Ministry of Education and Science of Ukraine
Ministry of Public Health of Ukraine
Sumy State University
Medical Institute

5372 Biochemical review questions for STEP-1 examination

for students of speciality *222 "Medicine"*
full-time form of education

Sumy
Sumy State University
2022

Biochemical review questions for Step-1 examination / N. M. Inshyna, I. V. Chorna, L. I. Hrebenyk, L. O. Primova. – Sumy : SumSU, 2022. – 168 p.

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CONTENT **P.**

PART I
Basic aspects of metabolism

1.3. Proteins, nucleic acids and enzymes

1. A 30-year-old woman has been ill for about a year: she complains of pain, reddening of skin und edema in the area of joints. A preliminary diagnosis is rheumatoid arthritis. One of the most probable causes of this disease is the change in the structure of the connective tissue protein:
A. Myosin.
B. Mucin.
C. Troponin.
D. Ovalbumin.
E. *Collagen.

2. 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. Optical activity.
C. Inability to denaturation.
D. Solubility and capacity for swelling.
E. *Presence of charge.

3. There is a peptide in a human body in which the forma-tion of γ-carboxylic group of glutamate takes part. What is this peptide called?
A. Vasopressin.
B. Carnosine.
C. Anserine.
D. Oxytocin.
E.*Glutathione.

4. What substance renders viscous and slimy properties to saliva, performs protective function and counteracts the mechanical damages of the oral cavity mucous membrane?
A. Lysozyme.
B. Glucose.
C. Kallikrein.
D. Amylase.
E. *Mucin.

5. Hemoglobin of an adult person is a tetramer consisting of two identical α- and β-polypeptide chains. What is this kind of the protein structure called?
A. Primary.
B. Secondary.
C. Tertiary.
D. Peptide.
E. *Quaternary.

6. Different functional groups can be presented in the structure of L-amino acid's radicals. Identify the group that is able to form ester bond:
A. $–CH_3$.
B. $–CONH_2$.
C. –SH.
D. $-NH_2$.
E. *–OH.

7. Denaturation of proteins can be found in some substances. Specify the substance that is used for the incomplete denaturation of hemoglobin:
A. Sulfuric acid.
B. Nitric acid.
C. Toluene.
D. Sodium hydroxide.
E. *Urea.

8. The conjugated protein necessarily contains special component as a nonprotein part. Choose the substance that can't carry out this function:
A. Glucose.
B. AMP.
C. Thiamine pyrophosphate.
D. ATP.
E. *HNO_3.

9. The samples of blood of a child and of a supposed father were directed for affiliation to medical forensic examination. Which chemical components need to be identified in the explored samples of blood?
A. mnRNA.
B. tRNA.
C. rRNA.
D. mRNA.
E. *DNA.

10. 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. Amylase.
C. Oligo-1,6-glucosidase.
D. β-Glucuronidase.
E. *Lysozyme.

11. The formation and secretion of trypsin is disturbed in case of pancreas diseases. The hydrolysis of which of the following substances is impairred in this case?
A. Phospholipids.
B. Lipids.
C. Carbohydrates.
D. Nucleic acids.
E. *Proteins.

12. A structural analogue of vitamin B_2 – acrichine – is prescribed in case of enterobiosis. The disturbance of the synthesis of what enzymes of microorganisms do this preparation disturbs?
A. Cytochrome oxidase.
B. Amino transfersses.
C. Peptidases.
D. NAD-dependent dechydrogenases
E. *FAD-dependent dechydrogenases.

13. Pathological processes associated with the development of hypoxia can be caused by incomplet reduction of an oxygen molecule in the electron transport chain and accumulation of hydrogen peroxide. Choose the enzyme which breaks the hydrogen peroxide.
A. Aconitase.
B. Cytochrome oxidase.
C. Succinate dehydrogenase.
D. Superoxidedismutase.
E. *Catalase.

14. 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. LDH_4.
B. LDH_2.
C. LDH_3.
D. LDH_5
E. *LDH_1.

15. 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. Hexokinase.
D. Leucine aminopeptidase.
E. *Ceruloplasmin.

16. The determination of activity of what enzyme in the urine is required as a diagnostic test for the verification of acute pancreatitis?
A. Alanine aminopeptidase.
B. Lactate dehydrogenase.
C. Pepsin.
D. Aldolase.

E. *Amylase.

17. In the practice of alcohollism treatment, the use of desulphiram, which is the inhibitor of alcohol dehydrogenase, is wide-spread. The increase of what metabolite in blood results in the evolving resistance to alcohol?
A. Methanol.
B. Ethanol.
C. Malonic dialdehyde.
D. Propionic aldehyde.
E. *Acetic dialdehyde.

18. The living organisms that did not develop the system of defence against the unfavorable action of H_2O_2 during the evolution can exist only in anaerobic conditions. Which of the enzymes can destroy hydrogen peroxide?
A. Oxygenases and hydroxylases.
B. Flavin-linked oxidases.
C. Cytochrome oxidase, cytochrome b_5.
D. Oxygenase and catalase.
E. *Peroxidase and catalase.

19. 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. Lactase.
B. Pepsin.
C. Dipeptidase.
D. Saccharose.
E. *α-Amylase.

20. The determination of which of the below listed enzymes is most informative for the disease during the first hours after myocardial infarction?
A. Glutamate dehydrogenase.
B. Aspartate aminotransferase.
C. Alanine aminotransferase.
D. Lactate dehydrogenase.
E. *Creatine kinase.

21. In human saliva there is an enzyme that renders potent bactericidal action due to the ability to destroy peptidoglycanes of the bacterial wall. Name this enzyme.
A. Phosphatase.
B. α-Amylase.
C. Trypsin.
D. Ribonuclease.
E. *Lysozyme.

22. 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 con-dition is grave, he is pale, and heart tones are decreased.

Laboratory studies revealed high activity of creatine kinase and LDH_1. What disease are these symptoms typical for?
A. Stenocardia.
B. Diabetes mellitus.
C. Acute pancreatitis.
D. Cholelithiasis.
E. *Acute myocardial infarction.

23. In human saliva there is an enzyme able to hydrolyze the α-[l→4]-glucosidic bonds. In the molecule of starch. Name this enzyme.
A. Lysozyme.
B. Phosphatase.
C. Fructofuranosidase.
D. β-Galactosidase.
E. *α-Amilase.

24. In case of enterobiasis acrihine - the structural analogue of vitamin B_2 - is administered. The synthetic disorder of which enzymes does this medicine cause in microorganisms?
A. NAD-dependet dehydrogenases.
B. Cytochromeoxidases.
C. Aminotransferases.
D. Peptidases.
E. *FAD-dependet dehydrogenases.

25. Succinate dehydrogenase catalyses the dehydrogenation of succinate. Malonic acid $HOOC-CH_2-COOH$ is used to interrupt the action of this enzyme. Choose the inhibition type:
A. Allosteric.
B. Limited proteolysis.
C. Non-competitive.
D. Dephosphorylation.
E. *Competitive.

26. A 58-year-old man has a clinical picture of acute pancreatitis. The increase of what substance in the urine from below mentioned will confirm the diagnosis ?
A. Urea.
B. Uric acid.
C. Albumin.
D. Non protein (rest) nitrogen.
E. *Amylase.

27. Which one of the following correctly pairs an amino acid with a valid chemical characeristic?
A. Glutamine: Contains α-OH group in its side chain.
B. Serine: Can form disulfide bonds.
C. Cysteine: Contains the smallest side chain.
D. Glycine: Contains an amide group in its side chain.

E. *Isoleucine: Is nearly always found buried in the center of proteins.

28. Which one of the following statements concerning glutamine is correct?

A. Contains three titratable groups.
B. Is classified as an acidic amino acid.
C. Migrates to the cathode (negative electrode) during electrophoresis at pH 7.0
D. Has E as its one-letter symbol.
E. *Contains an amide group.

29. A peptide bond:

A. occurs most commonly in the cis configuration.
B. is ionized at physiologic pH.
C. is cleaved by agents that denature proteins, such as organic solvents and high concentrations of urea.
D. is stable to heating in strong acids.
E. *has a partial double-bond character.

30. Which one of the following statements is correct?

A. The α-helix can be composed of more than one polypeptide chain.
B. β-sheets exist only in the antiparallel form.
C. The α-helix is stabilized primarily by ionic interactions between the side chains of amino acids.
D. Motifs are a type of secondary structure.
E. *β-Bends often contain proline.

31. Which one of the following statements about protein structure is correct?

A. Proteins consisting of one polypeptide can have quaternary structure.
B. The formation of a disulfide bond in a protein requires that the two-participating cysteine residues be adjacent to each other in the primary sequence of the protein.
C. The stability of quaternary structure in proteins is mainly a result of covalent bonds among the subunits.
D. The denaturation of proteins always leads to irreversible loss of secondary and tertiary structure.
E. *The information required for the correct folding of a protein is contained in the specific sequence of amino acids along the polypeptide chain.

32. An 80-year-old man presented with impairment of higher intellectual function and

alterations in mood and behavior. His family reported progressive disorientation and memory loss over the last six months. There is no family history of dementia. The patient was tentatively diagnosed with Alzeheimer disease. Which one of the following best describes the disease?

A. It is associated with β-amyloid - an abnormal protein with altered amino acid sequence.

B. It results from accumulation of denatured proteins that have random conformations.

C. It is associated with the accumulation of amyloid precursor protein.

D. It is an environmentally produced disease uninfluenced by the genetics of the individual.

E. *It is associated with the deposition of neurotoxic amyloid peptide aggregates.

33. Which one of the following statements concerning the hemoglobins is correct?

A. HbA_2 appears early in fetal life.

B. Purified HbF (stripped of 2,3-BPG) has a higher affinity for oxygen than does purified HbA.

C. The chain composition of HbF is $\alpha_2\delta_2$.

D. HbA_{1c} differs from HbA by a single, genetically determined amino acid substitution.

E. *Fetal blood has a higher affinity for oxygen than does adult blood because HbF has a decreased affinity for 2,3-BPG.

34. A 67-year-old man presented to the emergency department with one-week history of angina and shortness of breath. He complained that his face and extremities had a "blue color." His medical history included chronic stable angina treated with isosorbide dinitrate and nitroglycerin. Blood obtained for analysis was chocolate-colored. Which one of the following is the most likely diagnosis?

A. Sickle cell disease.

B. Carboxyhemoglobinemia.

C. Hemoglobin SC disease

D. β-Thalassemia.

E. *Methemoglobinemia.

35. A competitive inhibitor of an enzyme:

A. decreases both V_{max} and K_m.

B. decreases K_m without affecting V_{max}.

C. increases V_{max} without affecting K_m.

D. decreases V_{max} without affecting K_m.

E. *increases K_m without affecting V_{max}.

36. The Michaelis constant, K_m, is:
A. numerically equal to ½ V_{max}.
B. dependent on the enzyme concentration.
C. independent of pH.
D. increased in the presence of a noncompetitive inhibitor.
E. *numerically equal to the substrate concentration that gives half-maximal velocity.

1.2. Bioenergetics. General pathways of catabolism

1. 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. Glycerol.
B. Glucose.
C. Vitamin A.
D. Fatty acids.
E. *α-Tocoferol.

2. Microsomal oxidation is a universal biological system that oxidizes nonpolar substances including pharmaceutical drugs, toxins, steroid hormones and cholesterol. Which cytochrome takes part in the functioning of microsomal oxidation chain?
A. Cytochrome c.
B. Cytochrome a_3.
C. Cytochrome b.
D. Cytochrome a.
E. *Cytochrome $P_{450.}$

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 P_{450}.
B. Flavine enzymes.
C. Cytochrome b.
D. NAD^+-dependent dehydrogenases.
E. *Cytochrome oxidase (cytochrome aa_3).

4. The central intermediate which is common for the catabolic pathways of proteins, carbohydrates and lipids is:
A. Succinyl-CoA.
B. Citrate.
C. Oxaloacetate.
D. Lactate.
E. *Acetyl-CoA.

5. What substance is the principal energy source for brain tissues?
A. Acetone bodies.
B. Fatty acids.
C. Lactate.
D. Amino acids.
E. *Glucose.

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. Carbamoyl phosphate synthetase.
C. Heme synthase.
D. Aspartate amlnotransferase.
E. *Cytochrome oxidase.

7. 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 mitochondria! respiratory chain.
B. Activation of substrate level phosphorylation.
C. Blockage of substrate level phosphorylation.
D. Activation of oxidative phosphorylation.
E. *Uncoupling of oxidation and oxidative phosphorylation.

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

9. How many molecules of ATP can be synthesized in case of the complete oxidation of acetyl-CoA in the tricarboxylic acid cycle?
A. 1.
B. 8.
C. 5.
D. 5.
E. *12.

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 phosphorylatlon. Choose the name of these hormones from the following list:

A. Glucagon.
B. Adrenaline and noradrenaline.
C. Cortlcosteroids.
D. Insulin.
E. *Thyroid hormones.

11. Activation of membrane lipids peroxidation is one of the basic mechanisms of membrane structure and function damage as well as the death of a cell. The cause of this pathology is:

A. B_{12}-hypervitaminosis.
B. B_1-deficiency.
C. B_1-hypervitaminosis.
D. B_{12}-deficiency.
E. *Vitammin E deficiency.

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 b.
B. Chemical bonding to the substrates of citric acid cycle.
C. Blockage of succinate dehydrogenase.
D. Inactivation of oxygen molecule.
E. *Inhibition of cytochrome oxidase.

13. Brain bioenergetics depends essentially on oxygen supply. Which substrate of oxidation is the most important for the provision of brain cells chemical energy?

A. Fatty acids.
B. Phosphoenolpyruvate.
C. Ketone bodies.
D. Glycerol-3-phosphate.
E. *Glucose.

14. Profuse foam appeared when dentist put hydrogen peroxide on the mucous of the oral cavity. What enzyme caused such activity?

A. Methemoglobinreductase.
B. Cholinesterase.
C. Glucose-6-phosphatdehydrogenase.
D. Acetyltransferase.
E. *Catalase.

15. During metabolic process active forms of the oxygen including superoxide anion radical are formed in the

human body. With the help of what enzyme is this anion activated?
A. Catalase.
B. Glutathionereductase.
C. Peroxidase.
D. Glutathioneperoxidase.
E. *Superoxide dismutase.

16. Patient with abscess of the cut wound applied to the traumatological department. In order to clean the wound from the pus doctor washed it with 3% hydrogen peroxide. Foam was absent. What caused the absence of the drug activity?
A. Inherited insufficiency of erythrocyte phosphatdehydrogenase.
B. Pus in the wound.
C. Shallow wound.
D. Low concentration H_2O_2.
E. *Inherited insufficiency of catalase.

17. Oval and round organelles with double wall are seen at the electron micrograph. The outer membrane is smooth, the inner membrane folder into cristae contain enzyme ATPase synthetase. These are:
A. Ribosome's.
B. Centrioles.
C. Golgi complex.
D. Lysosomes.
E. *Mitochondria.

18. The preventive radioprotector was given to a worker of a nuclear power station. What mechanism from the below mentioned is considered to be the main mechanism of radioprotection?
A. Activation of oxidation reactions.
B. Increasing of respiration.
C. Increasing of tissue blood supply.
D. Prevention of tissue's hypoxia.
E. *Inhibition of free radicals formation.

19. Which one of the following statements concerning the components of the electron transport chain is correct?
A. All of the components of the electron transport chain are present in large, multisubunit protein complexes embedded in the inner mitochondrial membrane.
B. Oxygen directly oxidizes cytochrome c.
C. Succinate dehydrogenase directly reduces cytochrome c.
D. Cyanide inhibits electron flow, but not proton pumping or ATP synthesis.
E. *The electron transport chain contains some polypeptide chains

coded for by the nuclear DNA and some coded for by mtDNA.

20. A muscle biopsy from a patient with the rare disorder, Luft disease, showed abnormally large mitochondria that containned packed cristae when examined in the electron microscope. Basal ATPase activity of the mitochodria was seven times greater than normal. From these and other data it was concluded that oxidation and phosphorylation were par-tially uncoupled. Which of the following statements about this patient is correct?

A. The rate of electron transport is abnormally low.

B. The proton gradient across the inner mitochondrial membrane is greater than normal.

C. ATP levels in the mitochondria are greater than normal.

D. Cyanide would not inhibit electron flow.

E. *The patient shows hypermetabolism and elevated core temperature.

PART II

Metabolism of carbohydrates, lipids and its regulation

2.1. Metabolism and functions of carbohydrates

1. After taking sulfonamides and aspirin by a 38-year-old patient, hemolysis of erythytrocytes caused by the insufficiency of glucose-6-phosphate dehydrogenase developed. The disturbance of what coenzyme formation dose this pathology result from?
A. Ubiquinone.
B. NADH.
C. FADH.
D. FMNH.
E. *NADPH.

