

BIOLOGICAL CHEMISTRY.
THE BANK OF TESTS FOR KROK 1.
FOR FOREIGN CITIZENS TRAINING DEPARTMENT
STUDENTS
DENTISTRY SPECIALTY.

Module № 2

I. Biochemistry. Biomolecules, metabolic pathways.

1. Before prescribing protein-containing parenteral feeding to a patient, a doctor sent the patient's blood to a laboratory to determine the electrophoretic spectrum of proteins. What physico-chemical properties of proteins is this method based on?
 - A. Viscosity.
 - B. Presence of charge.
 - C. Inability to denaturation.
 - D. Solubility and capacity for swelling.
 - E. Optical activity.
2. Hemoglobin of an adult person is a tetramer consisting of two identical α - and two identical β - polypeptide chains. What is this kind of the protein structure called?
 - A. Primary.
 - B. Secondary.
 - C. Tertiary.
 - D. Quaternary.
 - E. Peptide.
3. The conjugated proteins necessarily contains special component as a non- protein part. Choose the substance that can't carry out this function:
 - A. Thiamine pyrophosphate
 - B. HNO_3
 - C. ATP
 - D. AMP
 - E. Glucose
4. Different functional groups can be present in the structure of L-amino acid's radicals. Identify the group that is able to form ester bond:
 - A. $-\text{COOH}$
 - B. $-\text{OH}$
 - C. $-\text{SH}$
 - D. $-\text{NH}_2$
 - E. $-\text{COH}$

II. Enzymes.

1. Structure of enzymes. Cofactors and coenzymes. Classification and nomenclature of enzymes.

1. Only one factor can influence the charge of amino acid radicals in the active centre of enzyme. Name this factor:
 - A. The presence of a competitive inhibitor
 - B. The surplus of a product
 - C. pH medium
 - D. Pressure
 - E. Temperature
2. Proteins digestion in the stomach constitutes the initial stage of protein destruction in a human digestive tract. Name the enzymes, which take part in the protein digestion in the stomach.

- A. Chymotrypsin and lysozyme.
 - B. Trypsin.
 - C. Pepsin and gastrin.
 - D. Enteropeptidase and elastase.
 - E. Carboxypeptidase and aminopeptidase.
3. Persons suffering from alcoholism get the bulk of calories with alcohol drinks. They usually have typical deficiency of thiamine (Wernicke-Korsakov syndrome) that impairs the function of the nervous system, leads to psychoses, loss of memory etc. The decreased activity of what enzyme is the cause of the development of this syndrome?
- A. Alcohol dehydrogenase.
 - B. Pyruvate dehydrogenase.
 - C. Transaminase.
 - D. Aldolase.
 - E. Hexokinase.
4. In human saliva there is an enzyme that renders potent bactericidal action due to the ability to destroy peptidoglycans of the bacterial wall. Name this enzyme.
- A. Phosphatase.
 - B. α -Amylase.
 - C. Trypsin.
 - D. Lysozyme.
 - E. Ribonuclease.
5. For diagnostics of certain illnesses the determination of blood transaminases activity is required. Which vitamin is a component of the cofactor for this enzymes?
- A. B₁
 - B. B₂
 - C. B₃.
 - D. B₅.
 - E. B₆
6. In human saliva there is an enzyme able to hydrolyze the α -1,4-glucosidic bonds in the molecule of starch. Name this enzyme.
- A. α -Amylase.
 - B. Phosphatase.
 - C. Fructofuranosidase.
 - D. β -Galactosidase.
 - E. Lysozyme.

