

Ministry of Health of the Republic of Belarus  
Educational institution  
"Gomel State Medical University"

Department of Biological Chemistry

Authors:

O.S. Logvinovich, Head of the Department, PhD (Biol. Sci.), Associate Professor

A.N. Koval, Associate Professor (position and title), PhD (Biol. Sci.)

A.V. Litvinchuk, Associate Professor (position and title), PhD (Biol. Sci.)

M.V. Gromyko, Senior Lecturer

**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. 4 on partitions: "Biochemistry of proteins and nucleic acids",  
"Biochemistry of nutrition"

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. LEARNING AND EDUCATIONAL GOALS, MOTIVATION FOR MASTERING THE THEME, REQUIREMENTS FOR THE INITIAL LEVEL OF KNOWLEDGE

The control of educational activity allows you to evaluate the knowledge, skills and abilities you receive, get the necessary help in time and achieve your learning goals, which creates favorable conditions for the development of cognitive abilities and the activation of independent work in the classroom.

### **Purpose of the lesson:**

Review and systematize the material covered.

### **Lesson objectives:**

#### ***The student must know:***

1. the main questions of the passed sections "Biochemistry of proteins and nucleic acids", "Biochemistry of nutrition"

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

2. organize the material covered.

## 3. TEST QUESTIONS FROM RELATED DISCIPLINES (none)

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

4.1 Interchangeable and irreplaceable AK. Integration of protein, carbohydrate and lipid metabolism. amino acid pool of the cell. Biosynthesis of non-essential AAs from glucose (examples). nitrogen balance.

4.2 Digestion of proteins in the gastrointestinal tract. Mechanism of HCl secretion, its role. Activation and mechanism of action of proteolytic enzymes. The role of the pH gradient of various parts of the gastrointestinal tract in protein digestion.

4.3 Mechanisms of absorption of amino acids in the gastrointestinal tract. Putrefaction of proteins in the large intestine. Neutralization of protein decay products in the liver.

4.4 Types of deamination. Direct and indirect oxidative deamination of AA. Transamination (enzymes and coenzymes). The significance of this process for cells.

4.5 Ammonia, its toxicity. Ways to detoxify ammonia. Ammoniogenesis, CSM. Process localization. Reactions, enzymes, meaning. Relationship of CSM with TCA and amino acid metabolism. Energy capacity of the CSM. Enzymopathies of the CSM.

4.6 Decarboxylation of amino acids (Trp, Tyr, His, Glu). Enzymes. Coenzymes. Biogenic amines, their role. Glycogenic and ketogenic amino acids. Pathways for entry of amino acids into the TCA.

4.7 Ser and Gly metabolism: biosynthesis of choline, ethanolamine, purine bases, heme, creatine, GSH, hippuric acid, bile acids. The role of THPA in the exchange of Ser and Gli. Gli metabolism disorders.

4.8 Glu and Asp: amination, deamination, transamination, decarboxylation. The role of Glu and Asp in metabolism.

4.9 Exchange Met. S-adenosylmethionine (SAM): its role in the synthesis of choline, adrenaline, carnitine, creatine, anserine, etc.

4.10 Phen and Tyr exchange: biosynthesis of catecholamines, thyroid hormones. Metabolism disorders Fen and Tyr (phenylketonuria, alkaptonuria, albinism).

4.11 The structure of nucleoproteins, structural features of ribosomes and

chromosomes. Exchange of nucleoproteins. Digestion and absorption of nucleic acids.

4.12 Biosynthesis and degradation of pyrimidine nucleotides. The role of THPA in the synthesis of pyrimidine nucleotides.

4.13 Biosynthesis (initial substrates, regulation) and degradation of purine nucleotides. Purine metabolism disorders (gout, Lesch-Nyhan syndrome).

4.14 The structure of nucleic acids: DNA and RNA. Structural features of mtDNA. Examples of mitochondrial diseases.

4.15 Matrix mechanism of DNA synthesis (replication and repair). Stages, enzymes, substrates. The significance of these processes for the body. Characteristics of the genetic code.

4.16 Transcription. Stages, enzymes, substrates, products. i-RNA processing and splicing. Alternative splicing. Features of transcription in viruses. The role of reverse.

4.17 Central dogma of molecular biology. Broadcast. Stages, enzymes, substrates. The significance of this process for the body. Processing of proproteins, its mechanisms: chemical modification, limited proteolysis, self-assembly of molecules.

4.18 Vitamin D. Regulation of Ca-P metabolism. parathormone and calcitonin. Violation of Ca-P exchange. Rickets, osteomalacia, osteoporosis, causes and main clinical manifestations.

4.19 Vitamins A, E, K. Chemical nature, role in metabolism. Intervitamin relationships on the example of antioxidant vitamins. A picture of hypo- and hypervitaminosis.

4.20 Vitamin PP and its coenzymes. Chemical nature, role in metabolism (on the example of PCDHC, TCA, glycolysis, PFP, participation in the work of DC Mx, etc.). A picture of hypovitaminosis.

4.21 Vitamin B1 and its coenzyme. Chemical nature, role in metabolism (direct and indirect oxidative decarboxylation, transketolase reactions of PFP). Intervitamin relationships on the example of PVKDGk. A picture of hypovitaminosis.

4.22 Vitamin B2 and its coenzymes. Chemical nature, role in metabolism (for example, TCA,  $\beta$ -oxidation of fatty acids, PVCDHA, structures of DC Mx complexes, etc.). A picture of hypovitaminosis.