2. The intake of aspirin by a 3-year-old child with a fever caused marked erythrocytes hemolysis. The inherited deficiency of what enzyme could be the cause of the hemolytic anemia development?
A. Glycerol-phosphate dehydrogenase.
B. Glucose-6-phosphatase.
C. Glycogen phosphorylase.
D. γ-Glutaminyl transferase.
E. *Glucose-6-phosphate dehydrogenase.

3. 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.

4. Some hours after an intensive physical training a sportsman showed activated gluconeogenesis. Which of the following is the basic substrate of gluconeogenesis?
A. Serine.
B. Aspartate.
C. Glutamate.
D. α-Ketoglutarate.
E. *Lactate.

5. The concentration of glucose in the blood plasma of a healthy man varies within the following limits:
A. 2,0-4,0 mM/l.
B. 1,0-2,0 mM/l.
C. 10,0-25,0 mM/l.
D. 6,0-9,5 mM/l.

E. *3,3-5,5 mM/l.

6. A 34-year-old patient's resistance to heavy physical load is reduced while the skeletal muscles glycogen level is increased. By decreasing of the activity of what enzyme can this phenolmenon be explained?
A. Phosphofructokinase.
B. Glucose-6-phosphate dehydrogenase.
C. Glucose-6-phosphatase
D. Glycogen synthetase.
E. *Glycogen phosphorylase.

7. A child with point mutation has the absence of glucose 6-phosphatase in body tissues, hypoglycemia and hepatomegaly detected. Define the type of pathology which these symptoms are characteristic of:
A. McArdle's disease.
B. Measles.
C. Addison's disease.
D. Parkinson's disease.
E. *Girke's disease.

8. A man who fainted while training at the final stage of the marathon distance was brought to a hospital in the comatose state. Define the type of coma that was diagnosed.
A. Hepatic.
B. Hyperglycemic.
C. Acidotic.
D. Hypothyroidal.
E. *Hypoglycemic.

9. 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 with enzyme takes part in the carbohydrates breakdown causes the indicated disorders?
A. Saccharase.
B. Amylase.
C. Maltase.
D. Isomaltase.
E. *Lactase.

10. The high-speed sprint causes a feeling of pain in skeletal muscles of untrained people that occurs due to lactate accumulation. The activation of what biochemical process is it resulting from?
A. Gluconeogenesis.
B. Glycogenesis.
C. Pentose phosphate pathway.
D. Lipogenesis.
E. *Glycolysis.

11. A 2-year-old boy has the increase of liver and spleen sizes detected and eye cataract present. The total sugar level in blood is

increased, but glucose tolerance is within the normal range. The inherited disturbance of the metabolism of what substance is the cause of the indicated state?
A. Glucose.
B. Fructose.
C. Saccharose.
D. Maltose.
E. *Galactose.

12. A worker of a chemical plant was brought to a hospital with signs of poisoning. In the woman's hair a high level of arsenate that blocks the lipoic acid was revealed. The disorder of what biochemical process is the most probable cause of poisoning?
A. Rendering superoxide radicals harmless.
B. Microsomal oxidation.
C. Reduction of methemoglobin.
D. Reduction of organic oxides.
E. *Oxidative decarboxylation of pyruvate.

13. Under Girke's glycogenosis the conversion of glucose-6-phosphate into glucose is disturbed, which results in excessive glycogen accumulation in liver and kidneys. The deficiency of what enzyme is the cause of the disease?
A. Phosphorylase.
B. Glycogen synthase.
C. Aldolase.
D. Hexokinase.
E. *Glucose-6-phosphatase.

14. A child is sluggish and inert. His liver is enlarged. The liver biopsy showed the excess of glycogen. The concentration of glucose in blood plasma is below the normal range. What is the cause of the glucose level decrease in blood?
A. Deficiency of the gene, which is responsible for the synthesis of glucose-1-phosphate uridine transferase.
B. Reduced (or absent) activity of hexokinase.
C. High activity of glycogen synthase.
D. Reduced (or absent) activity of glucose-6-phosphatase.
E. *Reduced (or absent) activity of glycogen phosphorylase in the liver.

15. Protein avidin, a minor constituent of uncooked eggs, is a powerful specific inhibitor of biotin enzymes. Which of the below listed metabolic transformations would be blocked in case of the avidin addition to the cells homoganate?
A, Glucose → ribose-5-phosphate.

B. Glucose → pyruvate.
C. Oxaloacetate→ glucose.
D. Lactate → pyruvate.
E. *Pyruvate → oxaloacetate.

16. A 7-year-old girl manifests obvious signs of anemia. Laboratory tests showed the deficiency of pyruvate kinase activity in erythrocytes. The disorder of what biochemical process is a major factor in the development of anemia?
A. Deamination of amino acid.
B. Oxidative phosphorylation.
C. Tissue respiration.
D. Breaking up of peroxides.
E. *Anaerobic glycolysis.

17. A newborn child with the signs of cataract, growth and mental retardation, who manifestted vomiting and diarrhea, was brought to an emergency clinic. A presumptive diagnosis - galactosemia. The deficiency of what enzyme occurs in case of this disease?
A. Glucose-6-phosphate dehydrogenase.
B. Glucokinase.
C. UDP-galactose-4-epimerase.
D. Hexokinase.
E. *Galactose-1-phosphate-uridyl transferase.

18. A 45-year-old woman does not have any symptoms of insulin dependent diabetes mellitus but testing on an empty stomach showed the increase of the blood glucose level (7.5 mM/l). What additional laboratory test needs to be done to substantiate the diagnosis?
A. Determination of tolerance to glucose.
B. Determination of ketone bodies concentration in the urine.
C. Determination of rest nitrogen level in the blood.
D. Determination of glycosylated hemoglobin level.
E. *Determination of tolerance to glucose on an empty stomach.

19. In the patient's blood the glucose level on an empty stomach was 5,65 mM/l, an hour after sugar loading the corresponding number was 8,55 mM/l, and two hours later it became 4,95 mM/l. Such indexes are typical of the state of:
A. Insulin dependent diabetes mellitus.
B. Latent diabetes mellitus.
C. Thyrotoxicosis.
D. Non-insulin dependent diabetes mellitus.

E. *Complete health.

20. What biochemical process is stimulated in the liver and kidneys of a patient exhausted by starvation?
A. Synthesis of bilirubin.
B. Synthesis of urea.
C. Synthesis of uric acid.
D. Formation of hippuric acid.
E. *Gluconeogenesis.

21. Erythrocytes require energy of ATP for their vital functions. What process provides these cells with the necessary amount of ATP?
A. Citric acid cycle.
B. Aerobic oxidation of glucose.
C. Pentose phosphate pathway.
D. β-Oxidation of fatty acids.
E. *Anaerobic glycolysis.

22. Due to the lack of thiamine (vitamin B_1) vitamin deficiency a disease called "beriberi" develops and carbohydrate metabolism becomes disturbed. What metabolite accumulates in blood under beri-beri?
A. Lactate.
B. Malate.
C. Succinate.
D. Citrate.
E. *Pyruvate.

23. Anaerobic oxidation of glucose to lactate is regulated by appropriate enzymes. What enzyme is the main regulator of this process?
A. Lactate dehydrogenase.
B. Glucose-6-phosphate isomerase.
C. Aldolase.
D. Enolase.
E. *Phosphofructokinase.

24. A cataract and fatty degeneration of the liver develop in the conditions of high galactose and low glucose level in blood. What disease do these symptoms testify to?
A. Diabetes mellitus.
B. Fructosemia.
C. Lactosemia.
D. Steroid diabetes.
E. *Galactosemia.

25. Appearance of sugar and ketone bodies is revealed in the patient's urine. Blood glucose concentration is 10.1 mM/1. What is a presumptive diagnosis of the patient?
A. Atherosclerosis.
B. Myocardial infarction.
C. Toxic hepatitis.
D. Pancreatitis.
E. *Diabetes mellitus.

26. Biosynthesis of the purine ring occurs owing to ribose-5-

phosphate by gradual joining of nitrogen and carbon atoms inside the heterocycle structure and closing of the rings. The metabolic source of ribose-5-phosphate is:
A. Glycogenolysis.
B. Glycolysis.
C. Glycogenesis.
D. Gluconeogenesis.
E. *Pentose phosphate pathway.

27. A woman in the unconscious state was brought to an emergency clinic. Laboratory research revealed that the blood glucose level makes 1,98 mM/l, the level of hemoglobin is 82 g/l, the amount of erythrocytes is $2,1 \cdot 10^{12}$, SSE (speed of erythrocytes setting) is 18 mm/hour and the amount of leucocytes is $4,3 \cdot 10^{9}$/l. Make a possible diagnosis.
A. Diabetes insipidus.
B. Diabetes mellitus.
C. Galactosemia.
D. Somatotropin deficiency.
E. *Hypoglycemia.

28. Because of prolonged starvation, the tissue carbohydrate stores are quickly exhausted and hypoglycemia ensues in a human body. Which of the following metabolic pathways can restore the level of glucose in blood?
A. Aerobic glycolysis.
B. Anaerobic glycolysis.
C. Pentose phosphate pathway.
D. Glycogenolysis.
E. *Gluconeogenesis.

29. Girke's disease is an inherited pathology due to which the superfluous accumulation of glycogen occurs in liver and kidneys. The deficiency of which enzyme Is the cause of this disease?
A. Glycogen phosphorylase.
B. Glucokinase.
C. Phosphorylase kinase.
D. Phosphoglucomutase.
E. *Glucose-6-phoshatase.

30. A 40-year-old man complains of intolerance to dairy products. The deficiency of what enzyme of the digestive system accounts for the phenomenon?
A. Amylase.
B. Lactate dehydrogenase.
C. Maltase.
D. Lipase.
E. *Lactase.

31. A patient suffering from diabetes mellitus fainted after the introduction of insulin, then cramps appeared. What level of sugar was determined in the

patient's blood by means of biochemical analysis?
A. 10.0 mM/1.
B.3.3 mM/1.
C.8.0 mM/1.
D. 5.5 mM/1.
E. *1.5 mM/1.

32. A 40-year-old woman diagnosed with diabetes mellitus is admitted to a department of endocrinology. The patient complains of thirst and increased hunger. What pathological components are exposed at laboratory research of the patient's urine?
A. Blood.
B. Protein, amino acid.
C. Protein, creatine.
D. Bilirubin, urobilin.
E. *Glucose, ketone bodies.

33. Skeletal muscle pain during physical work is a characteristic sign of glycogenosis. The inherited deficiency of what enzyme does this pathology result from?
A. Lysosomal glycosidase.
B. Glucose-6-phosphatase.
C. Glycogen synthetase.
D. Amylo-1.6-glicosidase.
E. *Glycogen phosphorylase.

34. Galactosemia is revealed in the child. Concentration of glucose in the blood is not considerably changed. Deficiency of what enzyme caused this illness?
A. Galactokinase.
B. Hexokinase.
C. Amylo-1.6-glucosidase.
D. Phosphoglucomutase.
E. *Galactose-l-phosphate uridyltransferase.

35. 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. Isomaltase.
B. Invertase.
C. Amylase.
D. Maltase.
E. *Lactase.

36. A 62-year-old female patient has developed a cataract (lenticular opacity) secondary to the diabetes mellitus. What type of protein modification is observed in case of diabetic cataract?
A. ADP-ribosylation.
B. Methylation.
C. Limited proteolysis.
D. Phosphorylation.

E. *Glycosylation.

37. To prevent long-term effects of 4-day malaria a 42-year-old patient was prescribed primaquine. On the 3-rd day from the begin of treatment there appeared stomach and heart pains, dyspepsia, general cyanosis, hemoglobinuria. What caused side effects of the preparation?

A. Drug potentiation by other preparations.
B. Delayed urinary excretion of the preparation.
C. Decreased activity of microsomal liver enzymes.
D. Cumulation of the preparation.
E. *Genetic insufficiency of glucose 6-phosphate dehydrogenase.

38. A patient with the symptoms of acute alcoholic poisoning was brought to the hospital. What carbohydrates metabolism changes are typical for this condition?

A. The anaerobic glucose metabolism predominates in muscles.
B. The gluconeogenesis is increased in liver.
C. The breakage of glycogen is increased in liver.
D. The anaerobic breakage of glucose is increased in muscles.
E. *The gluconeogenesis velocity in liver is decreased.

39. A patient, undergoing a course of curative starvation, has a normal glucose level of the blood mainly due to glucogenesis. What aminoacid in human liver most actively synthesizes glucose?

A. Valine.
B. Leucine.
C. Lysine.
D. Glutamic acid.
E. *Alanine.

40. A young black man entered his physician's office complainning of bloating and diarrhea. His eyes were sunken and the physician noted additional signs of dehydration. The patient's temperature was normal. He explained that the episode had occurred following a birthday party at which he had participated in an ice cream eating contest. The patient reported prior episodes of a similar nature following ingestion of a significant amount of dairy products. This clinical picture is most probably due to a deficiency in:

A. Salivary α-amylase.

B. Isomaltase.
C. Pancreatic α-amylase.
D. Sucrase.
E. *Lactase.

41. Which one of the following statements concerning glycollysis is correct?
A. The conversion of glucose to lactate requires the presence of oxygen.
B. Hexokinase is important in hepatic glucose metabolism only in the absorptive period following consumption of a carbohydrate-containing meal.
C. Fructose 2,6-bisphosphate is a potent inhibitor of phosphofructokinase.
D. The conversion of glucose to lactate yields two ATP and two NADH.
E. *The rate-limiting reactions are also the irreversible reactions.

42. The reaction catalyzed by phosphofructokinase:
A. Is activated by high concentrations of ATP and citrate.
B. Uses fructose 1-phosphate as substrate.
C. Is inhibited by fructose 2,6-bisphosphate.
D. Is near equilibrium in most tissues.
E. *Is the regulated reaction of the glycolytic pathway.

43. Compared with the resting state, vigorously contracting muscle shows:
A. Decreased level of fructose 2,6-bisphosphate.
B. Decreased oxidation of pyruvate to CO_2 and water.
C. Decreased $NADH/NAD^+$ ratio.
D. Decreased concentration of AMP.
E. *Increased conversion of pyruvate to lactate.

44. A 43-year-old man presented with symptoms of weakness, fatigue, shortness of breath, and dizziness. His hemoglobin levels were between 5 to 7 g/dl (normal for a male being greater than 13,5 g/dl). Red blood cells isolated from the patient showed abnormally low level of lactate production. A deficiency of which one of the following enzymes would be the most likely cause of this patient's anemia?
A. Phosphoglucose isomerase.
B. Phosphofructokinase.
C. Lactate dehydrogenase.
D. Hexokinase.
E. *Pyruvate kinase.

45. The conversion of pyruvate to acetyl CoA and CO_2:

A. Is reversible.
B. Depends on the coenzyme biotin.
C. Is activated when pyruvate dehydrogenase complex is phosphorylated by a protein kinase in the presence of ATP.
D. Occurs in the cytosol.
E. *Involves the participation of lipoic acid.

46. Which one of the following conditions decreases the oxidation of acetyl CoA by the citric acid cycle?
A. A low ATP/ADP ratio.
B. A low NADH due to rapid oxidization to NAD^+ through the respiratory chain.
C. A low GTP/GDP ratio.
D. A high concentration of AMP.
E. *A low NAD+/NADH ratio.

47. A one-month-old male showed abnormalities of the nervous system and lactic acidosis. Enzyme assay for pyruvate dehydrogenase (PDH) activity on extracts of cultured skin fibroblasts showed five percent of normal activity, with a low concentration of thiamine pyrophosphate (TPP), but eighty percent of normal activity when the assay containned a high concentration of TPP. Which one of the following statements concerning this patient is most correct?
A. Elevated levels of lactate and pyruvate in the blood reliably predict the presence of PDH deficiency.
B. The patient is expected to show disturbances in fatty acid degradation.
C. A diet consisting of high carbohydrate intake would be expected to be beneficial in this patient.
D. Alanine concentration in the blood is expected to be less than normal.
E. *Administration of thiamine is expected to reduce his serum lactate concentration and improve his clinical symptoms.

48. The synthesis of glucose from pyruvate by gluconeogenesis:
A. Occurs exclusively in the cytosol.
B. Is inhibited by an elevated level of glucagon.
C. Requires the oxidation / reduction of FAD.
D. Involves lactate as an intermediate.
E. *Requires the participation of biotin.

49. Which one of the following statements concerning gluconeogenesis is correct?

A. It occurs in muscle.

B. It is stimulated by fructose 2,6-bisphosphate.

C. It is inhibited by elevated levels of acetyl CoA.

D. It uses carbon skeletons provided by degradation of fatty acids.

E. *It is important in maintaining blood glucose during the normal overnight fast.

50. Which one of the following reactions is unique to gluconeogenesis?

A. Lactate → pyruvate.

B. Phosphoenolpyruvate → pyruvate.

C. 1,3-bisphosphoglycerate → 3-phosphoglycerate.

D. Glucose 6-phosphate → fructose 6-phosphate.

E. *Oxaloacetate → phosphoenolpyruvate.

51. A thirteen-year-old female was brought to your office by her mother, who was troubled by her daughter's chronic fatigue, dizziness, and loss of weight. Laboratory results showed leukopenia, blood glucose = 50 mg/dl (normal fasting blood glucose = 70 to 90 mg/dl), and elevated ketones. Persistent questioning revealed that the young woman had been virtually fasting for four months, hoping to obtain a "skinny face" as a prelude to a career in modeling. Which one of the following best explains the patient hypoglycemia?