2. Enzymes activation and inhibition. Regulation of enzyme activity.

1. Succinate dehydrogenase catalyses the dehydrogenation of succinate. Malonic acid HOOC - CH - COOH is used to interrupt the action of this enzyme. Choose the inhibition type:
- A. Limited proteolysis
 - B. Competitive
 - C. Non-competitive
 - D. Dephosphorylation
 - E. Allosteric
2. A structural analogue of vitamin B₂ — **acriflavine** — is prescribed in case of enterobiosis. The disturbance of the synthesis of what enzymes of microorganisms does this preparation cause?
- A. Cytochrome oxidase.
 - B. FAD-dependent dehydrogenases.
 - C. Peptidases.
 - D. NAD-dependent dehydrogenases.
 - E. Amino transferases.

3. Potassium cyanide is a very dangerous poison that causes instantaneous death of a human organism. What mitochondrial enzyme is affected by potassium cyanide?
- Cytochrome P₄₅₀.
 - Flavine enzymes.
 - Cytochrome b.
 - NAD⁺-dependent dehydrogenases.
 - Cytochrome oxidase (cytochrome aa₃).
4. In a human body chymotrypsin is produced by the pancreas as the inactive precursor called chymotrypsinogen. What intestinal lumen enzyme leads to the transforming of chymotrypsinogen into the catalytically active enzyme molecule?
- Aminopeptidase.
 - Enterokinase.
 - Pepsin.
 - Trypsin.
 - Carboxypeptidase.
5. What medicines should be prescribed to a patient with acute pancreatitis to prevent pancreas autolysis?
- Proteases activators.
 - Proteases inhibitors.
 - Trypsin.
 - Chymotrypsin.
 - Amylase.
6. In the practice of alcoholism treatment, the use of desulphiram, which is the inhibitor of alcohol dehydrogenase, is widespread. The increase of what metabolite in blood results in the evolving of disgust to alcohol?
- Methanol.
 - Ethanol.
 - Malonic dialdehyde.
 - Propionic aldehyde.
 - Acetic aldehyde.
7. During the necropsy of a 20-year-old girl a pathologist concluded that the death of the patient had resulted from poisoning by cyanides. The activity of what enzyme is mostly inhibited by cyanides?
- Malate dehydrogenase.
 - Cytochrome oxidase.
 - Heme synthase.
 - Aspartate aminotransferase.
 - Carbamoyl phosphate synthetase.
8. Post-translational covalent modification is an important factor in the regulation of the enzymes' activity. Choose the mechanism of regulation of glycogen phosphorylase and glycogen synthetase activities from the following:
- ADP-ribosylation.
 - Methylation.
 - Adenylation.
 - Restricted proteolysis.
 - Phosphorylation-dephosphorylation.
9. Treatment course of bacterial pneumonia included benzylpenicillin sodium salt. What is the mechanism of its antimicrobial action?
- Inhibition of the intracellular protein synthesis
 - Inhibition of the SH enzyme groups of the microorganisms
 - Inhibition of cell wall synthesis of the microorganism
 - Inhibition of the cholinesterase activity

- E. Antagonism with the paraaminobenzoic acid.
10. Certain infections caused by bacteria are treated with sulphanilamides that block the synthesis of bacterial growth factor. What is the mechanism of these drugs action?
- They are antivitamins of p-aminobenzoic acid
 - They inhibit the folic acid absorption
 - They are allosteric enzyme inhibitors
 - They are involved in redox processes
 - They are allosteric enzyme activators
11. Cyanide poisoning causes immediate death. What is the mechanism of cyanide effect at the molecular level?
- They inhibit cytochromoxidase
 - They bind substrates of tricarboxylic acid cycle
 - They block succinate dehydrogenase
 - They inactivate oxygene
 - They inhibit cytochrome B

