

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:** Lipids 3. Tissue lipid metabolism: lipid biosynthesis. Regulation and pathology of lipid 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 splitting of lipids provides from 30% to 40% of the energy required by the cells of various organs and tissues. The intensity and direction of lipid metabolism must fully correspond to the body's need for energy and plastic material. Accordingly, the issues of regulation of lipid metabolism at the level of the body, the relationship and coordination of the functioning of metabolic pathways for the synthesis of lipids and the exchange of compounds of other classes that provide cells with the energy they need are relevant. The effective work of regulatory and coordinating mechanisms contributes to the adaptation of the organism to changing conditions of existence.

**Purpose of the class:** to form ideas about the biosynthesis of saturated and unsaturated fatty acids, the biosynthesis of cholesterol; consolidate knowledge about the mechanisms of regulation of lipid metabolism, focus on hormones that regulate lipolysis and lipogenesis; to consolidate the educational material on the integration of lipid and carbohydrate metabolism. To master the method of determining the concentration of total cholesterol in blood plasma by enzymatic colorimetric method. 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 should know:***

- 1.1. Biosynthesis of saturated and unsaturated fatty acids.
- 1.2. The sequence of reactions and the mechanism of cholesterol biosynthesis.
- 1.3. Molecular mechanisms of lipid metabolism disorders, hormones that regulate lipolysis and lipogenesis.
- 1.4. Ways of integration of lipid and carbohydrate metabolism.
- 1.5. Fat-carbohydrate Randle cycle, mechanism and physiological significance.

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

- 1.6. Analyze the concentration of total cholesterol in blood plasma by enzymatic colorimetric method and evaluate the diagnostic significance of the result.

## 2. CHECKLIST OF THE QUESTIONS FROM RELATED SUBJECTS

- 2.1 Structure and classification of lipids (bioorganic chemistry)
- 2.2 The device and principle of operation of the photoelectrocolorimeter (biomed. physics)

## 3. CHECKLIST OF CONTROL QUESTIONS FOR THE LESSON

3.1 Biosynthesis of saturated fatty acids. Role of acyl transfer protein (ACP), pantothenic acid, biotin, NADPH + H<sup>+</sup> and enzymes. Sources of acetyl-CoA for the biosynthesis of fatty acids (FA). Regulation of FA biosynthesis. The scheme of the structure of the poly-enzyme complex of fatty acid synthase.

3.2 Biosynthesis of triacylglycerols (TAG) and phospholipids.

3.3 Cholesterol biosynthesis, its regulation, biological role of cholesterol. Cholesterol pool in the cell, its regulation.

3.4 The mechanism of regulation of lipid metabolism. Hormones that regulate lipolysis and lipogenesis. Integration of lipid and carbohydrate metabolism. Ketone bodies

during fasting.

3.5 Fat-carbohydrate Randle cycle. The triacylglycerol cycle is fatty acids. Their mechanisms and physiological significance. The relationship of ketone bodies, FFA and glucose.

3.6 Pathology of lipid digestion, absorption, transportation and metabolism:

3.6.1 Impairments of digestion and absorption of lipids, its manifestations.

3.6.2 Fatty infiltration and degeneration of the liver - mechanisms of development and prevention.

3.6.3 Obesity - types, mechanisms of development and complications. The concept of metabolic syndrome.

3.6.4 Dyslipoproteinemia. Classification by Fredrickson, biochemical and clinical diagnostic characteristics of the main groups.

3.6.5 Lipidoses are hereditary disorders of lipid metabolism.

3.6.6 Peroxidation of membrane lipids. Reactions, metabolites. Biological significance in normal and pathological conditions.

3.6.7 Antioxidant protection (see the topic "Biological oxidation").

#### 4. PRACTICAL PART OF THE LESSON

Laboratory work No. 1 "Analysis of total cholesterol concentration in blood plasma by the enzymatic colorimetric method" is performed practically using a set of reagents (Vital). This work is also being worked out theoretically according to the publication "Biological Chemistry: Workbook" (in 2 parts, part 1) / Gritsuk A.I. [et al.]. - Gomel: GomSMU, 2019. - 77 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.

5.3 Practical part of the lesson: laboratory work No. 1 "Analysis of total cholesterol concentration in the blood plasma by the enzymatic colorimetric method" is performed experimentally and 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 protocols.

#### 6. QUESTIONS FOR SELF-CHECKING KNOWLEDGE

Self-control of knowledge on the topic "Tissue lipid metabolism: lipid biosynthesis. Regulation and pathology of lipid metabolism" is carried out by computer testing using the Moodle platform or using the educational and methodological manual "Collection of test tasks in biological chemistry. 2 parts." Part 1: study method. allowance for independent work of 2nd year students of all faculty. honey. universities / Ministry of Health of the Republic of Belarus, EE "GomSMU", Department. general, bioorganic and biological chemistry; A. I. Gritsuk [et al.]. - Gomel: GomSMU, 2019. - pp. 30-55.

#### 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.