A. Impaired secretion of insulin.

B. Enhanced secretion of glucagon.

C. Impaired hydrolysis of liver glycogen.

D. Impaired mobilization of triglycerides.

E. *Impaired conversion of amino acids to glucose.

52. A two-year-old boy was brought into the emergency room, suffering from severe fasting hypoglycemia. On physical examination, he was found to have hepatomegaly. Laboratory tests indicated that he also had hyperlacticacidemia and hyperuricemia. A liver biopsy indicated that hepatocytes containned greater than normal amounts of glycogen that was of normal structure. The child was subsequently found to be missing which of the following enzymes?

A. Glycogen synthase.

B. Glycogen phosphorylase.
C. Amylo-α (1→6)-glucosidase.
D. Amylo-α (1→4) → α (1→6)-transglucosilase.
E. *Glucose 6-phosphatase.

53. Epinephrine and glucagon have which one of the following effects on glycogen metabolism in the liver?
A. The net synthesis of glycogen is increased.
B. cAMP-dependent protein kinase is activated, whereas phosphorylase kinase is inactivated.
C. Both glycogen phosphorylase and glycogen synthase are activeted but at significantly different rates.
D. Glycogen phosphorylase is inactivated, whereas glycogen synthase is activated.
E. *Glycogen phosphorylase is activated, whereas glycogen synthase is inactivated.

54. Following the intravenous injection of lactose into a rat, none of the lactose is metabolized. However, ingestion of lactose leads to rapid metabolism of this disaccharide. The difference in these observations is a result of:
A. The presence of lactase in the serum.
B. The absence of hepatic galactokinase.
C. The absence of maltase in the serum.
D. The absence of hepatic glucokinase.
E. *The presence of lactase in the intestine.

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55. A galactosemic female is able to produce lactose because:
A. Free (nonphosphorylated) galactose is the acceptor of glucose transferred by lactose synthase in the synthesis of lactose.
B. Galactose can be produced from fructose by isomerization.
C. Hexokinase can efficiently phosphorylate dietary galactose to galactose 1-phosphate.
D. The enzyme deficient in galactosemia is activated by a hormone produced in the mammary gland.
E. *Galactose can be produced from a glucose metabolite by epimerization.

56. A newborn baby experienced abdominal distension, severe bowel cramps, and diarrhea after being fed milk. A hydrogen analysis of his exhaled breath discovered an eighty-fold

increase in the production of H_2 ninety minutes after milk feeding. The infant most probably suffers from:

A. Galactokinase deficiency.

B. Galactose-1-phosphate uridyltransferase deficiency.

C. β-Glucosidase (isomaltase) deficiency.

D. Sucrase deficiency.

E. *β-Galactosidase (lactase) deficiency.

57. In male patients who are homozygous for glucose 6-phosphate dehydrogenase (G6PD) deficiency, pathophysiologic consequences are more apparent in erythrocytes (RBC) than in other cells, such as in the liver. Which one of the following provides a reasonable explanation for this different response by these individual tissue types?

A. Excess glucose-6-phosphate in the liver, but not in RBC, can be channeled to glycogen, thus averting cellular damage.

B. The catalytic properties of the liver enzyme are significantly different than those of the RBC enzyme.

C. Glucose-6-phosphatase activity in RBCs removes the excess glucose-6-phosphate, thus resulting in cell damage. This does not happen in the hepatocyte.

D. Because RBCs do not have mitochondria, production of ATP required to keep cell integrity depends exclusively on the routing of glucose-6-phosphate via the pentose phosphate pathway.

E. *Liver cells, in contrast to RBCs, have alternative mechanisms for supplying the NADPH required for keeping metabolic and cellular integrity.

58. Mucopolysaccharidoses are inherited storage diseases. They are caused by:

A. An increased rate of synthesis of proteoglycans.

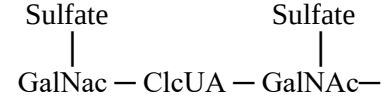
B. The synthesis of polysaccharides with an altered structure.

C. An insufficient amount of proteolytic enzymes.

D. The synthesis of abnormally small amounts of protein cores.

E. *Defects in the degradation of proteoglycans.

59. The presence of the following compound in the urine of a patient suggests a deficiency in which one of the enzymes listed below?



A. Galactosidase
B. Glucosidase
C. Glucuronidase
D. Mannosidase
E. *Sulfatase.

2.2 Lipids metabolism and functions

1. A 57-year-old patient, suffering from insulin dependent diabetes mellitus, showed the development of ketoacidosis. The biochemical mechanism of the development of this pathology is decreasing of acetyl-CoA utilization due to the deficiency of:
A. 2-Oxogluttarate
B. Succinate.
C. Glutamate.
D. Aspartate.
E. *Oxaloacetate.

2. The essence of lipolysis, that is the mobilization of fatty acids from neutral fats depots, is an enzymatic process of hydrolysis of triacylglycerols to fatty acids and glycerol. Fatty acids are that released during this process enter blood circulation and are transported as the components of:
A. LDL.
B. Globulins.
C. HDL.
D. Chylomicrons.
E. *Serum albumins.

3. After the consumption of animal food rich in fats, a patient celt discomfort, and droplets of fats are found during laboratory investigation of his feces. Bile acids are revealed in the urine. The cause of such state is the deficiency of _____ in the digestive tract.
A. Phospholipids.
B. Fatty acids.
C. Chylomicrons.
D. Triacylglycerols.
E. *Bile acids.

4. A patient suffered from arterial hypertension due to atherosclerotic injury of blood vessels. The consumption of what dietary lipid needs to be limited?
A. Lecithine.
B. Oleic acid.
C. Phosphatidylserine.
D. Monooleateglycerol.
E. *Cholesterol.

5. A 35-year-old man with pheochromocytoma has high levels of epinephrine and norepinephrine registered in the blood. The concentration of free

fatty acids is increased by a factor of eleven. Which of the following enzymes accelerates the lipolysis under the action of epinephrine?
A. Cholesterol esterase.
B. Lypoprotein lipase.
C. Phospholipase A_2.
D. Phospholipase C.
E. *Triacylglycerol lipase.

6. In a human body the adipose tissue is the basic location of triacylglycerols (TAG) deposit. At the same time their synthesis takes place in hepatocytes. In the form of what molecular complex are TAG transported from the liver into the adipose tissue?
A. Chylomicrons.
B. Complexes with albumin.
C. LDL.
D. HDL.
E. *VLDL.

7. Laboratory investigation of a patient revealed a high level of plasma LDL. What disease can be diagnosed?
A. Gastritis.
B. Nephropathy.
C. Acute pancreatitis.
D. Pneumonia.
E. *Atherosclerosis.

8. Laboratory testing of the patient's blood and urine showed the following biochemical indexes: blood: sugar – 16,0 mM/l, ketone bodies – 0,52 mM/l; urine: diuresis - 10 l/24 h, glucose – 2,0 %, ketone bodies +++. What is a credible diagnosis?
A. Kidney diabetes.
B. Diabetes insipidus.
C. Steroid diabetes.
D. Cushlng's disease.
E. *Diabetes mellitus.

9. Carnitine is recommended to a sportsman as a preparation that increases physical activity and improves achievements. What biochemical process is mostly activated under the action of carnitine?
A. Steroid hormones synthesis.
B. Ketone bodies synthesis.
C. Lipids synthesis.
D. Tissue respiration.
E. *Transport of fatty acids into mitochondria.

10. Under fatty infiltration of the liver the synthesis of phospholipids is disturbed. Which substance from the listed below can stimulate processes of methylation in the synthesis of phospholipids?
A. Citrate.

B. Ascorbic acid.
C. Glucose.
D. Glycerol.
E. *Methionine.

11. Clinical signs and laboratory testing of a patient allow to assume of gallbladder inflammation, colloid properties of bile disorder, the occurrence of gallstones. Which substances can underlie the formation of gallstones?
A. Oxalates.
B. Urates.
C. Phosphates.
D. Chlorides.
E. *Cholesterol.

12. A diet enriched with lipotropic substances is recommended to a 65-year-old patient with signs of total obesity and fatty dystrophy of the liver. Which substances from the listed below are lipotropic?
A. Vitamin C.
B. Cholesterol.
C. Glucose.
D. Glycine.
E. *Methionine.

13. Arachidonic acid, an essential component of a human diet, acts as a precursor of the vitally important physiologically active biomolecules. Which substances are synthesized from arachidonic acid?
A. Ethanolamine.
B. Choline.
C. Noradrenaline.
D. Triiodothyronine.
E. *Prostaglandin E_1.

14. Laboratory investigation of the patient's blood plasma, which was performed 4 hours after a consumption of a fat diet, displayed a marked increase of plasma turbidity. The most credible cause of this phenomenon is the increase of… in the plasma.
A. HDL.
B. Phospholipids.
C. LDL.
D. Cholesterol.
E. *Chylomicrons.

15. The insufficient secretion of what enzyme is the cause of incomplete fats degradation in the digestive tract and appearance of great quantity of neutral fats in feces?
A. Pepsin.
B. Phospholipase.
C. Enterokinase.
D. Amylase.
E. *Pancreatic lipase.

16. A 1-year-old child was brought to a clinic with signs of muscle weakness. Through the inspection, the deficiency of carnitine in the muscles was determined. The biochemical mechanism of the development of this pathology consists in the disorder of the process of:
A. Synthesis of action and myosin.
B. Regulation of the level of Ca^{2+} in mitochondria.
C. Substrate level of phosphorrylation.
D. Utilization of lactate.
E. *Transport of fatty acids into mitochondria.

17. Metabolism of phospholipids is disturbed due to fat infiltration of the liver. Indicate which of the presented substances can enhance the process of methylation during phospholipids synthesis?
A. Glucose.
B. Glycerin.
C. Ascorbic acid.
D. Citrate.
E. *Methionine.

18. Increased amount of free fat acids is observed in the blood of the patients with diabetes mellitus. It can be caused by:
A. Storage of pamitatoil-CoA.
B. Activation of the synthesis of the apolipoproteins.
C. Activation of the ketone bodies utilization.
D. Decreased activity of phosphatidylcholine-cholesterol-acyltransferase.
E. *Increased activity of triglyceride lipase in adipocytes.

19. Carnitine including drug was recommended to the sportsman for improving results. What process is activated most of all with the help of carnitine?
A. Synthesis of steroid hormones.
B. Synthesis of lipids.
C. Tissue respiration.
D. Synthesis of ketone bodies.
E. *Transport of fatty acids to the mitochondria.

20. A 65-year-old man with sings of profuse obesity and risk of fatty liver dystrophy was recommended high-lipotropic diet. The contents of what substance in his diet is the most effective in this case?
A. Glucose.
B. Vitamin C.
C. Glycin.
D. Cholesterol.
E. *Methionine.

21. Because of gallstones in the common bile duct, a patient has

no bile excretion into duodenum. What disorder can it cause?
A. Carbohydrates digestion.
B. Carbohydrates absorption.
C. Proteins adsorption.
D. Proteins digestion.
E. *Lipids digestion.

22. Synthesis of phospholipids is disordered under the liver fat infiltration. Indicate which of the following substances can enhance the process of methylation during phospholipids synthesis?
A. Glucose.
B. Citrate.
C. Ascorbic acid.
D. Glycerin.
E. *Methionine.

23. A patient with diabetes mellitus has been delivered in hospital in the state of unconsciousness. Arterial pressure is low. The patient has acidosis. Point substances, which accumulation in the blood results in these manifestations:
A. Cholesterol esters.
B. Monosaccharides.
C. Amino acids.
D. High fatty acids.
E. *Ketone bodies.

24. A. 12-year-old teenager has significantly put off weight within 3 months; glucose concentration raised up to 50 mM/l. He fell into a coma. What is the main mechanism of its development?
A. Hypoglycemic.
B. Hyperosmolar.
C. Hypoxic.
D. Lactacidemic.
E. *Ketonemic.

25. A patient with high rate of obesity was advised to use carnitine as a food additive in order to enhance "fat burning". What is the role of carnitine in the process of fat oxidation?
A. Activation of intracellular lipolysis.
B. FFA activation.
C. It takes part in one of reactions of FFA beta-oxidation.
D. Transport of FFA from fat depots to the tissues.
E. *Transport of FFA (free fatty acids) from cytosol to the mitochondria.

26. Examination of a patient suffering from chronic hepatitis revealed a significant decrease in the synthesis and secretion of bile acids. What process will be mainly disturbed in the patient's bowels?

A. Protein digestion.
B. Glycerin absorption.
C. Amino acid absorption.
D. Carbohydrate digestion.
E. *Fat emulsification.

27. Patients with diabetes mellitus and people during starvation have the increased contents of acetone bodies in their blood, which are used as energy material. What substance are they synthesized from?
A. Malate.
B. Ketoglutarate.
C. Succinyl-CoA.
D. Citrate.
E. *Acetyl-CoA.

28. Complaints and objective data allow to suggest that a patient has inflammation in his gallbladder, bile colloidoclasia, probability of gallstones formation, disorder of what metabolism?
A. Oxolates.
B. Urates.
C. Chlorides.
D. Phosphates.
E. *Cholesterol.

29. Which one of the following statements about the absorption of lipids from the intestine is correct?
A. Formation of chylomicrons does not require protein synthesis in the intestinal mucosa.
B. Dietary triacylglycerol must be completely hydrolyzed to free fatty acids and glycerol before absorption.
C. Release of fatty acids from triacylglycerol in the intestine is inhibited by bile salts.
D. Fatty acids that contain ten carbons or less are absorbed and enter the circulation primarily via the lymphatic system.
E. *Dietary triacylglycerol is partially hydrolyzed and absorbed as free fatty acids and monoacylglycerol.

30. The form in which most dietary lipids are packaged and exported from the intestinal mucosal cells is as:
A. Free fatty acids.
B. Mixed micelles.
C. Free triacylglycerol.
D. 2-Monoacylglycerol.
E. *Chylomicrons.

31. Triacylglycerol molecules stored in adipose tissue represent the major reserve of substrate providing energy during a prolonged fast. During such a fast:
A. The stored fatty acids are released from adipose tissue into

the plasma as components of the serum lipoprotein particle, VLDL.
B. Free fatty acids are produced at a high rate in the plasma by the action of lipoprotein lipase on chylomicrons.
C. Glycerol produced by the degradation of triacylglycerol is an important direct source of energy for adipocytes and fibroblasts.
D. Free fatty acids bind with plasma globulins.
E. *Hormone-sensitive lipase is phosphorylated by a cyclic AMP-activated protein kinase.

32. A low level of carbon dioxide labeled with ^{14}C is accidentally released into the atmosphere surrounding industrial workers as they resume work following the lunch hour. Unknowingly, they breathe the contaminated air for one hour. Which of the following compounds will be radioactively labeled?
A. All of the carbon atoms of newly synthesized fatty acid.
B. About one half of the carbon atoms of newly synthesized fatty acids.
C. The carboxyl atom of newly synthesized fatty acids.
D. One half of the carbon atoms of newly synthesized acetyl CoA.
E. *About one third of the carbons of newly synthesized malonyl-CoA.

33. A teenager, concerned about his weight, attempts to maintain a fat free diet for a period of several weeks. If his ability to synthesize various lipids were examined, he would be found to be most deficient in his ability to synthesize:
A. Triacylglycerol.
B. Phospholipids.
C. Cholesterol.
D. Sphingolipids.
E. *Prostaglandins.

34. Autoantibodies to a lipid in the membrane of platelets are seen in the disease, systemic lupus erythematosus. Which of the following membrane lipids is most likely to be involved?
A. Sphingomyelin.
B. Ceramide.
C. Dipalmitoylphosphatidylcholine.
D. Platelet-activating factor.
E. *Cardiolipin.

35. An infant, born at 28 weeks of gestation, rapidly gave evidence of respiratory distress. Lab and X-ray results

supported the diagnosis of infant respiratory distress syndrome (RDS). Which of the following statements about this syndrome is true?

A. It is unrelated to the baby's premature birth.

B. It's a consequence of too few type II pneumocytes.

C. The L/S ratio in the amniotic fluid is likely to be greater than two.

D. RDS is an easily treated disorder with low mortality.

E. *The concentration of dipalmitoylphosphatidylcholine in the amniotic fluid would be expected to be lower than that of a fullterm baby.