3. Medical enzymology.

1. Researchers isolate 5 isoenzymic forms of lactate dehydrogenase from the human blood serum and studied their properties. What property indicates that the isoenzymic forms were isolated from the same enzyme?
- The same physicochemical properties
 - Catalyzation of the same reaction
 - The same electrophoretic mobility
 - Tissue localization
 - The same molecular weight
2. The protective function of human saliva is realized in some ways, including the presence of an enzyme which shows bactericidal action accomplished by the lysis of membrane polysaccharides complexes of staphylococci and streptococci. Choose this enzyme from the following:
- Collagenase.
 - β - Amylase.
 - Oligo[1 \rightarrow 6]-glucosidase.
 - Lysozyme.
 - β -Glucuronidase.
3. The formation and secretion of trypsin is disturbed in case of pancreas diseases. The hydrolysis of which of the following substances is impaired in this case?
- Proteins.
 - Lipids.
 - Carbohydrates.
 - Nucleic acids.
 - Phospholipids.
4. In a patient's blood the activities of lactate dehydrogenase (LDH₄, LDH₅), alanine aminotransferase, carbamoyl ornithintransferase are increased. What organ is the pathological process developing in?
- In skeletal muscles.
 - In the myocardium (myocardial infarction is possible).
 - In the liver (hepatitis is possible).
 - In kidneys.
 - In connective tissue.
5. The activities of lactate dehydrogenase (LDH₁, LDH₂), aspartate aminotransferase, creatine kinase in the blood of a patient are increased. In which of the following organs is the pathological process probably developing?
- In the myocardium (the initial stage of myocardial infarction).

- B. In the skeletal muscles (dystrophy, atrophy).
 - C. In the kidneys and adrenal glands.
 - D. In the connective tissue.
 - E. In the liver and kidneys.
6. Pathological processes associated with the development of hypoxia can be caused by incomplete reduction of an oxygen molecule in the electron transport chain and accumulation of hydrogen peroxide. Choose the enzyme which breaks the hydrogen peroxide.
- A. Catalase.
 - B. Cytochrome oxidase.
 - C. Succinate dehydrogenase.
 - D. α -Ketoglutarate dehydrogenase.
 - E. Aconitase.
7. A 47-year-old patient was brought to an emergency department with the diagnosis of myocardial infarction. What lactate dehydrogenase (LDH) fraction's activity would prevail in the patient's blood serum during the first two days after hospitalization?
- A. LDH₄
 - B. LDH₆
 - C. LDH₃
 - D. LDH₁
 - E. LDH₅
8. A 50-year-old woman was brought to an emergency clinic with the diagnosis of myocardial infarction. The activity of what enzyme will prevail in her blood plasma during the first two days after hospitalization?
- A. Alkaline phosphatase.
 - B. γ -Glutamyl transpeptidase.
 - C. Aspartate aminotransferase.
 - D. Acidic phosphatase.
 - E. Hexokinase.
9. After 12 hours of acute pain behind the breastbone, the essential rise of blood plasma aspartate aminotransferase activity occurred. What pathology are the mentioned symptoms typical of?
- A. Collagenose.
 - B. Viral hepatitis.
 - C. Myocardial infarction.
 - D. Insulin dependent diabetes mellitus.
 - E. Diabetes insipidus.
10. A 27-year-old patient was found having pathological signs in the liver and cerebrum. A sharp decrease of copper level was determined in the blood plasma, whereas the urine concentration of the metal proved to be increased. A supposed diagnosis is Willson's disease. What blood plasma enzyme activity is it necessary to test to confirm the diagnosis?
- A. Xanthine oxidase.
 - B. Carboanhydrase.
 - C. Ceruloplasmin.
 - D. Leucine aminopeptidase.
 - E. Alcohol dehydrogenase.
11. The determination of activity of what enzyme in the urine is required as a diagnostic test for the verification of acute pancreatitis?
- A. Amylase.
 - B. Lactate dehydrogenase.
 - C. Creatine kinase.
 - D. Aldolase.
 - E. Alanine aminopeptidase.
12. The dramatic rise of a certain enzyme activity in the blood and urine of a patient who

suffered from acute pancreatitis was detected. Name this enzyme.

- A. α -Amylase.
- B. Pepsin.
- C. Dipeptidase.
- D. Saccharase.
- E. Lactase.

