

**BIOLOGICAL CHEMISTRY.
THE BANK OF MCQ TEST QUESTIONS
(GENERAL MEDICINE)**

2016-2017

Module № 2

Biochemistry. Biomolecules, metabolic pathways.

I. Enzymes.

LESSON 1

Theme: Biochemistry. Biomolecules and cell structures. Methods of biochemical investigations, their diagnostic significance.

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. $-\text{COH}$

5. Which of the listed proteins are simple:

- A. Albumins
- B. Hemoglobin
- C. Cazein
- D. Myoglobin
- E. Chlorophil

6. The stability of primary structure of proteins is supported by one of these bonds. Which?

- A. Ionic
- B. Estheric
- C. Hydrogen

- D. Peptide
 - E. Disulfide.
7. Watson and Crick states that the double helix of DNA is stabilized by the bonds between complementary nitrogenous bases. Which bonds are maintain double helical structure of DNA?
- A. N-glycosidic
 - B. Phosphodiester
 - C. Ester
 - D. Hydrogen
 - E. Disulfide.
8. Where can DNA be found in the cell:
- A. Only in the nuclei
 - B. Only in mitochondria
 - C. In nuclei and ribosomes
 - D. In all parts of the cell
 - E. In the nuclei and mitochondria.
9. Name the most important lipid components of the cell membrane:
- A. Triacylglycerols
 - B. Steroids
 - C. Phospholipids
 - D. Glycolipids
 - E. Sphingolipids.
10. What are the monomers of proteins:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
11. Choose from these carbohydrates the monosaccharide:
- A. Glycogen
 - B. Maltose
 - C. Starch
 - D. Glucose
 - E. Sucrose.
12. Fats consist of:
- A. Glycerol and amino acids
 - B. Cholesterol and fatty acids
 - C. Glycerol and ketoacids
 - D. Cholesterol and amino acids
 - E. Glycerol and fatty acids.
13. Choose the purine base:
- A. Uracil
 - B. Cytosine
 - C. Thymine
 - D. Adenine
 - E. Adenosine.
14. How many parts are there in a nucleotide:
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
15. What are the monomers of nucleic acids:

- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
16. Primary structure of proteins is formed thanks to one type of bonds. Point out it:
- A. Peptide bond
 - B. Disulfide bond
 - C. Ether bond
 - D. Hydrogen bond
 - E. Metal bond.
17. Choose from these carbohydrates the disaccharide:
- A. Glycogen
 - B. Cellulose
 - C. Starch
 - D. Glucose
 - E. Sucrose.
18. Choose the pyrimidine nucleoside:
- A. Uracil
 - B. Cytidine
 - C. Thymine
 - D. Adenine
 - E. Adenosine.
19. Point out the saturated fatty acid:
- A. Palmitic
 - B. Linolenic
 - C. Oleinic
 - D. Linoleic
 - E. Arachidonic.
20. What are the monomers of polysaccharides:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
21. The secondary structure of proteins is formed thanks to one type of bonds. Point it out:
- A. Peptide bonds
 - B. Disulfide bonds
 - C. Ionic bonds
 - D. Hydrogen bonds
 - E. Metal bonds.
22. Choose from these carbohydrates the polysaccharide:
- A. Glycogen
 - B. Maltose
 - C. Ribose
 - D. Glucose
 - E. Sucrose.
23. Choose the purine nucleotide:
- A. Uracil
 - B. Cytosine
 - C. Adenylic acid
 - D. Adenine

- E. Adenosine.
24. Point out the monounsaturated fatty acid:
- A. Palmitic acid
 - B. Stearic acid
 - C. Linoleic acid
 - D. Oleic acid
 - E. Linolenic acid.
25. What are the monomers of albumins:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
26. Choose from these carbohydrates the monosaccharide:
- A. Glycogen
 - B. Maltose
 - C. Starch
 - D. Fructose
 - E. Sucrose.
27. Choose the purine base:
- A. Uracil
 - B. Cytosine
 - C. Thymine
 - D. Guanine
 - E. Adenosine.
28. Lipids are natural organic compounds, which are:
- A. Good soluble in water
 - B. Insoluble in organic solvents
 - C. Insoluble in benzene
 - D. Soluble in organic solvents
 - E. Soluble in buffer solutions.
29. What are the monomers of DNA:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
30. Choose from these carbohydrates the disaccharide:
- A. Glycogen
 - B. Lactose
 - C. Starch
 - D. Glucose
 - E. Galactose.
31. Choose the pyrimidine base:
- A. Guanine
 - B. Guanosine
 - C. Thymine
 - D. Adenine
 - E. Adenosine.
32. Point out the saturated fatty acid:
- A. Stearic
 - B. Linolenic

- C. Oleinic
 - D. Linoleic
 - E. Arachidonic.
33. What are the monomers of glycogen:
- A. Nucleotides
 - B. Monosaccharides
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
34. Choose from these carbohydrates the polysaccharide:
- A. Lactose
 - B. Maltose
 - C. Starch
 - D. Glucose
 - E. Sucrose.
35. Choose the purine nucleoside:
- A. Uracil
 - B. Cytosine
 - C. Thymine
 - D. Adenine
 - E. Cytidine.
36. Which bonds are monosaccharides joined in polysaccharides?
- A. Peptide
 - B. Hydrogen
 - C. Glycosidic
 - D. Ionic
 - E. Disulfide.
37. What are the monomers of globulins:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.
38. Choose from these carbohydrates the monosaccharide:
- A. Glycogen
 - B. Maltose
 - C. Starch
 - D. Deoxyribose
 - E. Sucrose.
39. Choose the pyrimidine nucleoside:
- A. Uridine
 - B. Cytosine
 - C. Thymine
 - D. Adenine
 - E. Adenosine.
40. What are the monomers of starch:
- A. Nucleotides
 - B. Monosaccharides
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.