36. A 25-year-old woman with a history that included hepatosplenomegaly with eventual removal of the spleen, bone and joint pain with several fractures of the femur, and a liver biopsy that showed wrinkled-looking cells with accumulateons of glucosylceramides was presented at Grand Rounds. The likely diagnosis for this patient is:

A. Fabry disease.

B. Farber disease.

C. Niemann-Pick disease.

D. Krabbe disease.

E. *Gaucher disease.

37. Which of the following lipoprotein particles are most likely responsible for the appearance of the patient's plasma?

A. High density lipoproteins.

B. Very low-density lipoproteins.

C. Intermediate density lipoproteins.

D. Low density lipoproteins.

E. *Chylomicrons

38. Medium-chain length fatty acids are given because they:

A. Are more calorically dense than long-chain fatty acids.

B. Can be converted into a variety of gluconeogenic precursors.

C. Are activators of lipoprotein lipase.

D. Are more efficiently packed into serum lipoproteins.

E. *Enter directly into the portal blood, and can be metabolized by the liver.

39. A 35-year-old woman was seen in the emergency room because of recurrent abdominal pain. The history revealed a two-year pattern of pain in the upper right quadrant, beginning several hours after the ingestion of a meal rich in fried/fatty food. Ultrasonogra-

phic examination demonstrated the presence of numerous stones in the gallbladder. The patient initially elected treatment consisting of exogenously supplied chenodeoxycholic acid, but eventually underwent surgery for the removal of the gallblader, and had a full recovery. The rationale for the initial treatment of this patient with chenodeoxycholic acid is that this compound:

A. Interferes with the enterohepatic circulation.

B. Inhibits cholesterol synthesis.

C. Increases de novo bile acid production.

D. Stimulates VLDL production by the liver.

E. *Increases cholesterol solubility in bile.

PART III

Metabolism of proteins. Molecular biology. Biochemistry of intercellular communications

3.1. Metabolism of amino acids and proteins

1. The increased level of homogentisate is revealed in the urine of a three-month child. Being exposed to the open air, the urine darkens. Which of the following inherited diseases are the described symptoms typical of?
A. Cystinuria.
B. Phenylketonuria.
C. Albinism.
D. Aminoaciduria.
E. *Alcaptonuria.

2. After 12 hours of acute pain behind the breastbone, the essential rise of blood plasma aspartate aminotransferase activity occurred. What pathology are the mentjoned symptoms typical of?
A. Collagenose.
B. Viral hepatitis.
C. Diabetes insipidus.
D. Insulin dependent diabetes mellitus.
E. *Myocardial infarction.

3. 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. Carboxypeptidase and aminopeptidase.
D. Enteropeptidase and elastase.
E. *Pepsin and gastricsin.

4. Albinos suffer badly from the influence of ultraviolet light – they get sunburnt because of spending too much time in the sun. Metabolism disturbance of what amino acid is the reason for this phenomenon?
A. Tryptophan.
B. Methionine.
C. Histidine.
D. Glutamate.
E. *Phenylalanine.

5. High levels of serotonin and 3-oxiahthranilate are revealed in the blood of a patient suffering from urinary bladder cancer. By the disturbance of the metabolism of what amino acid is the cause?
A. Tyrosine.

B. Alanine. '
C. Histidine.
D. Methionine.
E. *Tryptophan.

6. A-newborn child rejects breast feeding, he is restless, and his breathing in unrhythmical and the urine has a specific smell of beer ferment or maple syrup. The innate defect of what enzyme causes this pathology?
A. Aspartate aminotransferase.
B. Glucose-6-phosphate dehydrogenase.
C. Glycerol kinase.
D. UDP – glucuronyltransferase.
E. *Dehydrogenase of branched-chain α-keto acids.

7. Laboratory analysis of the urine of a six-day infant displayed excessive concentration of phenylpyruvate and phenylacetate. Metabolism of what amino acid is disturbed in the body of the child?
A. Methionine.
B. Tryptophan.
C. Arginine.
D. Histidine.
E. *Phenylalanine.

8. A 46-year-old female has been suffering from progressive myodystrophy (Duchenne's disease) for a long time. The change of catalytic activity of what blood enzyme proves to be a diagnostic test for the disease?
A. Lactate dehydrogenase.
B. Adenylate kinase.
C. Pyruvate dehydrogenase.
D. Glutamate dehydrogenase.
E. *Creatine kinase.

9. Albinos become tanned poorly, instead they get sunburns. The disorder of what amino acid metabolism causes this phenomenon?
A. Glutamate.
B. Methionine.
C. Tryptophan.
D. Histidine.
E. *Phenylalanine.

10. A patient with a cranial trauma manifests repeated epileptoid seizures. The biosynthesis of what biogenic amine is disturbed in this clinical situation?
A. Histamine.
B. Dopamine.
C. Adrenaline.
D. Serotonin.
E. *GABA.

11. Under alkaptonuria, the excessive quantity of homogentisate was found in

the patient's urine (the urine darkens in the air), The innate defect of what enzyme is apparent?
A. Tyrosine aminotransferase.
B. Alanine aminotransferase.
C. Tyrosinase.
D. Phenylalanine-4-monooxygenase.
E. *Homogentisate oxidase.

12. In psychiatric practice, biogenic amines and their derivatives arc used for the treatment of certain diseases of the central nervous system. Name the substance mentioned below, which acts as an inhibitory mediator.
A. Dopamine.
B. Histamine.
C. Serotonin.
D. Taurine.
E. *GABA.

13. Nappies of a newborn have dark spots being the evidence of homogentisic acid formation. This is caused by the metabolic disorder of the following substance:
A. Galactose.
B. Cholesterol.
C. Methionine.
D. Tryptophan.
E. *Tyrosine.

14. A newborn child was found to have reduced intensity of sucking, frequent vomiting, hypotonia. Urine and blood exhibit increased concentration of citrulline. What metabolic pro-cess is disturbed?
A. Cori cycle.
B. Tricarboxylic acid cycle.
C. Glycoheogenesis.
D. Glycolysis.
E. *Ornithinic cycle.

15. Wilson's disease, so-called hepatocerebral degeneration, is manifested by the lowered blood ceruloplasmin level. Insufficiency of this transport protein leads to:
A. Decarboxylation of amino acids.
B. Degradation of tissue albumins.
C. Transamination of amino acids.
D. Synthesis of urea.
E. *Formation of complexes of amino acids with copper.

16. An infant shows the darkening of scleras, mucous membranes, and auricles. The excreted urine darkens in the air, homogentisate is determined both in the blood and urine. What is the diagnosis?
A. Hemolytic anemia.

B. Albinism.
C. Cystinuria.
D. Porphyria.
E. *Alkaptonuria.

17. A 9-year-old boy was brought to a hospital with signs of mental and physical retardation. A biochemical blood test revealed the increased level of phenylalanine. The blockage of what enzyme can result in such state of the patient?
A. Glutamate decarboxylase.
B. Homogentisate oxidase.
C. Glutamine transaminase.
D. Aspartate aminotransferase.
E. *Phenylalanine-4-mono-oxygenase.

18. A mother of a 5-year-old child has noticed that the child's urine is too dark. The child does not have any complaints. Bile pigments are not present in the urine. The diagnosis of alkaptonuria is set. The deficiency of what enzyme is observed in this case?
A. Oxyphenylpyruvate oxidase.
B. Phenylalanine hydroxylase.
C. Tyrosinase.
D. Decarboxylase of phenylpyruvate.
E. *Homogentisate oxidase.

19. Ammonia is a very poisonous chemical, especially for the nervous system. What substance takes a particularly active part in the detoxication of ammonia in the brain tissue?
A. Lysine.
B. Alanine.
C. Proline.
D. Histidine.
E. *Glutamic acid.

20. Biogenic amines, namely histamine, serotonin, dopamine etc., are very active substances that affect markedly various physiological functions of the organism. What biochemical process is the principal pathway for biogenic amines production in body tissues?
A. Reductive amination.
B. Deamination of amino acids.
C. Transamination of amino acids.
D. Oxidation of amino acids.
E. *Decarboxylation of amino acids.

21. Citrulline and high levels of ammonia are determined in the urine of a newborn child. The formation of what substance is the most credible to be disturbed?

A. Ammonia.
B. Uric acid.
C. Creatine.
D. Creatinine.
E. *Urea.

22. Fats, proteins, carbohydrates, vitamins, mineral salts, and water constitute the daily diet of a healthy adult. Name the amount of proteins, which provides normal vital functions of the organism:
A. 40-50 g daily.
B. 50-60 g daily.
C. 10-20 g daily.
D. 70-80 g daily
E. *100-120 g daily.

23. A 13-year-old patient complains of general weakness, rapid fatigue. There is retardation in his mental development. Laboratory investigation revealed high concentrations of valine, isoleucine and leucine in his blood and urine. The urine has a specific smell. What can the cause of such state?
A. Hlstidinemia.
B. Addison's disease.
C. Tyrosinosis.
D. Diffuse toxic goiter.
E. *"Maple syrup" disease.

24. Which of the substances listed below is an acceptor of NH_2-groups in the reactions of amino acids transamination?
A. Argininosuccinate.
B. Ornithine.
C. Lactate.
D. Citrulline.
E. *α-Ketoglutarate.

25. Krebs cycle plays an essential role in the realization of gluconeogenic effect of certain amino acids. It is caused by the obligatory transformation of their anazotic carbon skeletons into:
A. Malate.
B. Citrate.
C. Succinate.
D. Fumarate.
E. *Oxaloacetate.

26. A 2-year-old boy has been admitted to a hospital because of recurrent vomiting, especially after meals. The child does not gain weight, his physical development is retarded. His hair is dark with grey locks here and there. Prescribe proper treatment for him.
A. Introduction of specific amino acid mixtures.
B. Enzymatic therapy.
C. A diet with the lowered content of phenylalanine.
D. A protein-free diet.

E. *A diet with the increased content of carbohydrates (or fats) and the lowered content of proteins.

27. A 7-year-old child was admitted to an emergency clinic in the state of allergic shock provoked by a wasp sting. High concentration of histamine was determined in the patient's blood. Which biochemical reaction leads to the production of this amine?
A. Reduction.
B. Hydroxylation.
C. Dehydration.
D. Deamination.
E. *Decarboxylation.

28. A ten-month-old child, whose parents are dark haired, is fair haired, fair in complexion, and blue eyed. The neonate seemed to be healthy, but during the last three months the cerebral circulation disorder and the retardation of mental development appeared. The cause of such state is:
A. Histidinemia.
B. Galactosemia.
C. Glycogenosis.
D. Acute porphyria.
E. *Phenylketonuria.

29. A newborn child has dark coloring of scleras and mucous membranes. The excreted urine darkens in the air. Laboratory tests of blood and urine have revealed the occurrence of homogentisic acid. What can the cause of this state be?
A. Cystinuria.
B. Albinism.
C. Galactosemia.
D. Histidinemia.
E. *Alkaptonuria.

30. An unusually active amine, a mediator of inflammation and allergy, appears via decarboxylation of histidine. Which of the following is it?
A. Serotonin.
B. Tryptamine.
C. Dopamine.
D. γ-Aminobutyrate.
E. *Histamine.

31. One of the forms of Innate human' pathology is accompanied by the blockage of the conversion of phenylalanine into tyrosine. The biochemical manifestation of the disease is the accumulation of certain organic acids in the organism including:
A. Glutamate.
B. Citrate.

C. Pyruvate.
D. Lactate.
E. *Phenylpyruvate.

32. The signs of skin depigmentation of a 19-year-old patient are caused by the disorder of melanin synthesis. The disturbance of the metabolism of what amino acid causes this?
A. Histamine.
B. Tryptophan.
C. Lysine.
D. Proline.
E. *Tyrosine.

33. Affected by ultraviolet radiation, human skin darkens, which is a protective reaction of the organism. What protective substance, namely amino acid derivative, is synthesized in the cells under these conditions?
A. Arginine.
B. Thyroxin.
C. Methionine.
D. Phenylalanine.
E. *Melanin.

34. Under the repeated action of ultraviolet rays, skin darkens because of the synthesis of melanin which protects cells from damage. The principal mechanism of this defence reaction is:
A. Inhibition of tyrosinase.
B. Inhibition of phenylalanine hydroxylase.
C. Activation of homogentisate oxidasc.
D. Inhibition of homogentiate oxidase.
E. *Activation of tyrosinase.

35. In a newborn's stomach the conversion of soluble milk proteins, so-called caseins, into the insoluble derivatives occurs in the presence of calcium ions and a certain enzyme. Name this enzyme.
A. Trypsin.
B. Pepsin.
C. Gastrin.
D. Lipase.
E. *Rennin.

36. A 13-year-old boy complains of general weakness, dizziness, tiredness. He is mentally retarded. Increased level of valine, isoleucine, leucine is in the blood and urine. Urine has specific smell. What is the diagnosis?
A. Addison’s disease.
B. Histidinemia.
C. Graves’ disease.
D. Tyrosinosis.
E. *Maple syrup urine disease.

37. The greater amount of nitrogen is excreted from the organism in form of urea. Inhibition of urea synthesis and accumulation of ammonia in blood and tissues are induced by the decreased activity of the following liver enzyme:
A. Amylase.
B. Urease.
C. Aspartate aminotransferase.
D. Pepsin.
E. *Carbamoyl phosphate synthetase.

38. A 1,5-year-old child presents with both mental and physical lag, decolorizing of skin and hair, decrease in catecholamine concentration in blood. When a few drops of 5% solution of trichloroacetic iron had been added to the child's urine it turned olive green. Such alteration is typical for the following pathology of the amino acid metabolism:
A. Alkaptonuria.
B. Albinism.
C. Tyrosinosis.
D. Xanthinuria.
E. *Phenylketonuria.

39. Cerebral trauma caused increase of ammonia formation. What aminoacid takes part in removal of ammonia from cerebral tissue?
A. Lysine.
B. Tyrosine.
C. Valine.
D. Tryptophan.
E. *Glutamine.

40. After a serious viral infection a 3-year-old child has repeated vomiting, loss of consciousness, convulsions. Examination revealed hyperammoniemia. What may have caused changes of biochemical blood indices of this child?
A. Activated processes of amino acids decarboxylation.
B. Inhibited activity of transamination enzymes.
C. Disorder of biogenic amines neutralization.
D. Increased putrefaction of proteins in intestines.
E. *Disorder of ammonia neutralization in ornithinic cycle.

41. In the transamination reaction shown below, which of the following are the products, X and Y ?
Oxaloacetate → *X*
Glutamate → *Y*
A. Alanine, α-ketoglutarate.
B. Glutamate, α-ketoglutarate.
C. Pyruvate, alanine.
D. Pyruvate, asparate

E. *Asparate, α-ketoglutarate.

42. Which one of the following statements about the urea cycle is correct?

A. The two nitrogen atoms that are incorporated into urea enter the cycle as ammonia and alanine.
B. Urea is produced directly by the hydrolysis of ornithine.
C. ATP is required for the reaction in which argininosuccinate is cleaved to form arginine.
D. The urea cycle occurs exclusively in the cytosol.
E. *Urinary urea is increased by a diet rich in protein.

43. A female neonate did well initially until approximately 24 hours of age when she became lethargic. A sepsis workup proved negative. At 56 hours, she started showing focal seizure activity. The plasma ammonia level was found to be 1100 µmol/L (normal 5 to 50 µmol/L). Quantitative plasma amino acid levels revealed a marked elevation of argininesuccinate. These results supported the diagnosis of argininosuccinase deficiency. Which one of the following would be elevated in the serum of this patient, in addition to ammonia and argininosuccinate?

A. Asparagine
B. *Glutamine
C. Lysine
D. Urea
E. Uric acid

44. Which one of the following statements is correct?

A. An increase in gluconeogenesis from amino acids results in a decrease in urea formation.
B. All essential amino acids are glycogenic.
C. Ornithine and citrulline are found in tissue proteins.
D. In the presence of adequate dietary sources of tyrosine, phenylalanine is not an essential amino acid.
E. *Cysteine is an essential amino acid in individuals consuming a diet devoid of methionine.

45. Which one of the following statements concerning a one-week-old male infant with undetected classic phenylketonuria is correct?

A. Tyrosine is a nonessential amino acid for the infant.
B. When the infant reaches adulthood, it is recommended that diet therapy be discontinued.

C. Therapy must begin with in the first year of life.
D. A diet devoid of phenylalanine should be initiated immediately.
E. *High levels of phenylpyruvate appear in his urine.

46. A four-year-old boy of a first-degree consanguineous couple was noted by the parents to have darkening of the urine to an almost black color when it was left standing. He had a normal sibling, and there were no other medical problems. Childhood growth and development were normal. Which of the following is most likely to elevated in this patient?
A. Methylmalonate.
B. Homocystine.
C. Phenylpyruvate.
D. α-ketoisovalerate.
E. *Homogentisate.

47. 5-Aminolevulinic acid synthase activity:
A. is frequently decreased in individuals treated with drugs, such as the barbiturate phenobarbital.
B. occurs in the cytosol.
C. requires the coenzyme biotin.
D. is strongly inhibited by heavy metal ions such as lead.
E. *catalyzes a rate-limiting reaction in porphyrin biosynthesis.

