETION OF THE TOPIC, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE

As a result of the lesson, the student must:

- Know the main questions of the passed section "Lipid Biochemistry".
- Be able to systematize the material covered.

## 2. CONTROL QUESTIONS FROM RELATED DISCIPLINES.

2.1 no

## 3. CONTROL QUESTIONS ON THE TOPIC OF THE LESSON.

3.1 General characteristics, classification and function of lipids. The biological significance of individual classes.

3.2 Digestion of lipids in the gastrointestinal tract. Lipid emulsification mechanism. The structure and biological role of bile acids. Hepatic-intestinal bile acid cycle. Types of steatorrhea and the reasons that cause them.

3.3 Absorption of lipids in the gastrointestinal tract. Resynthesis of lipids in enterocytes: reactions, enzymes and the biological role of TAG resynthesis. The role of TAG in the body. Energy balance of tristearate oxidation.

3.4 Transport of lipids in the blood. Lipoproteins - structure, classification. Role of apoproteins, LCAT, ALCAT and LPL.

3.5 Chemical composition, function and metabolism of chylomicrons. The role of lipoprotein lipase and apoproteins in chylomicron metabolism.

3.6 VLDL, LDL, LDL: chemical composition, function and metabolism. Role of apoproteins, LPL, hepatic lipase, ALCAT and receptors. Mechanism of LDL uptake by the cell.

3.7 Chemical composition, function and metabolism of HDL. Role of LCAT and apoproteins.

3.8 Mechanism of TAG mobilization in adipocytes: reactions, enzymes, regulation (the role of hormones, cAMP,  $Ca^{2+}$ ). The biological role of lipolysis products.

3.9 Exchange of acetyl-CoA (formation and disposal). The mechanism of activation and transport of fatty acids across the mitochondrial membrane. Stages of  $\beta$ -oxidation of saturated fatty acids with an even number of carbon atoms (reactions, enzymes). Energy balance of oxidation of palmitic acid (C16).

3.10 Exchange of acetyl-CoA (formation and disposal). The mechanism of activation and transport of fatty acids across the mitochondrial membrane. Stages of  $\beta$ -oxidation of saturated fatty acids with an odd number of carbon atoms (reactions, enzymes). Energy balance of C15 oxidation.

3.11 Exchange of acetyl-CoA (formation and disposal). The mechanism of activation and transport of fatty acids across the mitochondrial membrane. Stages of  $\beta$ -oxidation of unsaturated fatty acids (MUFA and PUFA) (reactions, enzymes) Energy balance of oleic acid oxidation (C18: 1).

3.12 Formation of glycerol upon mobilization of TAG. Oxidation of glycerol and its energy balance.

3.13 Acetyl-CoA exchange (formation and disposal). Ketone bodies: structure, biosynthesis, oxidation, physiological role. Causes of ketonuria and ketonemia.

3.14 Biosynthesis of saturated fatty acids: reactions, regulation and biological role. Role of acyl transfer protein, pantothenic acid, biotin, NADPH + H<sup>+</sup> and enzymes. Sources of acetyl-CoA for the biosynthesis of fatty acids.

3.15 Triglyceride biosynthesis: biological role, reactions, enzymes, regulation and role of insulin.

3.16 Biosynthesis of unsaturated fatty acids. Localization, mechanism, role of APB, reactions, enzymes. Physiological role of unsaturated fatty acids.

3.17 Biosynthesis of phospholipids: reactions, enzymes, regulation, biological functions, the role of PL in LP metabolism.

3.18 Cholesterol biosynthesis: reactions, enzymes, regulation, biological role. Exogenous and endogenous cholesterol. Norms of cholesterol in the blood.

3.19 Mechanism of regulation of lipid metabolism. Hormones affecting lipolysis and lipogenesis. Randle's fat-carbohydrate cycle, its physiological role. The relationship of ketone bodies, fatty acids and glucose. Integration of carbohydrate and lipid metabolism (scheme of pathways for the formation and use of common metabolites).

3.20 Hormones that control feeding behavior: leptin, ghrelin, etc. Formation of the fat depot. Obesity - types, development mechanism.

3.21 Fatty infiltration and liver degeneration. Causes, development mechanism and prevention of infiltration. The role of essential nutritional factors (methionine, choline). Lipidosis.

3.22 Causes of hypercholesterolemia. The role of the LDL receptor in the development of hypercholesterolemia. The main elements of the pathogenesis of atherosclerosis. Atherogenic coefficient. Formation of atherosclerotic changes in the vascular wall. Foam cells.

3.23 Dyslipoproteinemia. Friedrickson classification, biochemical and clinical and diagnostic characteristics of the main groups.

3.24 Membrane lipid peroxidation. Mechanism of occurrence, reactions, final metabolites. Eicosanoids as derivatives of arachidonic acid, their structure and biological role.

#### 4. PRACTICAL PART OF THE LESSON

4.1. No

#### 5. PROCESS OF THE LESSON.

5.1 Introduction

5.2. Conducting a written test on the topics covered

5.3. Verification of laboratory protocols, UIRS assignments.

5.4 The final part of the lesson. Summarizing.

#### 6 QUESTIONS FOR KNOWLEDGE SELF-CONTROL

6.1. No

#### 7. LITERATURE

1. Biochemistry: textbook / ed. E.S. Severin. - 5th ed., Rev. and add. - M.: GEOTAR-Media, 2020. - p. 364-448

2. Schemes and reactions of the main metabolic pathways: study guide. manual for

students of institutions of higher education. education, studying in the specialties 1-79 01 01 "General Medicine", 1-79 01 04 "Medical Diagnostic Business" / Ministry of Health of the Republic of Belarus, UO "GomGMU", Dept. general, bioorganic and biological chemistry; A.I. Gritsuk [and others]. - Gomel: GomGMU, 2018 .-- 127 p. - Rec. UMO for the highest. med., pharmacist. education. P. 47-67

The methodological development was made by the teaching staff of the Department of Biological Chemistry: Nikitina I.A., Koval A.N., Gromyko M.V., Mazanik M.E., Myshkovets N.S.

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