41. Choose the purine nucleotide:
- A. Uracil
 - B. Cytosine
 - C. Guanylic acid
 - D. Adenine
 - E. Adenosine.
42. Point out the saturated fatty acid:
- A. Palmitic
 - B. Linolenic
 - C. Oleinic
 - D. Linoleic
 - E. Arachidonic.
43. By which bonds nucleotides are joined in the primary structure of nucleic acids?
- A. Peptide
 - B. Hydrogen
 - C. Hydrophobic
 - D. Ionic
 - E. Phosphodiester.
44. What are the monomers of RNA:
- A. Nucleotides
 - B. Sugars
 - C. Carbonic acids
 - D. Fatty acids
 - E. Amino acids.

LESSON 2

Theme: Structure of enzymes. Classification and nomenclature of enzymes.

1. 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.
2. 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.
3. 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.
4. Enzymes are the catalysts of protein nature. Name the property of enzymes which is not presented at the inorganic catalysts:
 - A. Ability to the denaturation
 - B. Wide specificity

- C. Inert to chemical substrates
 - D. Big half-life
 - E. Ability to lowering the energy to activate the reaction.
5. Some terms are used for the description of non-protein part of an enzyme. Point out the term of non-protein part, which easily dissociates from polypeptide chain:
- A. Apoenzyme
 - B. Coenzyme
 - C. Prosthetic group
 - D. Cofactor
 - E. Metal ions.
6. What is the chemical nature of enzymes?
- A. Carbohydrates
 - B. Lipids
 - C. Proteins
 - D. Nucleic acids
 - E. Polysacharides.
7. A substrate molecule is splitt upon enzyme action, and the water is used for the product's structure formation. Name the enzyme class:
- A. Oxidoreductase
 - B. Hydrolase
 - C. Lyase
 - D. Ligase
 - E. Isomerase.
8. A qualitative composition of product's molecule is completely identical to substrate's one, but the structure is different. Name the enzyme class:
- A. Oxidoreductase;
 - B. Hydrolase
 - C. Lyase
 - D. Ligase
 - E. Isomerase.
9. How many classes of enzymes are there?
- A. 4
 - B. 5
 - C. 6
 - D. 7
 - E. 9.
10. What kind of reactions is catalyzed by hydrolases?
- A. Hydrolytic cleavage of substrates
 - B. Transfer of hydrogen atoms between substrates
 - C. Addition to double bonds
 - D. Formation of bonds with ATP cleavage
 - E. Transposition of functional groups between substrates.

LESSON 3

Theme: Properties of enzymes. Enzyme kinetics.

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. 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.
3. 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:
- Amylase
 - Maltase
 - Invertase
 - Isomaltase
 - Lactase.
4. If the temperature of incubating environment is raised from 0° C up to 40° C the activity of human enzymes is usually increased. Find the cause of this change:
- The probability of ES complex formation is increased
 - A denaturation of enzymes occurs
 - The enzyme molecular charge changes
 - The substrate molecular charge changes
 - Enzyme action specificity increase.
5. The optimal pH for enzymes of cell cytoplasm varies from 7,2 to 7,6. Point out possible changes in the structure of active site of such enzymes at pH-7,0:
- Changes are not present
 - Radicals of amino acids get negative charge
 - Neutralization of negatively charged radicals
 - Formation of ester bonds between radicals
 - Destruction of the active center.
6. Optimal temperature for determining of enzyme activity in blood is:
- 0-5 °C
 - 10-20 °C
 - 20-40 °C
 - 60-70°C
 - 80-100°C.
7. Cell enzymes are denaturates at pH:
- 1.0
 - 5.0
 - 6.0
 - 7.0
 - 8.0.
8. Optimum pH for pepsin of gastric juice is:
- 1.5-2.5
 - 5.0-5.5
 - 7.0
 - 7.5-8.0
 - 8.5-9.0.
9. Optimum pH for trypsin of pancreatic juice is: A. 1.5-2.5
- 5.0-5.5
 - 6.0
 - 7.5-8.0
 - 8.5-9.0.