48. The catabolism of hemoglobin:
A. occurs in red blood cells.
B. is the sole source of bilirubin.
C. results in the liberation of carbon dioxide.
D. results in the formation of protoporphyrinogen.
E. *involves the oxidative cleavage of the porphyrin ring.

49. A fifty-year-old man presented with painful blisters on the backs of his hands. He was a golf instructor, and indicated that the blisters had erupted shortly after the golfing season began. He did not have recent exposure to poison ivy or sumac, new soaps or detergents, or new medications. He denied having previous episodes of blistering. He had partial complex seizure disorder that had begun about three years earlier after a head injury. The patient had been taking phenytoin - his only medication since the onset of the seizure disorder. He admitted to an average weekly ethanol intake of about 18 12-oz cans of beer. The patient's urine was reddish orange.

Cultures obtained from skin lesions failed to grow organisms. A 24-hour urine collection showed elevated uroporphyrin (1000 µg; normal, < 27). The most likely presumptive diagnosis is:
A. erythropoietic protoporphyria.
B. acute intermittent porphyria.
C. hereditary coproporphyria.
D. congenital erythropoietic porphyria.
E. *porphyria cutanea tarda.

3.2. Metabolism of nucleotides and nucleic acids

1. A 46-year-old patient consulted a doctor with complaints of soreness in the joints which increased when the weather changed. The increase of uric acid concentration was determined in his blood. The augmented degradation of which substance is the most credible cause of this state?
A. UTP.
B. CMP.
C. TMP.
D. UMP.
E. *AMP.

2. An 8-year-old boy suffers from Lesch-Nyhan's disease. The increased concentration of uric acid was determined in his blood. Which biochemical process disorder is the cause of this inherited disease?
A. Synthesis of deoxyribonucleotides.
B. Synthesis of purine nucleotides.
C. Synthesis of pyrimidine nucleotides.
D. Degradation of pyrimidine nucleotides.
E. *Degradation of purine nucleotides.

3. A 58-year-old man was operated on prostate cancer. Three months later he underwent a course of radiotherapy and chemotherapy. The complex of medicinal preparations prescribed to the patient included 5-fluorodeoxyuridine, which is a thymidylate synthase inhibitor. The synthesis of what biomolecule is blocked under the action of this medicine in the first place?
A. Protein.
B. mRNA.
C. rRNA.
D tRNA.
E. *DNA.

4. A human genome contains about 30.000 genes, and the amount of variants of

antibodies reaches millions. What mechanism is used for the formation of new genes that are responsible for the synthesis of such amount of antibodies?
A. Formation of Okazaki fragments.
B. Amplification of genes.
C. Replication of DMA.
D. Reparation of DNA.
E. *Recombination of genes.

5. A 65-year-old man, suffering from gout, complains of pains in the area of kidneys. Ultrasonic inspection revealed the presence of stones inside the kidneys. Which biochemical process is the main cause of kidney stones formation?
A. Ornithine cycle.
B. Catabolism of proteins.
C. Reduction of cysteine.
D. Degradation of heme.
E. *Degradation of purine nucleotides.

6. A 50-year-old patient is diagnosed with gout and there is hyperuricemia in his blood. The metabolism of what substances is disturbed?
A. Pyrimidines.
B. Fats.
C. Amino acids.
D. Carbohydrates.
E. *Purines.

7. The decrease of uric acid concentration and the accumulation of xanthine and hypoxanthine were found in the blood of a 12-year-old boy. The genetic defect of the synthesis of what enzyme does It testify to?
A. Arginase.
B. Glycerol kinase.
C. Ureane.
D. Ornithine carbamoyl-transferase.
E. *Xanthine oxydase.

8. A 40-year-old woman consulted a doctor complaining of pain in the small joints of hands and feet. The joints are enlarged; they have the appearance of thickened knots. The increased level of urates is determined in the blood plasma. The cause of this pathology is the disorder of metabolism of:
A. Amino acids.
B. Pyrimidines.
C. Carbohydrates.
D. Lipids.
E. *Purines.

9. A physician prescribed allopurinol to a patient suffering from gout. What pharmacological property of

allopurinol provides a therapeutic effect In this case?
A. Acceleration of pyrimidine nucleotides catabolism.
B. Increase of nitrogen-containing substances excretion.
C. Acceleration of nucleic acids biosynthesis.
D. Decrease of pyrimidine nucleotides reutilization.
E. *Competitive inhibition of xanthine oxidase.

10. Nitrates, nitrites and nitrosamines, present inside a human body, are precursors of nitrous acid which causes the oxidative deamination of nitrous bases of nucleotides. This can result in point mutation, which of the replaces of cytosine:
A. Thymine.
B. Guanine.
C. Inosine.
D. Adenine.
E. *Uracil.

11. A 42-year-old man suffering from gout has increased level of urinary acid in blood. Allopurinol was prescribed to decrease the level of urinary acid. Competitive inhibitor of what enzyme is allopurinol ?
A. Adenosine deaminase.
B. Hypoxanthine phosphoribosiltransferase.
C. Adenine phosphoribosiltransferase.
D. Guanine deaminase.
E. *Xanthine oxidase.

12. A patient with a suspicion of gout was brought to a clinic. What biochemical analysis is necessary to perform to confirm the diagnosis?
A. Determination of amino acids level in the blood.
B. Determination of concentration of urea in the blood and urine.
C. Determination of creatine level in the blood.
D. Measurement of urease activity in the blood.
E. *Determination of uric acid level in the blood and urine.

13. A 65-year-old man, suffering from gout, complains of pains in the area of kidneys. Ultrasonic inspection revealed the presence of stones inside the kidneys. The raised concentration of which substance is the most credible cause of kidney stones formation in this case?
A. Cystine.
B. Cholesterol.
C. Bilirubin.
D. Urea.
E. *Uric acid.

14. Chinolones that inhibit the enzyme DNA hyrase are used for the treatment of certain urogenital infections. What biochemical process is principally broken under the action of chinolones?
A. Reversible transcription.
B. DMA reparation.
C. Genes amplification.
D. Genes recombination.
E. *DNA replication.

15. Degeneration of the genetic code is the ability of more than one triplet to encode a single amino acid. Which amino acid is encoded by only one triplet?
A. Leucine.
B. Serine.
C. Alanine.
D. Lysine.
E. *Methionine.

16. Antibiotic riphamycin, which is used for the treatment of tuberculosis, affects certain biochemical processes in microbial cells. Name them.
A. Inhibition of the action of certain protein factors involved in the control of polypeptides synthesis.
B. Inhibition of DNA polymerase at the stage of initiation.
C. Inhibition of DNA ligase.
D. Inhibition of aminoacyl-tRNA synthetase.
E. *Inhibition of RNA polymerase at the stage of initiation.

17. Patients suffering from xeroderma pigmentosum show extraordinarily high sensitivity of skin to sunlight which can result in the development of skin cancer. A cause of the disease is the hereditary deficiency of the enzyme UV-endonuclease. The stated enzyme defect breaks the process of:
A. Translation.
B. Replication of DNA.
C. Transcription.
D. Reverse transcription.
E. *Reparation of DNA.

18. An experimental research demonstrated that steroid hormones affect protein synthesis. At what stage of this process do they carry out their action?
A. Synthesis of GTP.
B. Synthesis of ATP.
C. Synthesis of specific tRNAs.
D. Synthesis of specific rRNAs.
E. *Synthesis of specific mRNAs.

19. For the formation of the transport form of amino acid

during the protein synthesis in ribosomes _____ is required.
A. mRNA.
B. GTP.
C. Revertase.
D. Ribosome.
E. *Aminoacyl-tRNA-synthetase.

20. A 46-year-old man consulted a physician because of pains in small joints. The pains were intensified after the consumption of meat food. The patient was diagnosed with urolithiasis accompanied by uric acid accumulation. The treatment with allopurinol was prescribed. What enzyme is allopurinol a competitive inhibitor of?
A. Carbamoylphosphate synthase.
B. Urease.
C. Arginase.
D. Dihydrouracyl dehydrogenase.
E. *Xanthine oxidase.

21. A one-year-old female patient is lethargic, weak, and anemic. Her height and weight are both low for her age. Her urine contains an elevated level of orotic acid. The administration of which of the following compounds is most likely to alleviate her symptoms?
A. Thymidine.
B. Adenine.
C. Hypoxanthine.
D. Guanine.
E. *Uridine.

22. In case of poisoning by amanitine, a death-cup mushroom toxin, RNA-polymerase β (II) is blocked. This leads to the blockage of:
A. Processing of mRNA.
B. Synthesis of tRNA
C. Reverse transcription.
D. Synthesis of primers.
E. *Synthesis of mRNA.

23. You are studying functioning of a bacteria operon. The operator gene has been released from the repressor gene. Immediately after this the following process will start in the cell:
A. Translation.
B. Repression.
C. Processing.
D. Replication.
E. *Transcription.

24. A patient's organism has decreased concentration of magnesium ions that are necessary for attachment of ribosomes to the granular endoplasmatic reticulum. It is known that this causes protein biosynthesis disturbance. What

stage of protein biosynthesis will be disturbed?
A. Transcription.
B. Replication.
C. Translation.
D. Termination.
E. *Amino acid activation.

25. An experiment proved that UV-radiated cells of patients with xeroderma pigmentosum restore the native DNA structure slower than cells of healthy individuals as a result of reparation enzyme defect. What enzyme helps this process?
A. Primase.
B. RNA-ligase.
C. DNA-polymerase III.
D. DNA gyrase.
E. *Endonuclease.

26. Tuberculosis can be treated by means of combined chemotherapy that includes substances with different mechanisms of action. What antituberculous medication inhibits transcriptiton of RNA into DNA in mycobacteria?
A. Izoniazid.
B. Streptomycin.
C. Ethionamide.
D. Para-aminosalicylic acid.
E. *Rifampicin.

27. RNA-polymerase β (II) is blocked due to amanitine poisoning (poison of death-cup). It disturbs:
A. Reverse transcription.
B. Primers synthesis.
C. Maturation of m-RNA.
D. Synthesis of t-RNA.
E. *Synthesis of m-RNA.

28. Part of the DNA chain turned about 180 degrees due to gamma radiation. What type of mutation took place in the DNA chain?
A. Replication.
B. Epidemic typhus.
C. Translocation.
D. Deletion.
E. *Inversion.

29. Methotrexate (structural analogue of the folic acid which is competitive inhibitor of the dihydrofolatreductase) is prescribed for treatment of the malignant tumour. On which level does methotrexate hinder synthesis of the nucleic acids?
A. Reparation.
B. Transcription.
C. Replication.
D. Processing.
E. *Mononucleotide synthesis.

30. For the formation of the transport form of amino acid

during the protein synthesis in ribosome _____ is required.
A. mRNA.
B. Revertase.
C. GTP.
D. Ribosome.
E. *tRNA.

31. Nowadays about 50 minor bases have been found in the tRNA structure besides the main four nitrogenous bases. Choose the minor nitrogenous base:
A. Cytosine.
B. Cysteine.
C. Uracil.
D. Adenine.
E. *Dihydrouracil.

32. A patient has increased contents of uric acid in his blood, what is clinically manifested by pain syndrome due to accumulation of urates in his acid?
A. Purine bases re-using.
B. Proteolysis.
C. Heme catabolism.
D. Pyrimidine nucleotide decay.
E. *Purine nucleotide decay.

33. Genetic structure of eukaryote is "exon-intron-exon". This structure-functional organiza-tion of gene caused transcription peculiarities. What will be pro-mRNA according to the scheme?
A. Intron-exon.
B. Exon-intron.
C. Exon-exon-intron.
D. Exon-exon.
E. *Exon-intron-exon.

34. 46 chromosomes were revealed on karyotype examination of the 5-year-old girl. One of the 15th pair of chromosomes is longer than usual due to connected chromosome from the 21 pair. What type of mutation does this girl have ?
A. Insufficiency.
B. Deletion.
C. Duplication.
D. Inversion.
E. *Translocation.

35. A patient with urolithiasis after the examination was administerred allopurinol – compe-tiive inhibitor of xanthine oxidase. It was influenced by chemical analysis of the calculuses, which consisted mainly of:
A. Calcium phosphate.
B. Calcium oxalate monohydrate.
C. Calcium oxalate dehydrate.
D. Calcium sulphate.
E. *Sodium urate.

36. A doctor administered allopurinol to a 26-year-old young man with the symptoms of gout. What pharmacological action of Allopurinol ensures therapeutical effect?
A. By general analgetic effect.
B. By general anti-inflammatory effect.
C. By increasing uric acid excretion.
D. By inhibiting leucocyte migration into the joint.
E. *By inhibiting uric acid synthesis.

37. An oncological patient was administered methotrexate. With the lapse of time the target cells of the tumour lost sensitivity to this preparation. We can observe changes in the gene expression of the following enzyme:
A. Desaminase.
B. Folate oxidase.
C. Thiminase.
D. Folate decarboxylase.
E. *Dihydrofolate reductase.

38. A 42-year-old male cancer patient undergoing radiation therapy develops severe pain in his right big toe. Laboratory analyses indicate an elevated serum uric acid level and urate crystals in his urine. This patient's pain is caused by the overproduction of the end product of which of the following metabolic pathways?
A. De novo pyrimidine biosynthesis
B. Pyrimidine degradation
C. De novo purine biosynthesis
D. Purine salvage
E. *Purine degradation

39. The rate of DNA synthesis in a culture of cells could be most accurately determined by measuring the incorporation of which of the following radioactive compounds?
A. Phosphate.
B. Adenine.
C. Guanine.
D. Uridine.
E. *Thymidine.

40. After several weeks of chemotherapy in the form of methotrexate, a cancer patient's tumor begins to show signs of resistance to treatment. Which of the following mechanisms is most likely to explain the tumor's methotrexate resistance?
A. Deficiency of thymidylate synthase.
B. Overproduction of xanthine oxidase
C. Deficiency of PRPP synthase

D. Deficiency of thymidine kinase
E. *Overproduction of dihydrofolate reductase

41. A ten-year-old girl is brought to the dermatologist by her parents. She has many freckles on her face, neck, arms, and hands, and the parents report that she is unusually sensitive to sunlight. Two basal cell carcinomas are identified on her face. Which of the following processes is most like to be defective in this patient?
A. Removal of primers from Okazaki fragments.
B. Removal of mismatched bases from the 3' end of Okazaki fragments.
C. Removal of mismatched bases from the 5' end of Okazaki fragments.
D. Removal of uracil from DNA.
E. *Removal of pyrimidine dimers from DNA.

42. An eight-year-old girl with cystic fibrosis is treated with ciprofloxacin for a Pseudomonas aeruginosa infection in her lungs. Which of the following enzymatic activities is most directly affected by this drug?
A. The synthesis of RNA primers.
B. The breaking of hydrogen bonds in front of the replication fork.
C. The joining together of Okazaki fragments.
D. The removal of RNA primers.
E. *The breaking and subsequent rejoining of the DNA backbone.

43. Didanosine (dideoxyinosine, ddl) is a nucleoside analog sometimes used to treat HIV infections. This drug is converted metabolically to 2',3'-dide-oxyATP (ddATP), which blocks DNA chain elongation when it is incurporated into viral DNA synthesized by reverse transcriptase. Why does DNA synthesis stop?
A. The analog becomes covalently bound to reverse transcriptase, thus inactivating the enzyme.
B. Incorporation of the analog initiates rapid degradation of the newly synthesized strand.
C. Proofreading is inhibited.
D. The analog cannot hydrogen bond to the RNA template.
E. *There is no 3'-hydroxyl group to form the next phosphordiester bond.

44. While studying the structure of a small gene that was recently sequenced during the Human Genome Project, an investigator notices that one strand of the DNA molecule contains 20 A's, 25 G's, 30 C's, and 22 T's. How many of each base is found in the complete double-stranded molecule?

A. A = 40, G = 50, C = 60, T = 44
B. A = 44, G = 60, C = 50, T = 40
C. A = 45, G = 45, C = 52, T = 52
D. A = 50, G = 47, C = 50, T = 47
E. *A = 42, G = 55, C = 55, T = 42

45. A one-year-old male with chronic anemia is found to have β-thalassemia. Genetic analysis shows that one of his β-globin genes has a G to A mutation that creates a new splice acceptor site nineteen nucleotides upstream from the normal splice acceptor site of the first intron. Which of the following best describes the new messenger RNA molecule that can be produced from this mutant gene?

A. Exon 1 will be too short.
B. Exon 1 will be too long.
C. Exon 2 will be too short.
D. Exon 2 will be missing.
E. *Exon 2 will be too long.

46. A culture of E. coli that has been growing in medium containing lactose as its only source of energy is suddenly supplemented by the addition of a large amount of glucose. What change occurs in these bacteria to cause the rate of β-galacto-sidase synthesis to dramatically decrease?