4.23 Vitamin B6 and its coenzyme. Chemical nature, role in metabolism (for example, the reaction of decarboxylation (Trp, Tyr, Gln, Glu) and amino acid transamination (Asp, Ala)). A picture of hypovitaminosis.

4.24 Vitamin H and its coenzyme. Chemical nature, role in metabolism (on the example of carboxylation reactions in GNG,  $\beta$ -oxidation of fatty acids with an odd number of carbon atoms, synthesis of fatty acids). A picture of hypovitaminosis.

4.25 Vitamin B9 and its coenzyme. Chemical nature, role in metabolism (synthesis of pyrimidines and purines, role in Met, Ser and Gly metabolism). Vitamin B12 and its coenzymes. Chemical nature, role in metabolism (reactions of  $\beta$ -oxidation of fatty acids with an odd number of carbon atoms, role in Met metabolism). Intervitamin relationships of vitamins B9 and B12 on the example of Met metabolism.

4.26 Vitamin C. Chemical nature, role in metabolism (hydroxylation reactions, AOD, participation in the work of DC Mx).

4.27 Hormones. Definition. Properties. Nomenclature, classification. Principles of organization and functioning of the neuroendocrine system. Examples.

4.28 The mechanism of action of hormones (catecholamines, peptide, steroid,

thyroid). Characterization of receptors (1-TMS, 7-TMS, intracellular).

4.29 TG: chemical nature, regulation of secretion, mechanism of action. T3, T4: chemical nature, synthesis reactions, regulation of secretion, mechanism of action, role in metabolism, metabolism in tissues, main clinical manifestations of hypo- and hyperproduction of T3 and T4.

4.30 STH: chemical nature, regulation of secretion, mechanism of action, mechanism of anabolic and contra-insular effects, main clinical manifestations of hypo- and hyperproduction.

4.31 Insulin, glucagon, somatostatin: chemical nature, regulation of secretion, mechanism of action, role in metabolism, main clinical manifestations of hypo- and hyperinsulinism.

4.32 ACTH: chemical nature, mechanism of action, main clinical manifestations of hypo- and hyperproduction. Glucocorticoids: structure, regulation of synthesis and secretion, metabolism in tissues, mechanism of action, role in metabolism, main clinical manifestations of hypo- and hypercorticism.

4.33 ACTH: chemical nature, mechanism of action, main clinical manifestations of hypo- and hyperproduction. Mineralocorticoids: structure, regulation of secretion, metabolism in tissues, mechanism of action, role in metabolism, main clinical manifestations of hypo- and hyperproduction.

4.34 Catecholamines: site of synthesis, synthesis reactions, regulation of secretion, metabolism in tissues, mechanism of action, role in metabolism.

4.35 Gonadotropins, FSH, LH: chemical nature, mechanisms of regulation of secretion, mechanism of action. Androgens: structure, regulation of secretion, mechanism of action, role in metabolism, tissue metabolism, main clinical manifestations of hypo- and hyperproduction.

4.36 Gonadotropins, FSH, LH: chemical nature, mechanisms of regulation of secretion, mechanism of action. Estrogens: structure, regulation of secretion, mechanism of action, role in metabolism, tissue metabolism, main clinical manifestations of hypo- and hyperproduction.

4.37 The adaptive role of hormones. Stress: main manifestations, stages and their clinical significance. The concept of distress and eustress. Hormonal regulation of energy metabolism under stress.

3.38 SSART questions: no

## 5. PRACTICAL PART OF THE LESSON (no)

## 6. STUDY PROCEDURE.

### 5.1 Introduction

### 5.2. Writing a written test on the topics covered

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

SSART to the topic "Biochemistry of blood-1":

**Exercise 1.** Complete the scheme of Figure 1 with the following terms:  $K^+$ , urea, fibrinogen,  $SO_4^{2-}$ ,  $Ca^{2+}$ , plasma, albumins,  $HCO_3^-$ , erythrocytes, globulins,  $Mg^{2+}$ , dry residue,  $Na^+$ , electrolytes, cations,  $Cl^-$ ,  $HPO_4^{2-}$ , organic substances, glucose, creatinine, organic acids, leukocytes, platelets.

**Task 2.** Draw a diagram of electrophoresis of blood serum proteins and complete the following tasks:

- a) write down the names of the protein fraction;
- b) indicate the positions of the cathode and anode;
- c) indicate the location of the blood serum sample before electrophoresis and explain this location;
- e) indicate what factors influence the speed of movement of protein molecules during their electrophoretic separation.

Control questions on the topic "Blood-1" include knowledge of the main biochemical constants of blood.

## 7. QUESTIONS FOR SELF-CHECKING KNOWLEDGE (no)

## 8. LITERATURE

1. Biochemistry: textbook / ed. E.S. Severin. - 5th ed., Rev. and additional - M.: GEOTAR-Media, 2020. - pp. 123-224, 449-603

2. Schemes and reactions of the main metabolic ways: textbook.-method. allowance for students of institutions of higher education. education, students in the specialties 1-79 01 01 "Medical business", 1-79 01 04 "Med. diagnostic business" / Ministry of Health of the Republic of Belarus, Educational Establishment "GomGMU", Department. general, bioorganic and biological chemistry; A.I. Gritsuk [i dr.]. - Gomel: GomGMU, 2018. - 127 p. – Rec. UMO on higher. med., pharmacist education. Page 68-106