10. Optimal pH for determining of enzyme activity in blood is:
- A. 1.5-2.5
 - B. 5.0-5.5
 - C. 6.8-7.2
 - D. 7.3-7.4
 - E. 7.5-8.0.
11. What is optimal temperature for enzyme-drugs storage:
- A. 0-5⁰C
 - B. 10-20⁰C
 - C. 30-40⁰C
 - D. 50-60⁰C
 - E. 70-80⁰C.
12. Optimum pH for amylase of saliva is:
- A. 1.5-2.5
 - B. 5.0-5.5
 - C. 7.0-7,5
 - D. 8.5-9.0
 - E. 9.5-10.
13. Cell enzymes denaturate at pH:
- A. 5.0
 - B. 5.5
 - C. 6.0
 - D. 7.0
 - E. 11.0.
14. Optimum pH for enzymes of cell cytoplasm is:
- A. 1.5-2.5
 - B. 5.0-5.5
 - C. 7.0-7.6
 - D. 8.5-9.0
 - E. 9.0-9.5.
15. Optimal pH for determining of enzyme activity in gastric juice of adults is:
- A. 2.0
 - B. 5.0
 - C. 7.0
 - D. 9.0
 - E 11.0.
16. Optimum pH for lipase of pancreatic juice is:
- A. 1.5-2.5
 - B. 5.0-5.5
 - C. 6.0
 - D. 7.5-8.0
 - E. 8.5-9.0.
17. Optimal pH for determining of enzyme activity in urine is:
- A. 2.0
 - B. 5.0
 - C. 7.0
 - D. 9.0
 - E. 11.0.
18. After addition of pancreatic extract into a test tube with starch solution disappearance of blue color in iodine test was observed. Under the action of which pancreatic enzyme the starch is completely hydrolyzed?
- A. α -Amylase

- B. Chymotrypsin
 - C. Lipase
 - D. Aldolase
 - E. Trypsin.
19. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for lipase:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
20. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for urease:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
21. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for pepsin:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
22. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for glucosooxidase:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
23. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for arginase:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
24. One of the important properties of enzymes is their action specificity. Check up a kind of specificity for isomaltase:
- A. Absolute substrate specificity
 - B. Absolute grouped substrate specificity
 - C. Stereochemical specificity
 - D. Relative grouped substrate specificity
 - E. Relative substrate specificity (reaction specificity).
25. You need to degrade DNA. What enzyme will you use:
- A. proteinase
 - B. oxidase
 - C. nuclease
 - D. lipase
 - E. transferase.

26. You need to degrade carbohydrate. What enzyme will you use:
- A. proteinase
 - B. oxidase
 - C. nuclease
 - D. lipase
 - E. glycosidase.
27. Optimal conditions for the determination of the enzyme activity in the blood are:
- A. 5°C; pH 7.3; high concentration of substrates
 - B. 20°C; pH 6.5; low concentration of substrates
 - C. 40°C; pH 7.3; high concentration of substrates
 - D. 50°C; pH 5.8; low concentration of substrates
 - E. 70°C; pH 7.8; high concentration of substrates.
28. Optimal conditions for the determination of the enzyme activity in the pancreatic juice are:
- A. 5°C; pH 8.0; high concentration of substrates
 - B. 20°C; pH 6.5; low concentration of substrates
 - C. 40°C; pH 8.0; high concentration of substrates
 - D. 50°C; pH 1.0; low concentration of substrates
 - E. 40°C; pH 5.0; high concentration of substrates.
29. K_m equals to the substrate concentration when the reaction rate is:
- A. minimal
 - B. maximal
 - C. half of maximal
 - D. quarter of maximal.
30. Unknown enzyme was added into two test tubes. The first tube contained starch, the second one – sucrose. After 10 min. incubation the solution in the first tube gives the positive Feling reaction, in the second one – negative. What enzyme was added?
- A. lipase
 - B. sucrase
 - C. amylase
 - D. nuclease
 - E. lactase.
31. Unknown enzyme was added into two test tubes. The first tube contained starch, the second one – sucrose. After 10 min incubation the solution in the first tube gives the negative Feling reaction, in the second one –positive. What enzyme was added?
- A. lipase
 - B. sucrose
 - C. amylase
 - D. nuclease.
 - E. lactase.
32. Unknown enzyme was added into two test tubes. The first tube contained starch, the second one –lactose. After 10 min incubation the solution in the first tube gives the negative Feling reaction, in the second one –positive. What enzyme was added?
- A. lipase
 - B. sucrase
 - C. amylase
 - D. nuclease
 - E. lactase.
33. Unknown enzyme was added into two test tubes. The first tube contained maltose, the second one – sucrose. After 10 min incubation the solution in the first tube gives the positive Feling reaction, in the second one – negative. What enzyme was added?
- A. lipase
 - B. sucrase

- C. maltase
- D. nuclease
- E) lactase.

34. Unknown enzyme was added into two test tubes. The first tube contained glycogen, the second one – sucrose. After 10 min incubation the solution in the first tube gives the negative Feling reaction, in the second one –positive. What enzyme was added?

- A. lipase
- B. sucrase
- C. amylase
- D. nuclease
- E. lactase.

LESSON 4

Theme: Mechanism of enzyme action.

1. Enzymes catalase and peroxidase contain metal:

- A. Cu.
- B. Zn
- C. Na.
- D. Fe.
- E. Ca.

2. Coenzyme carboxybiotin is the derivative of vitamin:

- A. B₁
- B. B₂
- C. B₃
- D. B₆
- E. H.

3. Coenzyme FMN is the derivative of vitamin:

- A. B₁
- B. B₂
- C. B₃
- D. B₆
- E. H.

4. Vitamin B₃ (niacin) is a part of coenzyme:

- A. Coenzyme A
- B. FMN, FAD
- C. NAD, NADP
- D. TPP
- E. PALP.

5. Coenzyme PALP is the derivative of vitamin:

- A. B₁
- B. B₂
- C. B₃
- D. B₆
- E. H.