A. The repressor becomes bound to the operator.
B. The CAP protein becomes bound to its DNA binding site.
C. The inducer dissociates from the repressor.
D. The repressor dissocates from the operator.
E. *The CAP protein dissociates from its DNA binding site.

47. The base sequence of the strand of DNA used as the template for transcription has the base sequence GATCTAC. What is the base sequence of the RNA product?

A. CTAGATG.
B. GTAGATC.
C. GAUCUAC.
D. GUAGAUC.
E. *CUAGAUG.

48. A four-year-old child who becomes easily tired and has trouble walking is diagnosed with Duchenne muscular dystrophy, an X-linked recessive disorder. Genetic analysis shows that the patient's gene for the muscle protein dystrophin contains a mutation in its promoter region. What would be the most likely effect of this mutation?

A. Tailing of dystrophin mRNA will be defective.
B. Termination of dystrophin transcription will be deficient.
C. Capping of dystrophin mRNA will be defective.
D. Splicing of dystrophin mRNA will be defective.
E. *Initiation of dystrophin transcription will be deficient.

49. A 20-year-old anemic man is found to have an abnormal form of β-globin (Hemoglobin Constant Spring) that is 172 amino acids long, rather than the 141 found in the normal protein. Which of the following point mutations is consistent with this abnormality?

A. GCA → GAA.
B. UAA → UAG.
C. CGA → UGA.
D. GAU → GAC.
E. *UAA → CAA.

50. A pharmaceutical company is studying a new antibiotic that inhibits bacterial protein synthesis. When this antibiotic is added to an in vitro protein synthesis system that is translating the mRNA sequence AUGUUUUUUAG, the only product formed is the dipeptide fMet-Phe. What step in protein synthesis is most likely inhibited by the antibiotic?

A. Initiation.
B. Binding of charged tRNA to the ribosomal A site.
C. Peptidyltransferase activity.
D. Termination.
E. *Ribosomal translocation.

51. A tRNA molecule that is supposed to carry cysteine ($tRNA^{cys}$) s mischarged, so that it actually carries alanine (ala-$tRNA^{cys}$). What will be the fate of this alanine residue during protein synthesis?

A. It will be incorporated into a protein in response to an alanine codon.
B. It will be chemically converted to cysteine by cellular enzymes.
C. It will remain attached to the tRNA, as it cannot be used for protein synthesis.

D. It will be incorporated randomly at any codon.
E. *It will be incorporated into a protein in response to a cysteine codon.

52. In a patient with cystic fibrosis, the mutant cystic fibrosis transmembrane conductance regulator (CFTR) protein folds incorrectly. The patient's cells modify this abnormal protein by attaching ubiquitin molecules to it. What is the fate of this modified CFTR protein?
A. It performs its normal function, as the ubiquitin largely corrects for the effect of the mutation.
B. It is secreted from the cell.
C. It is placed into storage vesicles.
D. It is repaired by cellular enzymes.
E. *It is degraded by the proteasome.

53. Hind is a restriction endonuclease commonly used to cut human DNA into pieces before inserting it into a plasmid. Which of the following is most likely to be the recognition sequence for this enzyme?
A. AAGGAA.
B. AAGAAG.
C. AAGTTC.
D. AAGAGA.
E. *AAGCTT.

54. A physician would like to determine the global patterns of gene expression in two different types of tumor cells in order to develop the most appropriate form of chemotherapy for each patient. Which of the following techniques would be most appropriate for this purpose?
A. Southern blot.
B. Northern blot.
C. Western blot.
D. ELISA.
E. *Microarray.

55. A pharmaceutical company wants to produce a transgenic goat that will secrete human growth hormone into its milk. Which of the following tests would be most appropriate to apply to milk samples in order to identify a goat meeting this requirement?
A. RFLP analysis.
B. Northern blot.
C. Southern blot.
D. Dot blot using allele specific oligonucleotide probes.
E. *ELISA.

3.3. Hormones and mediators

1. Parents of a 5-year-old child consulted a doctor. Examination of the child discovered retardation in mental development and growth, as well as a basement of the child's agility. The basal metabolism is lowered. What disease does the child suffer from?
A. Lesch-Nyhan syndrome.
B. Endemic goiter.
C. Phenylketonuria.
D. Hyperparathyroidism.
E. *Cretinism.

2. A patient that resides in a specific geochemical territory was diagnosed with endemic goiter. What type of posttranslation modification of thyroglobulin is impaired in the organism of the patient?
A. Glycosylation.
B. Methylation.
C. Acetylation.
D. Phosphorylation.
E. *Iodination.

3. After the injection of insulin, a patient, suffering from insulin dependent diabetes mellitus, fainted, then he got cramps. What level of glucose does the biochemical blood glucose test show?
A. 5,5 mM/l.
B. 3,3 mM/l.
C. 8,0 mM/l.
D. 10,0 mM/l.
E. *2,5 mM/l.

4. Which of the listed hormones reduces the rate of lipolysis in fatty tissue?
A. Adrenaline.
B. Noradrenaline.
C. Hydrocortisone.
D. Somatotropin.
E. *Insulin.

5. A 42-year-old man was hospitalized to cardiologic department with the diagnosis of stenocardia. The inhibitor of phosphordiesterase was included in the medicinal treatment of the patient. The concentration of what substance will be increased in the cardiac muscle?
A. ADP.
B. GMP.
C. AMP.
D. ATP.
E. *cAMP.

6. Endemic goiter is known to be widespread in certain geochemical areas. The

deficiency of what chemical element causes this disease?
A. Iron.
B. Cobalt.
C. Zinc.
D. Copper.
E. *Iodine.

7. A patient is in the state of hypoglycemic coma. The overdose of what hormone can cause this state?
A. Corticotropin.
B. Progesterone.
C. Cortisol.
D. Somatotropin.
E. *Insulin.

8. Which of the substances listed below is a precursor in the synthesis of prostaglandins in a human organism?
A. Linoleic acid.
B. Palmitic acid.
C. Linolenic acid.
D. OIeic acid.
E. *Arachidonic acid.

9. A patient consulted a doctor with complaints of frequent and abundant urination and thirst. The urine analysis showed the following: diurnal diuresis - 19 1, density of urine – 1,001. What disease are these symptoms characteristic of?
A. Diabetes mellitus.
B. Steroid diabetes.
C. Addison's disease.
D. Thyrotoxicosis.
E. *Diabetes insipidus.

10. During the operation on a thyroid gland, parathyroid glands were removed by mistake. The patient got tetanic cramps. The metabolism of which chemical element was disturbed?
A. Magnesium.
B. Sodium.
C. Potassium.
D. Iron.
E. *Calcium.

11. Destruction of pancreatic islets of Langerhans results in the decrease of the production of:
A. Parathormone and cortlione.
B. Thyroxine and calcitonin.
C. Insulin and adrenaline.
D. Callicrein and angiotensin.
E. *Glucagon and insulin.

12. A patient consulted a doctor with complaints of permanent thirst. Hyperglycemia, polyuria and high level of 17-ketosteroids in the urine were determined. What is the most credible diagnosis in this case?
A. Addison's disease.

B. Insulin dependent diabetes mellitus.
C. Myxedema.
D. Glycogenosis of the I type.
E. *Steroid diabetes.

13. A patient complains of body weight loss, excessive irritability, insignificant increase of temperature, exophthalmia. Hyperglycemia and the rise of nitrogen-containing substances in blood serum were detected. Which is the most credible diagnosis in this case?
A. Neurosis.
B. Bronzed disease.
C. Myxedema.
D. Tuberculosis of adrenal glands.
E. *Diffuse toxic goiter.

14. For analgesia, a certain substance which imitates the physiological properties of morphine but is synthesized in side the human brain can be used. Name this substance.
A. Somatoliberin.
B. Oxytocin.
C. Vasopressin.
D. Calcitonin.
E. *Endorphine.

15. Laboratory testing of the patient's blood plasma showed K^+ level of 7,0 mM/1. What is the possible cause of such state?
A. Increase of sexual hormones level.
B. Increase of aldosterone level.
C. Decrease of thyroid hormones level.
D. Increase of thyroid hormones level.
E. *Decrease of aldosterone level.

16. Laboratory testing of the patient's blood plasma showed Na^+ level of 160,0 mM/l. The change in concentration of what hormone can be the cause of such state?
A. Increase of atrial natriuretic factor level.
B. Decrease of aldosterone level.
C. Increase of glucocorticoids level.
D. Increase of thyroid hormones level.
E. *Increase of aldosterone level.

17. A woman with low arterial pressure after the parenteral introduction of a certain hormone showed the essential rise of arterial pressure as well as blood levels of glucose and lipids. What hormone was administered to the patient?
A. Insulin.
B. Glucagon.

C. Estradiol.
D. Progesterone.
E. *Adrenaline.

18. A 35-year-old patient addicted to alcohol manifests sharp muscle and cardiac weakness against the background of treatment by diuretics. The patient has vomiting, diarrhea, depression, A/P - 100/60. The cause of such symptoms is the increased excretion the urine of:
A. Chlorine.
B. Sodium.
C. Phosphates.
D. Calcium.
E. *Potassium.

19. A typical symptom of cholera is loss of body fluidi and sodium ions. The biochemical mechanism of unfavorable action of cholera toxin consists of:
A. Activation of synthesis of atrial natriuretic factor.
B. Activated oxidation of aldosterone in the cells of adrenal glands.
C. Decrease of synthesis of antidiuretic hormone in hypothalamus.
D. Stimulation of renin secretion by the cells of kidney glomerular arteriolae.
E. *Activation of adenylate cyclase activity of enterocytes.

20. A 23-year-old patient complains of headache, change of appearance (increase in feet and wrists size, face features distortion). His voice grew harsh, memory worsened. The disease set in three years ago without apparent causes. The analysis of the urine is without special changes. A possible cause of this status can be:
A. Deficiency of aldosterone.
B. Deficiency of glucagon.
C. Deficiency of thyroxine.
D. Hyperproduction of corticosteroids.
E. *Hyperproduction of somatotropin.

21. Biologically active substances, especially hormones, are products of hydrolysis and modification of certain proteins. From which of the listed proteins below do lipotropin, corticotropin, melanotropin and endorphines appear in hypophysis?
A. Thyroglobulin.
B. Neuroalbumins.
C. Neurostromin.
D. Neuroglobulin.
E. *Proopimelanocortin (POMC).

22. Cushing's disease (hyper-function of adrenal glands cortex which results in the augmentted production of corticosteroids) is accompanied by hyperglycemia. What process is stimulated in this state?
A. Glycolysis.
B. Phosphorolysis of glycogen.
C. Citric acid cycle.
D. Pentose phosphate pathway.
E. *Gluconeogenesis.

23. Utilization of glucose occurs by means of sugar transport from the extracellular matrix through the plasma membrane into the cell. What hormone stimulates this process?
A. Adrenaline.
B. Glucagon.
C. Thyroxine.
D. Aldosterone.
E. *Insulin.

24. Ca^{2+} ions constitute one of the most ancient evolutionally second messengers. They arc activators of glycogenolysis in case of reactions with:
A. Calcitonin.
B. Phosphorylase C.
C. Calciferol.
D. Kinase of myosin light chains.
E. *Calmodulin.

25. After a brain hemorrhage that led to the damage of the hypotalamic nuclei, diabetes insipidus of a 67-year-old patient developed. What will be the reason of polyuria in this case?
A. Hypoglycemia.
B. Decrease of potassium ions reabsorbtion.
C. Acceleration of glomerular filtration.
D. Hyperglycemia.
E. *Decrease of water reabsorb-tion.

26. A 40-year-old woman suffers from Cushing's disease, so-called steroid diabetes. Hyperglycemia and hypo-chlorinemia are biochemically exposed. Which of the following biochemical processes is activated in the first place?
A. Glycolysis.
B. Glycogenolysis.
C. Reabsorbtion of glucose.
D. Transport of glucose into cells.
E. *Gluconeogenesis.

27. A 10-year-old boy was brought to a hospital for the inspection of the cause of growth retardation. He had grown only by three centimeters in the last two years. What

hormone's deficiency is the cause of such state?
A. Thyrotropin.
B. Corticotropin.
C. Gonadotropin.
D. Parathormone.
E. *Somatotropin.

28. A 50-year-old man was under intensive stress. Concentrations of adrenaline and noradrenaline in his blood rose sharply. Which enzymes catalyze the inactivation of these hormones?
A. Glycosidases.
B. Tyrosinase.
C. Peptidases.
D. Carboxylases.
E. *Monoaminooxidases.

29. A 46-year-old woman complains of dryness in the oral cavity, thirst, frequent urination, general weakness. Biochemical research of the patient's blood showed hyperglycemia and hyperketonemia. Sugar and ketone bodies are revealed in the uurine. Diffuse changes in myocardium are marked on the electrocardiogram. Make an assumptive diagnosis of the illness.
A. Ischemic cardiomyopathy.
B. Alimentary hyperglycemia.
C. Acute pancreatitis.
D. Diabetes insipidus.
E. *Diabetes mellitus.

30. Increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, psychic excitement and so on is present on thyrotoxicosis. How do thyroidal hormones affect energy metabolism in the mitochondrion of cells?
A. Activates oxidated phosphorylation.
B. Stops respiratory chain.
C. Stops phosphorylation of substrate.
D. Activates phosphorylation of substrate.
E. *Disconnect oxidation and oxidative phosphorylation.

31. Patient with diabetes gets insulin injection in time that caused hyperglycemic coma (glucose in the blood 50 mmol/L). What mechanism is prevalent in the development of the coma?
A. Hyponatremia.
B. Hypokaliemia.
C. Hypoxia.
D. Hyperosmia.
E. *Acidosis.

32. Aspirin has antiinflammatory effect due to inhibition of the cyclooxygenase activity.

Level of what biological active acids will decrease?
A. Iodinethyronyns.
B. Catecholamines.
C. Leucotriens.
D. Biogenic amines.
E. *Prostaglandins.

33. The patient with complaints of permanent thirst applied to the doctor. Hyperglycemia, polyuria and increased concentration of 17-ketosteroids in the urine were revealed. What disease is the most likely?
A. Addison's disease.
B. Myxoedema.
C. Insulin-dependent diabetes mellitus.
D. Type 1 glycogenosis.
E. *Steroid diabetes.

34. A 50-year-old patient complains of thirst, drinking of a lot of water, marked polyuria. Blood glucose is 4,8 mmol/L, urine glucose and acetone bodies are absent, urine is colorless, specific gravity is 1,002-1.004: What is the cause of polyuria?
A. Insulin insufficiency.
B. Aldosteronism.
C. Hypothyroidism.
D. Thyrotoxicosis.
E. *Vasopressin insufficiency.

35. On empty stomach in the patients, blood glucose level was 5,65 mmol/L, in an hour after usage of sugar it was 8,55 mmol/L, in 2 hours - 4,95 mmol/L. Such indicators are typical for:
A. Patient with hidden diabetes mellitus.
B. Patient with insulin-dependent diabetes mellitus.
C. Patient with non-insulin dependent diabetes mellitus.
D. Patient with tireotoxicosis.
E. *Healthy person.

36. Arterial hypertension is caused by the stenosis of the renal arteries in the patient. Activation of what system is the main link in the pathogenesis of this form of hypertension?
A. Kallikrein-kinin.
B. Hypothalamic-pituitary.
C. Sympathoadrenal.
D. Parasympathetic.
E. *Renin-angiotensin.

37. A 2-year-old child experienced convulsions because of lowering of calcium ions concentration in the blood plasma. Function of what structure is decreased?
A. Adrenal cortex.
B. Pituitary gland.
C. Thymus.

D. Pineal gland.
E. *Parathyroid glands.

38. A person has decreased diuresis, hypernatremia, hypokaliemia. Hypersecretion of what hormone can cause such changes?
A. Auricular sodiumuretic factor.
B. Adrenalin.
C. Vasopressin.
D. Parathormone.
E. *Aldosterone

39. On simulation of inflammation of the lower extremity the animal experienced raise of the temperature, increase of amount of antibodies and leucocytes in the blood. What substances caused this general reaction of the organism on inflammation?
A. Leucotriens.
B. Mineralocorticoids.
C. Somatomedins.
D. Glucocorticoids.
E. *Interleucins.

40. On some diseases it is observed aldosteronism with hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected on aldosteronism?
A. Testicle.
B. Ovaries.
C. Hypophysis.
D. Pancreas.
E. *Adrenal glands.

41. Testosterone and its analogs increase the mass of skeletal muscles that allows using them for treatment of dystrophy. Due to interaction of the hormone with what cell substance is this action caused?
A. Membrane receptors.
B. Proteins - activators of transcripttion.
C. Ribosomes.
D. Chromatin.
E. *Nuclear receptors.

42. Secretion of which gastrointestinal hormones is primarily decreased in patient with removed duodenum?
A. Gastrin and histamine.
B. Gastrin.
C. Histamine.
D. Neurotensin.
E. *Cholecystokinin and secretin.