13. The determination of which of the below listed enzymes is most informative for the disease during the first hours after the myocardial infarction?

- A. Glutamate dehydrogenase.
- B. Aspartate aminotransferase.
- C. Alanine aminotransferase.
- D. Lactate dehydrogenase.
- E. Creatine kinase.

14. A newborn child had dyspepsia phenomena (diarrhea, vomiting) detected after feeding with milk. After additional feeding with glucose the morbid symptoms disappeared. The insufficient activity of what enzyme that takes part in the carbohydrates breakdown causes the indicated disorders?

- A. Saccharase.
- B. Amylase.
- C. Lactase.
- D. Isomaltase.
- E. Maltase.

15. 12 hours after an acute attack of retrosternal pain a patient presented a jump of aspartate aminotransferase activity in blood serum. What pathology is this deviation typical for?

- A. Myocardium infarction
- B. Diabetes insipidus
- C. Collagenosis
- D. Diabetes mellitus
- E. Viral hepatitis

16. A 30-year-old male patient with acute pancreatitis has been found to have a disorder of cavity protein digestion. The reason for such condition can be the hyposynthesis and hyposecretion of the following enzyme:

- A. Pepsin
- B. Dipeptidase
- C. Amylase
- D. Lipase
- E. Trypsin

17. A 46-year-old female patient has a continuous history of progressive muscular (Duchenne's) dystrophy. Which blood enzyme changes will be of diagnostic value in this case?

- A. Pyruvate dehydrogenase
- B. Lactate dehydrogenase
- C. Creatine phosphokinase
- D. Glutamate dehydrogenase
- E. Adenylate cyclase

18. A 49-year-old driver complains about unbearable constricting pain behind the breastbone irradiating to the neck. The pain arose 2 hours ago. Objectively: the patient's condition is grave, he is pale, heart tones are decreased. Laboratory studies revealed high activity of creatine kinase and LDH₁. What disease are these symptoms typical for?

- A. Acute myocardial infarction
- B. Diabetes mellitus
- C. Acute pancreatitis
- D. Cholelithiasis

E. Stenocardia

19. A newborn develops dyspepsia after the milk feeding. When the milk is substituted by the glucose solution the dyspepsia symptoms disappear. The newborn has the subnormal activity of the following enzyme:

- A. Amylase
- B. Maltase
- C. Invertase
- D. Isomaltase
- E. Lactase.

III. Bioenergetics. Introduction to the metabolism and energy exchange.

Tissue respiration and oxidative phosphorylation.

1. What mitochondrial enzyme is affected by **rotenone**?
 - A. ATP-synthase (complex IV)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃)
2. What mitochondrial enzyme is affected by **amytal (amobarbital)**?
 - A. ATP-synthase (complex IV)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
3. During the necropsy of 40-year-old woman a pathologist concluded that the death of the patient had resulted from poisoning by carbon monoxide (CO). The activity of what enzyme is inhibited by CO?
 - A. Malate dehydrogenase
 - B. Cytochrome oxidase
 - C. Heme synthase
 - D. Aspartate aminotransferase
 - E. Carbamoyl phosphate synthetase.
4. What mitochondrial enzyme is affected by **antimycin A**?
 - A. ATP-synthase (complex IV)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
5. What mitochondrial enzyme is affected by **oligomycin**?
 - A. ATP-synthase (complex IV)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
6. Potassium cyanide is a very dangerous poison that causes instantaneous death of a human organism. What mitochondrial enzyme is affected by potassium cyanide?
 - A. Cytochrome P₄₅₀
 - B. Flavine enzymes
 - C. Cytochrome b
 - D. NAD⁺-dependent dehydrogenases
 - E. Cytochrome oxidase (cytochrome aa₃).
7. The central intermediate which is common for the catabolic pathways of proteins, carbohydrates and lipids is:

- A. Succinyl-CoA.
 - B. Acetyl-CoA.
 - C. Oxaloacetate.
 - D. Lactate.
 - E. Citrate.
8. What substance is the principal energy source for brain tissues?
- A. Acetone bodies.
 - B. Fatty acids.
 - C. Glucose.
 - D. Amino acids.
 - E. Lactate.
9. During the necropsy of a 20-year-old girl a pathologist concluded that the death of the patient had resulted from poisoning by cyanides. The activity of what enzyme is mostly inhibited by cyanides?
- A. Malate dehydrogenase.
 - B. Cytochrome oxidase.
 - C. Heme synthase.
 - D. Aspartate aminotransferase.
 - E. Carbamoyl phosphate synthetase.
10. High resistance of "winter-swimmers" (so-called "walruses") to low temperatures is explained by the increased production of certain hormones that stimulate the processes of biological oxidation and heat formation in the cells through the uncoupling of mitochondrial electron transfer and the oxidative phosphorylation. Choose the name of these hormones from the following list:
- A. Glucagon.
 - B. Adrenaline and noradrenaline.
 - C. Thyroid hormones.
 - D. Insulin.
 - E. Corticosteroids.
11. The production of thyroid hormones T_3 and T_4 is stimulated under thyrotoxicosis. It leads to body weight loss, tachycardia, rise of psychic irritability etc. Choose the biochemical mechanism by which thyroid hormones affect the tissue bioenergetics from the listed below.
- A. Blockage of mitochondrial respiratory chain.
 - B. Activation of substrate level phosphorylation.
 - C. Blockage of substrate level phosphorylation.
 - D. Uncoupling of oxidation and oxidative phosphorylation.
 - E. Activation of oxidative phosphorylation.
12. Instant death occurs due to cyanide poisoning. What is the biochemical mechanism of cyanides' unfavorable action at the molecular level?
- A. Inhibition of cytochrome oxidase.
 - B. Chemical bonding to the substrates of citric acid cycle.
 - C. Blockage of succinate dehydrogenase.
 - D. Inactivation of oxygen molecule.
 - E. Inhibition of cytochrome b.
13. Brain bioenergetics depends essentially on oxygen supply. Which substrate of oxidation is the most important for the provision of brain cells by chemical energy?
- A. Fatty acids.
 - B. Glucose.
 - C. Ketone bodies.
 - D. Glycerol 3-phosphate.
 - E. Phosphoenolpyruvate.
14. Thyrotoxicosis leads to increased production of thyroidal hormones T_3 and T_4 , weight loss,

tachycardia, psychic excitement and so on. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?

- A. Disconnect oxidation and oxidative phosphorylation
- B. Stop respiratory chain
- C. Activate oxidative phosphorylation
- D. Stop substrate phosphorylation
- E. Activate substrate phosphorylation

15. During the necropsy of a 20-year-old girl a pathologist discovered that her death had resulted from poisoning by cyanides. The disturbance of what process became the most credible cause of the girl's death?

- A. Tissue respiration.
- B. Synthesis of hemoglobin.
- C. Transport of oxygen by hemoglobin.
- D. Urea synthesis.
- E. Transport of hydrogen with malate-aspartate shunt.

16. Cyanide poisoning causes immediate death. What is the mechanism of cyanide effect at the molecular level?

- A. They inhibit cytochromoxidase
- B. They bind substrates of tricarboxylic acid cycle
- C. They block succinate dehydrogenase
- D. They inactivate oxygene
- E. They inhibit cytochrome B

17. Researches of the latest decades established that immediate "executors" of cell apoptosis are special enzymes called caspases. Generation of one of them proceeds with participation of cytochrome C. What is its function in a normal cell?

- A. Enzyme of respiratory chain of electron transport
- B. Enzyme of tricarboxylic acid cycle
- C. Enzyme of beta-oxidation of fatty acids
- D. Component of H⁺ATP system
- E. Component of pyruvate-dehydrogenase system