6. Vitamin B₆ (pyridoxine) is a part of coenzyme:

- A. Coenzyme A
- B. FMN, FAD
- C. NAD, NADP
- D. TPP
- E. PALP.

7. Vitamin B₂ (riboflavin) is a part of coenzyme:

- A. Coenzyme A

- B. FMN, FAD
 - C. NAD, NADP
 - D. TPP
 - E. PALP.
- 8 Vitamin B₁ (thiamin) is a part of coenzyme:
- A. Coenzyme A
 - B. FMN, FAD
 - C. NAD, NADP
 - D. TPP
 - E. PALP.
9. Coenzyme A is the derivative of vitamin:
- A. B₁
 - B. B₂
 - C. B₅
 - D. B₆
 - E. H.
10. Coenzyme NADP is the derivative of vitamin:
- A. B₁
 - B. B₃(PP)
 - C. B₅
 - D. B₆
 - E. H.
11. 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.
12. The activation energy of reaction is the difference of free energy levels of:
- A. initial state and transition state
 - B. initial state and final state
 - C. transition state and final state.
13. How do the enzymes influence on activation energy level:
- A. increase
 - B. decrease
 - C. do not change.
14. Activities of aminotransferases are usually determined for diagnostics of certain diseases
What vitamin is included in the enzymes as cofactor?
- A. B₁
 - B. B₂
 - C. B₅
 - D. B₆
 - E. H.
15. What coenzymes are biological redox agents?
- A. Coenzyme A
 - B. FMN, FAD
 - C. Biocytin
 - D. TPP
 - E. PALP.
16. What coenzymes are biological redox agents?
- A. Coenzyme A

- B. NAD, NADP
- C. Biocytin
- D. TPP
- E. PALP.

17. In case of enterobiosis **acrichine** - the structural analogue of vitamin B₂- is administered. The synthesis disorder of which enzymes does this medicine cause in microorganisms?
- A. Cytochrome oxidases
 - B. FAD-dependent dehydrogenases
 - C. Peptidases
 - D. NAD-dependent dehydrogenases
 - E. Aminotransferases.
18. In case of vitamin B₆ disorders of amino acid transamination takes place. Which class of enzyme catalyses these reactions?
- A. Oxidoreductases
 - B. Hydrolases
 - C. Lyases
 - D. Ligases
 - E. Transferases.

LESSON 5

Theme: Enzymes activation and inhibition.

1. Succinate dehydrogenase catalyses the dehydrogenation of succinate. Malonic acid HOOC-CH₂-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 - **acrichine** - is prescribed in case of enterobiosis. The inhibition 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?
- A. Cytochrome P₄₅₀.
 - B. Flavine enzymes.
 - C. Cytochrome b.
 - D. NAD⁺-dependent dehydrogenases.
 - E. Cytochrome oxidase (cytochrome aa₃).
4. What medicines should be prescribed to a patient with acute pancreatitis to prevent pancreas autolysis?
- A. Proteases activators
 - B. Proteases inhibitors
 - C. Trypsin
 - D. Chymotrypsin
 - E. Amylase.
5. In the practice of alcoholism treatment, the use of desulphiram, which is the inhibitor of acetaldehyde dehydrogenase, is widespread. The increase of what metabolite in blood results in the evolving of disgust to alcohol?

- A. Methanol
 - B. Ethanol
 - C. Malonic dialdehyde
 - D. Propionic aldehyde
 - E. Acetic aldehyde.
6. 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.
7. Treatment course of bacterial pneumonia included benzylpenicillin sodium salt. What is the mechanism of its antimicrobial action?
- A. Inhibition of the intracellular protein synthesis
 - B. Inhibition of the SH enzyme groups of the microorganisms
 - C. Inhibition of cell wall synthesis of the microorganism
 - D. Inhibition of the cholinesterase activity
 - E. Antagonism with the paraaminobenzoic acid.
8. Some infectious diseases caused by bacteria are treated with sulfanilamides which block the synthesis of bacteria growth factor. What is the mechanism of their action?
- A. They are antivitamins of para-amino benzoic acid
 - B. They inhibit the absorption of folic acid
 - C. They are allosteric enzyme inhibitors
 - D. They are involved in redox processes
 - E. They are allosteric enzyme activators.
9. A 42-year man suffering from gout has increased level of uric acid in the blood. Allopurinol was prescribed to decrease the level of uric acid. Competitive inhibitor of what enzyme is allopurinol?
- A. Xanthineoxidase
 - B. Adenosinedeaminase
 - C. Adeninephosphoribosiltransferase
 - D. Hypoxantinphosphoribosiltransferase
 - E. Guaninedeaminase
10. Inhibitor of succinate dehydrogenase is:
- A. sulfa drugs.
 - B. cyanides
 - C. succinic acid
 - D. organophosphate compounds
 - E. malonic acid.
11. Hydrochloric acid activates:
- A. lipase
 - B. amylase
 - C. trypsin
 - D. pepsin
 - E. sucrase.
12. What inhibitors have bacteriostatic action?
- A. arsenic acid
 - B. cyanides
 - C. sulfa drugs
 - D. organophosphate compounds