43. Usage of oral contraceptives with sex hormones inhibits secretion of the hypophysial hormones. Secretion of which of the indicated hormones is inhibited while using oral contraceptives with sex hormones?

A. Thyrotropic.
B. Vasopressin.
C. Somatotropic.
D. Oxytocin.
E. *Follicle-stimulating.

44. Arterial hypertension, hyperglycemia, glucosuria were observed clinically for a long time in the patient with upper type of obesity. Death was due to the cerebral haemorrhage. Basophilic hypophysis adenoma, hyperplasia of adrenal gland cortex were revealed on pathomorphological examination. What is the likely diagnosis?
A. Adiposogenitalis dystrophy.
B. Hypophysis nanism.
C. Diabetes mellitus.
D. Acromegaly.
E. *Cushing disease.

45. A 38-year-old man is receiving treatment for schizophrenia in hospital. The initial levels of glucose, ketone bodies and urea in the blood are within the normal range. Shock therapy put into practice by regular insulin injections resulted in the development of the comatose state which improved the clinical status of the patient. What is the most probable cause of insulin coma?
A. Hyperglycemia.
B. Dehydratation of tissues.
C. Metabolic acidosis.
D. Ketonemia.
E. *Hypoglycemia.

46. A 42-year-old man was admitted to the cardiological department because of angina pectoris. Among the medicines administered to the patient there was inhibitor of phosphodiesterase. The concentration of what substance in the heart muscle will be increased?
A. ATP.
B.ADP.
C. GMP.
D.AMP.
E. *Cyclic-AMP.

47. An experimental dog by means of stomach tube was given 150 ml of meat broth. The concentration of which of the below mentioned substances will be increased in animal's blood?
A. Neurotensis.
B. Somatostatin.
C. Vasoactive intestinal polypeptide.
D. Insulin.
E. *Gastrin.

48. Careless student occasionally met his dean. The concentra-

tion of what hormone will most likely increase in the blood of the student?
A. Cortricotropin.
B. Somatotropin.
C. Thyrotropin-releasing hormone.
D. Cortisol.
E. *Adrenalin.

49. A man after 1,5 litre blood loss has suddenly reduced diuresis. The increased secretion of what hormone caused such diuresis alteration?
A. Natriuretic.
B. Corticotrophin.
C. Cortisol.
D. Parathormone.
E. *Vasopressin.

50. There is only one hormone among the neurohormones which refers to the derivatives of amino acids according to classification. Point it out:
A. Somatotropin.
B. Vasopressin.
C. Oxytocin.
D. Thyroliberin.
E. *Melatonin.

51. The β-cells of endocrine portion of pancreas are selectively damaged by alloxan poisoning. How will it be reflected in blood plasma?
A. The content of globulins decreases.
B. The content of albumins decreases.
C. The content of fibrinogen decreases.
D. The level of sugar decreases.
E. *The content of sugar increases.

52. Patient with diabetes mellitus experienced loss of consciousness and convulsions after an injection of insulin. What might be the result of biochemical blood analysis for concentration of sugar?
A. 3, 3 mmol/L.
B. 10,0 mmol/L.
C. 8, 0 mmol/L.
D. 5,5 mmol/L.
E. *1,5 mmol/L.

53. The formation of a second-dary mediator is obligatory in membrane-intracellular mechanism of hormone action. Point out the substance that is unable to be a secondary mediator:
A. Diacylglycerol.
B. CAMP.
C. Inositol-3,4,5-triphosphate.
D. Ca^{2+}.
E. *Glycerol.

54. A 19-year-old female suffers from tachycardia in rest condition, weight loss, excessive sweating. What hormone would you expect to find elevated in her serum?
A. ACTH.
B. Mineralocorticoids.
C. Cortisol.
D. Insulin.
E. *Thyroxine.

55. When the pH level of the stomach lumen decreases to less than 3, the antrum of the stomach releases peptide that acts in paracrine fashion to inhibit gastrin release. This peptide is:
A. Acetylcholine.
B. Vasoactive intestinal peptide (VIP).
C. Somatostatin.
D. Gastrin-releasing peptide (GRP).
E. *GIF.

56. Kidneys of a man under examination show increased reabsorption of calcium ions and decreased reabsorption of phosphate ions. What hormone causes this phenomenon?
A. Hormonal form D_3.
B. Vasopressin.
C. Aldosterone.
D. Thyrocalcitonin.
E. *Parathormone.

57. A 44-year-old woman complains of common weakness, heart pain, considerable increase of body weight. Objectively: moon like face, hirsutism, AP - 165/100 mm Hg, height - 164 cm, weight - 103 kg: fat is mostly accumulated in the region of neck, upper shoulder girdle, stomach. What is the main pathogenetic mechanism of obesity?
A. Decreased production of thyroidal hormones.
B. Decreased production of glucagon.
C. Increased production of insulin.
D. Increased production of mineralocorticoids.
E. *Increased production of glucocorticoids.

58. A patient has osmotic pressure of blood plasma at the rate of 350 mOsmol/l (norm is 300 mOsmol/l). This will cause hypersecretion of the following hormone:
A. Vasopressin.
B. Natriuretic.
C. Adrenocorticotropin.
D. Cortisol.
E. *Aldosterone.

59. A 40-year-old patient complains of intensive heartbeats, sweating, nausea, visual impairment, arm tremor, hyperten-sion. From his anamnesis: 2 ye-ars ago he was diagnosed with pheochromocytoma. Hyperproduction of what hormones causes the given pathology?

A. Thyroidal hormones.
B. Glucocorticoids.
C. ACTH.
D. Aldosterone.
E. *Catecholamines.

60. Secretion of what gastrointestinal hormones will be primarily decreased as a result of duodenum removal?

A. Gastrin.
B. Neurotensin.
C. Gastrin and histamine.
D. Histamine.
E. *Cholecystokinin and secretin.

61. Thyrotoxicosis leads to increased production of thyroidal hormones T3 and T_4, weight loss, tachycardia, and psychic excitement and so on. How do thyroidal hormones affect energy metabolism in the mitochondrion of cells?

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

62. A 46-year-old patient has complained of headache, fatigue, thirst, pains in the spine and joints for the last 2 years. Clinically observed disproportion; an enlargement of hands, feet, nose, superciliary arches. He notes that he needed to buy bigger shoes three times. What is the main reason of such disproportional enlargement of different parts of the body?

A. Joints chronic inflammation development.
B. Joints dystrophy development.
C. Cartilaginous tissue proliferation under growth hormone influence.
D. Increased sensitivity of the tissues to insulin.
E. *Increased sensitivity of the tissues to growth hormone.

63. A 32-year-old patient consulted a doctor about the absence of lactation after parturition. Such disorder might be explained by the deficit of the following hormone:

A. Somatotropin.
B. Thyrocalcitonin.
C. Glucagon.
D. Vasopressin.
E. *Prolactin.

64. Depressions and emotional insanities is result from the deficiency of noradrenalin, serotonin and other biogenic amines in the brain. Their concentration in the synapses can be increased by means of the antidepressant that inhibits the following enzyme:
A. L-amino-acid oxidase.
B. D-amino-acid oxidase.
C. Phenylalanine-4-monooxygenase.
D. Diamine oxidase.
E. *Monoamine oxidase.

65. To prevent the transplant rejection after organ transplantation it is required to administer hormonotherapy for the purpose of immunosuppression. What hormones are used for this purpose?
A. Mineralocorticoids.
B. Sexual hormones.
C. Catecholamines.
D. Thyroid.
E. *Glucocorticoids.

66. A girl has been diagnosed with adrenogenital syndrome (pseudohermaphroditism). This pathology is caused by hypersecretion of the following adrenal hormone:
A. Estrogens.
B. Catecholamines.
C. Mineralocorticoids.
D. Glucocorticoids.
E. *Androgens.

67. A patient with android-type obesity had been suffering from arterial hypertension, hyperglycemia, glycosuria for a long time and died from the cerebral haemorrhage. Pathologic examination revealed pituitary basophil adenoma, adrenal cortex hyperplasia. What is the most likely diagnosis?
A. Adiposogenital dystrophy.
B. Diabetes mellitus.
C. Acromegalia.
D. Pituitary nanism.
E. *Itsenko-Cushing's syndrome.

68. Examination of a patient revealed overgrowth of facial bones and soft tissues, tongu enlargement, wide interdental spaces in the enlarged dental arch. What changes of the hormonal secretion are the most likely?
A. Hyposecretion of the somatotropic hormone.
B. Hyposecretion of thyroxin.

C. Hyposecretion of insulin.
D. Hypersecretion of insulin.
E. *Hypersecretion of the somatotropic hormone.

69. Pharmacological effects of antidepressants are based upon blocking (inhibiting) the enzyme that acts as a catalyst for the breakdown of biogenic amines noradrenalin and serotonin in the mitochondria of cephalic neurons. What enzyme takes part in this process?
A. Lyase.
B. Transaminase.
C. Decarboxylase.
D. Peptidase.
E. *Monoamine oxidase.

70. In which one of the following tissues is glucose transport into the cell enhanced by insulin?
A. Brain.
B. Lens.
C. Red blood cells.
D. Liver.
E. *Adipose tissue.

71. Which one of the following is characteristic of low insulin levels?
A. Increased glycogen synthesis.
B. Decreased gluconeogenesis from lactate.
C. Decreased glycogenolysis.
D. Decreased action of hormone-sensitive lipase.
E. *Increased formation of 3-hydroxybutyrate.

72. Which one of the following statements about glucagon is correct?
A. High levels of blood glucose increase the release of glucagon from the α cells of the pancreas.
B. Glucagon levels decrease following ingestion of a protein-rich meal.
C. Glucagon depresses the formation of ketone bodies by the liver.
D. Glucagon is the only hormone important in combating hypoglycemia.
E. *Glucagon increases the intracellular levels of cyclic AMP in liver cells, causing an increase in glycogen breakdown.

73. A 39-year-old woman is brought to the emergency room complaining of dizziness. She recalls getting up early that morning to do as much shopping as possible and had skipped breakfast. She drank a cup of coffee for lunch and had nothing to eat during the day. She met with friends at 8 p. m. and had a drink at the bar. She soon became weak and dizzy

and was transported to the hospital. Following examination, the patient was given orange juice and immediately felt better. Which one the following best completes this sentence? "The patient has:

A. Blood glucose greater than 70 mg/dl.
B. Elevated insulin.
C. Presence of an insulinoma.
D. Elevated liver glycogen.
E. *Elevated glucagon.

74. Which one of the following is most often found in untreated patients with type 1 and type 2 diabetes?

A. Ketoacidosis.
B. Extremely low levels of insulin synthesis and secretion.
C. Synthesis of insulin with an abnormal amino acid sequence.
D. A simple pattern of genetic inheritance.
E. *Hyperglycemia.

75. An obese individual with type 2 diabetes:

A. Usually shows a normal glucose tolerance test.
B. Usually has a lower plasma level of insulin than a normal individual.
C. Usually has lower plasma levels of glucagon than a normal individual.
D. Usually benefits from receiving insulin about six hours after a meal.
E. *Usually shows significant improvement in glucose tolerance if body weight is reduced to normal.

76. An individual with insulin resistance:

A. Usually shows elevated fasting glucose levels.
B. Is treated by injection of insulin.
C. Will eventually become diabetic.
D. Is rarely obese.
E. *Usually shows elevated fasting insulin levels.

PART IV

Biochemistry of tissues and physiological functions

4.1. Nutrition and vitamins

1. A patient complains of bad appetite and belching. General acidity of gastric juice makes 10 units. Such symptoms develop under:
A. Gastritis with anacidlty.
B. Gastritis with hyperacidity.
C. Acute pancreatitis.
D. Ulcerous illness of stomach.
E. *Hypoacidic gastritis.

2. A man who abstained from eating fat food for a long time but consumed a lot of carbohydrates and proteins, began to complain of dermatitis, bad healing of wounds, worsening of sight. What is the possible cause of this disease?
A. Deficiency of oleic acid.
B. Deficiency of palmitic acid.
C. Deficiency of vitamins PP, H.
D. Low caloric content of the diet.
E. *Deficiency of linolic acid, vitamins A, D, E, K.

3. A patient is complaining of gums bleeding. What vitamins are prescribed for the treatment of this patient?
A. B_1, B_2.
B. Biotin, panthothenic acid.
C. A, E.
D. PP, B_{12}.
E. *C, K.

4. For diagnostics of certain illnesses the determination of blood transaminases activity is required. Which vitamin is a component of the cofactors of the enzymes?
A. B_5.
B. B_2.
C. B_1.
D. B_8.
E. *B_6.

5. Pyridoxal phosphate was prescribed to a patient according to the clinical indication. For the correction of what biochemical pathway is this drug recommended?
A. Deamination of purine nucleotides.
B. Oxidative decarboxylation of ketoacids.
C. Protein synthesis.
D. Synthesis of purine and pyrimidine bases.
E. *Transamination and decarboxylation of amino acids.

6. A 2-year-old child developed intestinal dysbacteriosis with a hemorrage syndrome. The most probable cause of this syndrome is:
A. Hypocalcemia.
B. Activation of tissue thromboplastin.
C. Vitamin PP deficiency.
D. Fibrinogen deficiency.
E. *Vitamin K deficiency.

7. 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. Choline.
D. Pyridoxine.
E. *α-Tocopherol.

8. Patients with biliary ducts obturation manifested bleeding due to the suppression of the blood coagulation system. The coagulation disturbance symptoms result from the deficiency of assimilation of the vitamin:
A. Carotin.
B. A.
C. D.
D. E.
E. *K.

9. The twilight sight of a patient who suffers from dryness of hit conjunctiva and cornea has decreased. Such disorder can be caused by the deficiency of:
A. Vitamin B_1.
B. Vitamin B_{12}.
C. Vitamin C.
D. Vitamin D.
E. *Vitamin A.

10. After the resection of a 2/3 part of the stomach, the amount of erythrocytes in the blood of a patient has decreased, their volume has increased, and the level of hemoglobin has decreased. The deficiency of what vitamin causes such changes of blood contents?
A. PP.
B. C.
C. P.
D. B_6.
E. *B_{12}.

11. The simultaneous disorder of the human reproductive function and the dystrophy of skeletal muscles are caused by the deficiency of:
A. Vitamin B_1.
B. Vitamin A.

C. Vitamin K.
D. Vitamin D.
E. *Vitamin E.

12. A 30-year-old woman was diagnosed with insufficiency of exocrinous function of pancreas. Hydrolisis of what nutrients will be disturbed?
A. Proteins.
B. Fats, carbohydrates.
C. Proteins, carbohydrates.
D. Proteins, fats.
E. *Proteins, fats, carbohydrates.

13. Malignant hyperchrome anemia, or Birmer's disease, is a pathological state caused by the deficiency of vitamin B_{12}. What chemical element is a constituent of the structure of this vitamin?
A. Iron.
B. Molybdenum.
C. Zinc.
D. Magnesium.
E. *Cobalt.

14. The treatment of a child, who suffers from rachitis, with vitamin D_3 proved to be unsuccessful. Which is the most likely cause of treatment inefficiency?
A. Insufficiency of lipids in food.
B. Disturbance of vitamin D_3 transport by the proteins of blood.
C. Disturbance of insertion of vitamin D_3 into the molecule of enzyme.
D. Increased consumption of vitamin D_3 by microorganisms of intestines.
E. *Disturbance of hydroxylation of vitamin D_3.

15. After prolonged treatment of a patient with antibiotics, the suppression of intestinal microorganisms occurred. What kind of hypovitaminosis can result from this treatment?
A. A.
B. C.
C. D.
D. P.
E. *B_{12}.

16. Persons suffering from alcohollism 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. Hexokinase.

C. Transaminase.
D. Aldolase.
E. *Pyruvate dehydrogenase.

17. 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. Antiscurving.
B. Antihemorragic.
C. Antidermatitic.
D. Antineuritic.
E. *Antioxydant.

18. A physician recommended a patient, who suffered from ulcer of duodenum, to drink daily juices made of cabbage and potatoe. What substances contributing to the prophylaxis and cicatrization of ulcers do these vegetables contain ?
A. Vitamin K.
B. Panthothenic acid.
C. Vitamin C.
D. Vitamin B_1.
E. *Vitamin U.

19. Most participants of the round-the-world voyage of Magellan perished from avitaminosis that was manifested by general weakness, hypodermic hemorrhages, loss of teeth, bleeding of gums. Name the disease which develops as a result of this avitaminosis.
A. Pellagra.
B. Birmer's anemia.
C. Rachitis.
D. Polyneuritis.
E. *Scurvy.

20. During the patronage a doctor revealed that a child had symmetric roughness of skin on the cheeks, diarrhea, disturbance of nervous activity. The deficiency of what food factors caused the appearance of such symptoms?
A. Phenylalanine, pangamic acid.
B. Lysine, ascorbic acid.
C. Threonine, panthothenic acid.
D. Methionine, lipoic acid.
E. *Nicotine acid, tryptophan.