- E. malonic acid.
13. Inhibitor of acetylcholinesterase is:
A. sulfa drugs
B. cyanides
C. arsenic acid
D. organophosphate compounds
E. malonic acid.
14. Inhibitor of cytochrome oxidase is:
A. sulfa drugs
B. cyanides
C. heavy metals
D. organophosphate compounds
E. malonic acid.
15. What inhibitors are nerve toxins?
A. penicillins
B. aspirin
C. sulfa drugs
D. organophosphate compounds
E. malonic acid.
16. Inhibitors of folic acid synthesis is:
A. heavy metals
B. cyanides
C. sulfa drugs
D. organophosphate compounds
E. malonic acid.
17. Bile acids activate:
A. lipase
B. amylase
C. trypsin
D. pepsin
E. sucrase.
18. What inhibitors are belonging to pesticides?
A. arsenic acid
B. cyanides
C. sulfa drugs
D. organophosphate compounds
E. malonic acid.
19. Sodium chloride activates:
A. lipase
B. amylase
C. trypsin
D. pepsin
E. sucrase.
20. What inhibitor has anti-inflammatory action?
A. arsenic acid
B. penicillin
C. sulfa drug
D. aspirin
E. malonic acid.
21. 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.
22. A competitive inhibitor of an enzyme:
- A. Increases K_m but does not affect V_{max}
 - B. Decreases K_m but does not affect V_{max}
 - C. Increases V_{max} but does not affect K_m
 - D. Decreases V_{max} but does not affect K_m
 - E. Decreases both V_{max} and K_m .
23. What is competitive inhibitor of succinate dehydrogenase:
- A. Fumarate
 - B. Alanine
 - C. Succinate
 - D. α -Ketoglutarate
 - E. Malonate.
24. What is the mechanism of inhibition of folic acid synthesis by sulfanilamide drugs?
- A. Irreversible
 - B. Enzyme denaturation
 - C. Competitive
 - D. Noncompetitive
 - E. Binding to allosteric site of enzyme.
25. For the treatment of tuberculosis isoniazid – structural analog of nicotinamide and pyridoxine – is prescribed. Which type of inhibition is caused by isoniazid?
- A. Irreversible
 - B. Competitive
 - C. Noncompetitive
 - D. Uncompetitive
 - E. Allosteric.
26. Heavy metals inhibit enzymes which have sulfhydryl groups. Which amino acid is used for reactivation of these enzymes?
- A. Histidine
 - B. Isoleucine
 - C. Cysteine
 - D. Aspartate
 - E. Glycine.
27. Sulfanilamide drugs are used for treatment of infectious diseases. What is the mechanism of bacteria growth inhibition of the drugs?
- A. Inhibition of the intracellular protein synthesis
 - B. Inhibition of the SH enzyme groups of the microorganisms
 - C. Inhibition of cell wall synthesis of the microorganism
 - D. Allosteric inhibition of bacterial enzymes
 - E. They are structural analogs of para-aminobenzoic acid required for the synthesis of folic acid.
28. A patient with methanol poisoning was prescribed oral or intravenous ethanol administration at high doses. What is biochemical mechanism of such treatment?
- A. Acceleration of methanol excretion by gastrointestinal tract
 - B. Increase of methanol detoxication by liver
 - C. Competitive inhibition of alcohol dehydrogenase
 - D. Uncompetitive inhibition of alcohol dehydrogenase
 - E. Allosteric activation of alcohol dehydrogenase.

LESSON 6

Theme: Regulation of enzyme activity.

1. 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?
 - A. Aminopeptidase
 - B. Enterokinase
 - C. Pepsin
 - D. Trypsin
 - E. Carboxypeptidase.
2. 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:
 - A. ADP-ribosylation
 - B. Methylation
 - C. Adenylation
 - D. Restricted proteolysis
 - E. Phosphorylation-dephosphorylation.
3. Which way of regulating enzyme activity is irreversible?
 - A. covalent modification
 - B. allosteric regulation
 - C. partial proteolysis.
4. Which way of regulating enzyme activity is the basis for the feedback inhibition?
 - A. covalent modification
 - B. allosteric regulation
 - C. partial proteolysis.
5. What covalent modification is used mainly for regulation of enzyme activity?
 - A. carboxylation
 - B. methylation
 - C. amination
 - D. phosphorylation
 - E. acetylation.
6. In a human body trypsin is produced by the pancreas as the inactive precursor called trypsinogen. What intestinal lumen enzyme leads to the transforming of trypsinogen into the catalytically active enzyme molecule?
 - A. Aminopeptidase
 - B. Enterokinase
 - C. Pepsin
 - D. Trypsin
 - E. Carboxypeptidase.
7. 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:
 - A. ADP-ribosylation
 - B. Methylation
 - C. Adenylation
 - D. Restricted proteolysis
 - E. Phosphorylation-dephosphorylation.
8. Which mechanism of allosteric regulation of enzyme activity?
 - A. denaturation of enzyme molecule
 - B. changes of enzyme quantity

- C) phosphorylation-dephosphorylation of enzyme molecule
 - D. conformational change of enzyme molecule
 - E. partial proteolysis of enzyme molecule.
9. What enzymes catalyze the reactions of protein-enzyme phosphorylation?
- A. protein hydrolases
 - B. protein synthetases
 - C. protein phosphatases
 - D. protein kinases
 - E. protein oxidases.
10. Which mechanism of proenzyme conversion into the active enzyme?
- A. denaturation of enzyme molecule
 - B. changes of enzyme quantity
 - C. phosphorylation-dephosphorylation of enzyme molecule
 - D. conformational change of enzyme molecule
 - E. partial proteolysis of enzyme molecule.
11. Which substance activates pepsinogen?
- A. Trypsin
 - B. Enterokinase
 - C. Chymotrypsin
 - D. Pepsin
 - E. Protein kinase.
12. Which mechanism of allosteric regulation of enzyme activity?
- A. denaturation of enzyme molecule
 - B. changes of enzyme quantity
 - C. phosphorylation-dephosphorylation of enzyme molecule
 - D. conformational change of enzyme molecule
 - E. partial proteolysis of enzyme molecule.
13. Which mechanism of regulation of enzyme activity by covalent modification?
- A. denaturation of enzyme molecule
 - B. changes of enzyme quantity
 - C. phosphorylation-dephosphorylation of enzyme molecule
 - D. conformational change of enzyme molecule
 - E. partial proteolysis of enzyme molecule.
14. Which way of regulation of enzyme activity is the basis for the feedback inhibition?
- A. Covalent modification;
 - B. Allosteric regulation;
 - C. Partial proteolysis.
15. What enzymes catalyze the reactions of protein-enzyme phosphorylation?
- A. protein hydrolases
 - B. protein synthetases
 - C. protein phosphatases
 - D. protein kinases
 - E. protein oxidases.
16. Which substance activates trypsinogen?
- A. HCl
 - B. enterokinase
 - C. chymotrypsin
 - D. pepsin
 - E. protein kinase.
17. What enzymes catalyze the reactions of protein-enzyme dephosphorylation?
- A. protein hydrolases
 - B. protein synthetases

- C. protein phosphatases
- D. protein kinases
- E. protein oxidases.

LESSON 7

Theme: 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?
 - A. The same physicochemical properties
 - B. Catalyzation of the same reaction
 - C. The same electrophoretic mobility
 - D. Tissue localization
 - E. 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:
 - A. Collagenase.
 - B. β - Amylase.
 - C. Oligo[1 \rightarrow 6]-glucosidase.
 - D. Lysozyme.
 - E. 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?
 - A. Proteins.
 - B. Lipids.
 - C. Carbohydrates.
 - D. Nucleic acids.
 - E. 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?
 - A. In skeletal muscles.
 - B. In the myocardium (myocardial infarction is possible).
 - C. In the liver (hepatitis is possible).
 - D. In kidneys.
 - E. 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?
 - A. 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 cavitary 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.
20. To prevent attacks of acute pancreatitis a doctor prescribed the patient trasylol (contrycal, gordox), which is an inhibitor of:
- A. Trypsin
 - B. Elastase
 - C. Carboxypeptidase
 - D. Chymotrypsin
 - E. Gastricsin
21. Katal is defined as amount of enzyme that convert:
- A. μmol of substrate per minute
 - B. mmol of substrate per second
 - C. mol of substrate per second
 - D. μmol of substrate per hour
 - E. mmol of substrate per minute.
22. Lactate dehydrogenase (LDH) isoenzymes catalyze the transformation of pyruvate to lactic acid in different types of tissues. Point out the structural distinctive peculiarity of each LDH isoenzyme:
- A. Different native protein structure
 - B. Different level of structural organization in native molecule
 - C. Different by the type of coenzyme in native molecule
 - D. Different by the quantity of subunits
 - E. Different by the combination of subunits, forming a native molecule.
23. Patient's amylase activity in the urine exceeds the normal values in ten times as much. Point out the possible diagnosis:
- A. Viral hepatitis
 - B. Diabetes mellitus
 - C. Acute pancreatitis
 - D. Influenza
 - E. Angina.
24. What condition is developed in the absence of phenylalanine-4-monooxygenase?
- A. Phenylketonuria
 - B. Alkaptonuria
 - C. Galactosemia
 - D. Hyperglycemia
 - E. Hypoglycemia.
25. What is the cause of primary enzymopathologies?
- A. Liver diseases
 - B. Genetic disorders
 - C. Trauma
 - D. Ischemia
 - E. Brain diseases.
26. A considerable rise of activities of MB-form of creatine kinase and LDH_1 is revealed in the blood of a patient. Name the most probable pathology.
- A. Hepatitis
 - B. Myocardial infarction
 - C. Rheumatism
 - D. Pancreatitis
 - E. Cholecystitis
27. The activities of amylase in the patient's urine and blood are increased, trypsin is present in the urine. What organ is the pathological process taking place in?
- A. Liver

- B. Pancreas
 - C. Stomach
 - D. Kidney
 - E. Intestine.
28. The elevated activity of aspartate aminotransferase (AST) in the blood is indication of:
- A. kidney disease
 - B. muscle dystrophy
 - C. acute pancreatitis
 - D. myocardial infarction
 - E. stomach disease.
29. The composition of LDH-1 subunits is:
- A. HHHH
 - B. HHHM
 - C. HHMM
 - D. HMMM
 - E. MMMM.
30. What enzyme profile is characteristic of acute pancreatitis?
- A. ALT, amylase, AST
 - B. lipase, ALT, amylase
 - C. CPK, trypsin, LDH
 - D. AST, LDH, lipase
 - E. amylase, lipase, trypsin.
31. The elevated activity of creatinphosphokinase (CPK) in the blood is indication of:
- A. hepatitis
 - B. kidney disease
 - C. acute pancreatitis
 - D. myocardial infarction
 - E. stomach disease.
32. The composition of LDH-2 subunits is:
- A. HHHH
 - B. HHHM
 - C. HHMM
 - D. HMMM
 - E. MMMM.
33. What enzyme profile is characteristic of liver disease?
- A ALT, amylase
 - B. lipase, AST
 - C. CPK, trypsin
 - D. ALT, LDH-5
 - E. AST, LDH-1.
34. The elevated activity of amylase in the blood is indication of:
- A. hepatitis
 - B. muscle dystrophy
 - C. acute pancreatitis
 - D. myocardial infarction
 - E. stomach disease.
35. The composition of LDH-3 subunits is:
- A. HHHH
 - B. HHHM
 - C. HHMM
 - D. HMMM
 - E. MMMM.

36. What enzyme profile is characteristic of heart disease?
- A. ALT, amylase, AST
 - B. lipase, ALT, amylase
 - C. CPK, trypsin, LDH-4
 - D. AST, LDH-3, lipase
 - E. AST, CPK, LDH-1.
37. The elevated activity of alaninaminotransferase (ALT) in the blood is indication of:
- A. hepatitis
 - B. muscle dystrophy
 - C. acute pancreatitis
 - D. myocardial infarction
 - E. stomach disease.
38. The composition of LDH-4 subunits is:
- A. HHHH
 - B. HHHM
 - C. HHMM
 - D. HMMM
 - E. MMMM.
39. The elevated activity of creatin phosphokinase in the blood is indication of:
- A. hepatitis
 - B. muscle dystrophy
 - C. acute pancreatitis
 - D. kidney disease
 - E. stomach disease.
40. The composition of LDH-5 subunits is:
- A. HHHH
 - B. HHHM
 - C. HHMM
 - D. HMMM
 - E. MMMM.
41. The elevated activity of lipase in the blood is indication of:
- A. hepatitis
 - B. muscle dystrophy
 - C. acute pancreatitis
 - D. myocardial infarction
 - E. stomach disease.
42. What medicines should be prescribed to a patient with acute pancreatitis to prevent pancreas autolysis?
- A. Proteases activators
 - B. Proteases inhibitors
 - C. Trypsin
 - D. Chymotrypsin
 - E. Amylase.
43. International unit (IU) is defined as amount of enzyme that converts:
- A. mmol of substrate per minute
 - B. mmol of substrate per second
 - C. mol of substrate per second
 - D. mmol of substrate per hour
 - E. mmol of substrate per minute.

II. BIOENERGETICS

LESSON 8

Theme: Introduction to the metabolism and energy exchange.

1. 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
2. What substance is the principal energy source for brain tissues?
 - A. Ketone bodies
 - B. Fatty acids
 - C. Glucose
 - D. Amino acids
 - E. Lactate.
3. 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.
4. Metabolic conversion of proteins to amino acids is:
 - A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
5. Metabolic conversion of glucose to pyruvic acid (pyruvate) is called
 - A. glycogenolysis
 - B. glycolysis
 - C. lipolysis
 - D. glycogenesis
 - E. gluconeogenesis.
6. Metabolic conversion of acetyl-CoA into CO₂ and H₂O can occur:
 - A. only in aerobic conditions;
 - B. only in anaerobic conditions;
 - C. in the aerobic and anaerobic conditions.
7. Metabolic conversion of pyruvic acid (pyruvate) to glucose is:
 - A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
8. Metabolic conversion of glycogen into glucose is:
 - A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
9. Metabolic conversion of glucose to glycogen are called
 - A. glycogenolysis
 - B. glycolysis

- C. lipolysis
 - D. glycogenesis
 - E. gluconeogenesis.
10. Metabolic conversion of proteins to amino acids is called:
- A. glycogenolysis
 - B. glycolysis
 - C. lipolysis
 - D. proteolysis
 - E. gluconeogenesis.
11. Metabolic conversion of amino acids to proteins is called:
- A. glycogenolysis
 - B. proteogenesis
 - C. lipolysis
 - D. proteolysis
 - E. gluconeogenesis.
12. Metabolic conversion of fatty acids into acetyl-CoA is:
- A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
13. Metabolic conversion of fatty acids into acetyl-CoA can occur:
- A. only in aerobic conditions
 - B. only in anaerobic conditions
 - C. in the aerobic and anaerobic conditions.
14. Metabolic conversion of pyruvic acid (pyruvate) to glucose is called:
- A. glycogenolysis
 - B. glycolysis
 - C. lipolysis
 - D. glycogenesis
 - E. gluconeogenesis.
15. Metabolic conversion of pyruvic acid (pyruvate) to glucose is
- A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
16. Metabolic conversion of fatty acids and glycerol into fats is:
- A. 1st stage of catabolism
 - B. 2nd stage of catabolism
 - C. 3rd stage of catabolism
 - D. anabolic pathway
 - E. amphibolic pathway.
17. Metabolic conversion of fatty acids and glycerol into fats is:
- A. energy-requiring (endergonic)
 - B. energy-releasing (exergonic)
 - C. without energy change.
18. Metabolic conversion of fatty acids and glycerol into fats is called:
- A. glycogenolysis
 - B. glycolysis
 - C. lipolysis
 - D. proteolysis

E. lipogenesis.

LESSON 9

Theme: Tissue respiration.

1. What mitochondrial enzyme is affected by **rotenone**?
 - A. ATP-synthase (complex V)
 - 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 V)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
3. What mitochondrial enzyme is affected by **cyanides**?
 - A. ATP-synthase (complex V)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
4. What mitochondrial enzyme is affected by **carbon monoxide**?
 - A. ATP-synthase (complex V)
 - 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 **carboxin**?
 - A. ATP-synthase (complex V)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
6. What mitochondrial enzyme is affected by **antimycin A**?
 - A. ATP-synthase (complex V)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
7. 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.
8. 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).
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. 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.
11. 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.
12. 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.

LESSON 10

Theme: Oxidative phosphorylation.

1. What mitochondrial enzyme is affected by **oligomycin**?
 - A. ATP-synthase (complex V)
 - B. Flavine enzymes (complex II)
 - C. Cytochrome b (complex III)
 - D. NAD-dependent dehydrogenases (complex I)
 - E. Cytochrome oxidase (cytochrome aa₃).
2. 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.
3. 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.
4. 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
5. How many is P/O ratio when the NAD^+ -containing dehydrogenase catalyzes the oxidation of lactate?
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5.
6. How many is P/O ratio when the FAD-containing dehydrogenase catalyzes the oxidation of succinate?
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5.
7. A 4-year-old boy presented with seizures, progressive muscle weakness, and encephalopathy. Accumulation of lactate, a product of anaerobic metabolism of glucose, in the cerebrospinal fluid (CSF) suggested a defect in mitochondrial oxidative metabolism. Muscle mitochondria were isolated for study. The activities of the individual Complexes I, II, III, and IV were normal, but the combined activities of I +III and II +III were significantly decreased. Treatment with which coenzyme will improve the muscle weakness.
- A. Coenzyme Q_{10}
 - B. FMN, FAD
 - C. NAD, NADP
 - D. TPP
 - E. PALP.

LESSON 11

Theme: Reactive oxygen species and antioxidants. Oxidative stress.

1. 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.
2. Under different pathological states the level of active forms of oxygen rises, which results in the destruction of cellular membranes. In order to prevent the damage of membranes, antioxidants are used. The most powerful natural antioxidant is:
- A. α -Tocopherol
 - B. Glucose
 - C. Vitamin A
 - D. Fatty acids
 - E. Glycerol.
3. The Institute of gerontology recommends the aged people to take a complex of vitamins that contains vitamin E. What is the basic biological action of vitamin E?
- A. Antiscurling
 - B. Antihemorrhagic
 - C. Antioxydant
 - D. Antineuritic
 - E. Antidermatitic.
4. In the course of treatment of parodontal disease the application of natural and synthetic antioxidants is recommended. Which of the below listed natural substances is used as an antioxidant?
- A. Gluconate
 - B. Thiamine
 - C. α -Tocopherol
 - D. Pyridoxins
 - E. Choline.
5. Activation of membrane lipids peroxidation is one of the basic mechanisms of membrane structure and functions damage as well as the death of a cell. The cause of this pathology is:
- A. B₁₂-hypervitaminosis
 - B. B₁-deficiency
 - C. B₁-hypervitaminosis
 - D. Vitamin D - deficiency
 - E. Vitamin E deficiency.
6. Profuse foam appeared when dentist put hydrogen peroxide on the mucous of the oral cavity. What enzyme caused such activity?
- A. Catalase
 - B. Cholinesterase
 - C. Acetyltransferase
 - D. Glucose-6-phosphatdehydrogenase
 - E. Methemoglobinreductase
7. The living organisms that did not develop the system of defence against the unfavorable action of H₂O₂ during the evolution can exist only in anaerobic conditions. Which of the enzymes can destroy hydrogen peroxide?
- A. Oxygenases and hydroxylases
 - B. Peroxidase and catalase
 - C. Cytochrome oxidase, cytochrome b
 - D. Oxygenase and catalase
 - E. Flavin-linked oxidases.
8. In course of metabolic process active forms of oxygen including superoxide anion radical are formed in the human body. By means of what enzyme is this anion inactivated?

- A. Super oxide dismutase
 - B. Glutathionereductase
 - C. Peroxidase
 - D. Catalase
 - E. Glutathioneperoxidase.
9. Under the action of oxidants (hydrogen peroxide, nitrogen oxides etc.), Fe²⁺-containing hemoglobin is converted into the substance that includes Fe³⁺ and is not able to transport oxygen. What substance is it?
- A. Carbihemoglobin
 - B. Carboxyhemoglobin
 - C. Methemoglobin
 - D. Oxyhemoglobin
 - E. Glycosylated hemoglobin.
10. In erythrocytes and other tissues, the enzyme glutathioneperoxidase catalyzes the destruction of H₂O₂ and lipid hydroperoxides by reduced glutathione, protecting membrane lipids and hemoglobin against oxidation by peroxides. What microelement is a component of prosthetic group of this enzyme?
- A. Calcium
 - B. Selenium
 - C. Magnesium
 - D. Potassium
 - E. Sodium.
11. Under most conditions in vivo, the peroxidase activity of catalase seems to be favoured.
- Catalase