21. A patient was diagnosed with dermatitis as a result of prolonged consumption of uncooked eggs. What vitamin deficiency developed in this case?
A. Folic acid.
B. Vitamin C.
C. Pantothenic acid.
D. Para-amino benzoic acid.
E. *Biotin.

22. There is an increase of the pyruvate level in the patient's

blood and urine. What kind of avitaminosis developed in this case?
A. B_2-avitaminosis.
B. E-avitaminosis.
C. B_3-avitaminosis.
D. B_6-avitaminosis.
E. *B_1-avitaminosis.

23. Vitamin B_1 deficiency causes disturbance of oxidative decarboxylation of α-keto-glutaric acid. This leads to the impaired synthesis of the following coenzyme:
A. Nicotinamide adenine dinucle-otide.
B. Lipoic acid.
C. Flavine adenine dinucleotide.
D. Coenzyme A.
E. *Thiamine pyrophosphate.

24. A patient with frequent bleedings inside the internal organs and mucous membranes was found having proline and lysine in the collagen fibers composition. What vitamin absence results in the disturbance of these amino acids hydroxylation?
A. D.
B. E.
C. K.
D. A.
E. *C.

25. A patient suffers from hemorrhages that are associated with the obstruction of the common bileduct. This symptom is caused by the disturbance of assimilation of the vitamin:
A. F.
B. A.
C. E.
D. D.
E. *K.

26. A 9-month-old infant is fed with artificial formulas with un-balanced vitamin B_6 concen-tration. The infant presents with pellagral dermatitis, con-vulsions, anaemia. Convulsion development might be caused by the disturbed formation of:
A. Histamine.
B. Dopamine.
C. DOPA.
D. Serotonin.
E. *GABA.

27. An ophthalmologist found that an outpatient had the increase of the time of sight adaptation for darkness. What kind of vitamin deficiency can be the cause of the symptom?
A. E.
B. D.
C. C.
D. K.

E. *A.

28. A patient suffers from dermatitis, diarrhea and dementia. The absence of which vitamin is the cause of such clinical state?
A. Folic acid.
B. Ascorbic acid.
C. Rutin.
D. Biotin.
E. *Nicotin amide.

29. A patient was diagnosed with megaloblastic anemia. The lack of which substance in the human organism can cause this disease?
A. Copper.
B. Glycine.
C. Magnesium.
D. Cholecalciferol.
E. *Cobalamine.

30. Hydroxyproline is an essential amino acid in the collagen structure. Which of the following vitamins takes part in the formation of this amino acid by the proline hydroxylation pathway?
A. B_1.
B. D.
C. B_6.
D. B_2.
E. *C.

31. A 10-year-old girl suffers from acute respiratory system infections, after which multiple punctuate hemorrhages in the places of clothes friction are observed. The deficiency of which of the following vitamins occurs in this case?
A. B_2.
B. B_6.
C. B_1.
D. A.
E. *C.

32. Vitamin therapy is appointted to a pregnant with a few involuntary abortions in anamnesis. What vitamin contributes to the bearing of pregnancy?
A. Rutin.
B. Folic acid.
C. Cobalamine.
D. Pyridoxine.
E. *α-Tocopherol.

33. A child manifests epileptic seizures caused by vitamin B deficiency. This is conditioned by the decrease of the γ-aminobutyrate level in the nervous tissue which acts as an inhibiting neurotransmitter. The activity of which enzyme is decreased in this case?
A. Pyridoxal kinase.
B. Alanine aminotransferase

C. Glutamate dehydrogenase.
D. Glutamate synthetase.
E. *Glutamate decarboxylase.

34. Pain along large nervous stems and increased amount of pyruvate in the blood were revealed in the patient. Insufficiency of what vitamin can cause such change?
A. B_2.
B. Biotin.
C. Pantothenic acid.
D. PP.
E. *B_1.

35. Patient with hypochromic anemia has splitting hair and loss of hair, increased nails brittling and taste alteration. What is the mechanism of the development of these symptoms?
A. Deficiency of vitamin A.
B. Deficiency of iron-containing enzymes.
C. Decreased production of parathyrin.
D. Decreased production of hormones.
E. *Deficiency of vitamin B_{12}.

36. A woman, who was keeping a diet for a long time and eating refined rice, has developed polyneuritis (beriberi disease). The absence of what vitamin in the diet causes the development of such disease?
A. Pyridoxal.
B. Folic acid.
C. Ascorbic acid.
D. Riboflavin.
E. *Thiamine.

37. In case of enterobiosis acrihine – the structural analogue of vitamin B_2-is administered. The synthetic disorder due to which enzymes does this medicine cause in microorganisms?
A. Aminotransferases.
B. Peptidases.
C. Cytochromeoxidases.
D. NAD-dependent dehydrogenases.
E. *FAD-dependent dehydrogenases.

38. A patient has got frequent internal organs and mucosal hemorrhages. The analysis indicated insufficiency of hydroxyproline and hydroxyllysine in the collagenous fibres. The insufficiency of what vitamin caused the impairment of hydroxylylation of the abovementioned aminoacids in a patient?
A. Vitamin PP.
B. Vitamin H.
C. Vitamin K.

D. Vitamin A.
E. *Vitamin C.

39. A 43-year-old man suffers from chronic atrophic gastritis and megaloblastic hyperchromic anemia. He also has methylmalonic aciduria. Insufficiency of what vitamin led to the development of such complex of symptoms?
A. Vitamin B_5.
B. Vitamin B_2.
C. Vitamin B_3.
D. Vitamin B_1.
E. *Vitamin B_{12}.

40. A patient with symmetric dermatitis of open dermal areas came to the doctor. Talking to the patient the doctor found out that the patient mostly eats cereals and eats little meat, milk and eggs. The deficiency of which of the mentioned vitamins is dominant in this patient?
A. Tocopherol.
B. Folic acid.
C. Biotin.
D. Calciferol.
E. *Nicotinamide.

41. A patient has pellagra. Interrogation revealed that he had lived mostly on maize for a long time and eaten little meat. This disease had been caused by the deficit of the following substance in the maize:
A. Alanine.
B. Histidine.
C. Proline.
D. Tyrosine.
E. *Tryptophan.

42. Pyruvate concentration in the patient's urine has increased 10 times from normal amount. What vitamin deficiency can be the reason of this change:
A. Vitamin B_6.
B. Vitamin A.
C. Vitamin E.
D. Vitamin C.
E. *Vitamin B_1.

43. Hydroxylation of endogenous substrates and xenobiotics requires a donor of protons. Which of the following vitamin can play this role?
A. Vitamin B_6.
B. Vitamin E.
C. Vitamin P.
D. Vitamin A.
E. *Vitamin C.

44. A patient who was previously ill with mastectomy as a result of breast cancer was prescribed radiation therapy. What vitamin preparation has

marked radioprotective action caused by antioxidant activity?
A. Thiamine chloride.
B. Ergocalciferol.
C. Folic acid.
D. Riboflavin.
E. *Tocopherol acetate.

45. A 10-year-old girl often experiences acute respiratory infections with multiple punctate haemorrages in the places of clothes friction. Hypovitaminosis of what vitamin has the girl?
A. A.
B. B_1.
C. B_2.
D. B_6.
E. *C.

46. A patient suffers from hemeralopia. Which of the suggested substances will have curable effect?
A. Carnitine.
B. Keratin.
C. Creatine.
D. Carnosine.
E. *Carotene.

47. Which one of the following is elevated in plasma during the absorptive period (compared with the post-absorptive state)?
A. Glucagon.
B. Acetoacetate.
C. Lactate.
D. Free fatty acids.
E. *Chylomicrons.

48. Increased formation of ketone bodies during fasting is a result of:
A. Decreased levels of circulating glucagon.
B. Decreased formation of acetyl CoA in the liver.
C. A decreased activity of hormone sensitive lipase in adipose tissue.
D. Inhibition of β-oxidation of fatty acids in the liver.
E. *Increased levels of free fatty acids in serum.

49. Which one of the following is the most important source of blood glucose during the last hours of a 48 hour fast?
A. Muscle glycogen.
B. Acetoacetate.
C. Liver glycogen.
D. Lactate.
E. *Amino acids.

50. Which one of the following statements concerning dietary lipid is correct?
A. Corn oil and soybean oil are examples of fats rich in saturated fatty acids.
B. Triacylglycerols obtained from plants generally contain less

unsaturated fatty acids than those from animals.
C. Olive oil is rich in saturated fats.
D. Coconut and palm oils are rich in polyunsaturated fats.
E. *Fatty acids containing double bonds in the transconfiguration, unlike the naturally occurring cis-isomers, raise plasma cholesterol levels.

51. Given the information that a 70-kg man is consuming a daily average of 275 g of carbohydrate, 75 g of protein, and 65 g of lipid, one can draw which of the following conclusions?
A. Total energy intake per day is approximately 3000 kcal.
B. About twenty percent of the calories are derived from lipids.
C. The diet does not contain a sufficient amount of dietary fiber.
D. The individual is in nitrogen balance.
E. *The proportions of carbohydrate, protein, and lipid in the diet conform to the recommendations of academic groups and government agencies.

52. Which one of the following statements concerning vitamin B_{12} is correct?
A. The cofactor form is vitamin B_{12} it self.
B. It is involved in the transfer of amino groups.
C. Its deficiency is most often caused by a lack of the vitamin in the diet.
D. It is present in plant products.
E. *It requires a specific glycoprotein for its absorption.

53. Retinol:
A. can be enzymically ormed from retinoic acid.
B. mediates most of the actions of the retinoids.
C. is the light-absorbing portion of rhodopsin.
D. is phosphorylated and dephosphorylated during the visual cycle.
E. *is transported from the intestine to the liver in chylomicrons.

54. Which one of the following statements concerning vitamin D is correct?
A. A deficiency in vitamin D results in an increased secretion of calcitonin.
B. Its s required in the diet of individuals exposed to sunlight.
C. 25-Hydroxycholecalciferol is the active form of the vitamin.
D. Vitamin D opposes the effect of parathyroid hormone.
E. *Chronic renal failure requires the oral administration of 1,25-dihydroxycholecalciferol.

55. Vitamin K:
A. plays an essential role in preventing thrombosis.
B. increases the coagulation time in newborn infants with hemorrhagic disease.
C. is present in high concentration in cow or breast milk.
D. is a water-soluble vitamin.
E. *is synthesized by intestinal bacteria.

4.2. Biochemistry of blood

1. What medicines should be prescribed to a patient with acute pancreatitis to prevent pancreas autolysis?
A. Proteases activators.
B. Amylase.
C. Trypsin.
D. Chymotrypsin.
E. *Proteases inhibitors.

2. 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. Carboxypeptidase.
E. *Trypsin.

3. 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. Hexokinase.
D. Acidic phosphatase.
E. *Aspartate aminotransferase.

4. In a patient's blood the activities of lactate dehydrogenase (LDH_4, LDH_5), alanine aminotransferase, carbamoyl ornithine transferase were increased. What organ is the pathological process developed?
A. In skeletal muscles.
B. In the myocardium (myocardial infraction is possible).
C. In connective tissue.
D. In kidneys.
E. *In the liver (hepatitis is possible).

5. The activities of lactate dehydrogenase (LDH_1, LDH_2), aspartate aminotransferase, creatine kinase in the blood of a patient were increased. In which of the following organs is

the pathological process probably developed?
A. In the liver and kidneys.
B. In skeletal muscles (dystrophy, atrophy).
C. In the kidneys and adrenal glands.
D. In connective tissue.
E. *In the myocardium (the initial stage of myocardial infraction).

6. Inadequate feeding of a newborn resulted in profuse diarrhea that entailed intensified excretion of sodium bicarbonate. What form of acid-base balance disorder is observed in this case?
A. The acid-base balance is not broken.
B. Metabolic alkalosis.
C. Respiratory acidosis.
O. Respiratory alkalosis.
E. *Metabolic acidosis.

7. A mother of a 5-year-old child consulted a doctor complaining of developing skin erythema, vesicular rash and itching of her baby under the influence of sunbeams. Laboratory investigation revealed the decrease of blood serum iron and the rise of urine excretion of uroporphyrinogen I. The most credible inherited pathology of the child is:
A. Coproporphyria.
B. Methemoglobinemia.
C. Hepatic porphyria.
D. Acute intermittent porphyria.
E. *Erythropoietic porphyria.

8. Hemoglobin catabolism is accompanied by the release of iron which enters bone marrow in composition with special transport protein and thereafter is repeatedly used for the synthesis of hemoglobin. The transport protein for iron is:
A. Albumin.
B. Transcobalamine.
C. Haptoglobin.
D. Ceruloplasmin.
E. *Transferrin (siderofilin).

9. Under the action of oxidants (hydrogen peroxide, nitro-gen oxides etc.), Fe^{2+}-containing hemoglobin is converted into the substance that Includes Fe^{3+} and is not able to transport oxygen. What substance is it?
A. Carbhemoglobin.
B. Carboxyhemoglobin.
C. Glycosylated hemoglobin.
D. Oxyhemoglobin
E. *Methemoglobin.

10. Visual inspection of a patient revealed the presence of bubbles and increased pigmentation of skin that evolves after ultraviolet irradiation. The patient's urine becomes red in the open air. Which of the following urine constituents determination is required for the verification of Gunter's disease?

A. Acetone.
B. Hemoglobin.
C. Bilirubin.
D. Creatinine.
E. *Uroporphyrinogen I.

11. α-Thalassemia of a patient is diagnosed. What disturbances concerning hemoglobin synthesis are observed in case of this disease?

A. Inhibition of δ- and β-chains synthesis.
B. Inhibition of β-chains synthesis.
C. Inhibition of γ-chains synthesis.
D. Inhibition of γ- and β-chains synthesis.
E. *Inhibition of α-chains synthesis.

12. A six-month-old child has manifestation of frequently expressed hypodermic hemorrages. The administration of synthetic analogue of vitamin K (vicasol) proved to have a favorable effect. In what reaction of γ-carboxylation of glutamate does the blood coagulation system proteins of this vitamin take part?

A. Fibrinogen.
B. Rosenthal factor.
C. Hageman factor.
D. Antihemophilic globulin A.
E. *Protrombin.

13. A patient shows rapid development of edemata. The decrease of which scrum blood proteins is responsible for edemata appearance?

A. α_1-Glohulins.
B. Fibrinogen.
C. α_2-Globulins.
D. β-Globulins.
E. *Albumins.

14. A patient has sickle-cell anemia diagnosed. Replacement of which amino acid in the hemoglobin polypeptide chain with valine is result in this disease?

A. Threonine.
B. Aspartate.
C. Leucine.
D. Arginine.
E. *Glutamate.

15. 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. Cholecystitis.
C. Rheumatism.
D. Pancreatitis.
E. *Myocardial infarction.

16. A presumptive diagnosis of acute pancreatitis was made on the basis of clinical symptoms. Name the biochemical test required for the verification of this diagnosis.

A. Determination of creatinine level in blood.
B. Determination of the activity of acid phosphatase in blood.
C. Determination of the activity of alkaline phosphatase in blood.
D. Determination of the activities of amino transferases in blood.
E. *Determination of the activity of amylase in blood.

17. A 33-year-old patient has been suffering from Illness for ten years. Periodically he complains of sharp pains in the stomach, cramps, and disorders of vision. His relatives manifest similar clinical symptoms. The urine has red color. The patient was hospitalized with the diagnosis of acute alternative porphyria. The cause of the disease can be in the biosynthetic disturbance of:

A. Insulin.
B. Collagen.
C. Bile acids.
D. Prostaglandins.
E. *Heme.

18. A man in the state of rest purposely makes himself breathe frequently and deeply for 3 or 4 minutes. How does this exercise influence the acid-basic balance of his organism?

A. Metabolic alkalosis appears.
B. Respiratory acidosis appears.
C. Acid-base balance does not change.
D. Metabolic acidosis appears
E. *Respiratory alkalosis appears.

19. Symptoms of hemorrhagic disease due to hypovitaminosis of vitamin K of a newborn child appeared. The development of the disease is conditioned by a special biological role of vitamin K. What role is it?

A. It is a specific inhibitor of antithrombin.

B. It is a cofactor of prothrombin.
C. It inhibits the synthesis of heparin.
D. It affects the proteolytlc activity of thrombin.
E. *It is a cofactor of γ-glutamate carhoxyase.

20. The molecular analysis of hemoglobin of a patient suffering from anemia showed the replacement of 6Glu with 6VaI in β-chain. What is the molecular mechanism of this pathology?
A. Transduction of genes.
B. Chromosome mutation.
C. Genomic mutation.
D. Amplification of genes.
E. *Gene mutation.

21. A 70-year-old man has an intensified blood clotting, caused, first and foremost, by the decrease of the level of _____ in the blood plasma.
A. Vitamin D.
B. Albumin.
C. Immunoglobulin A.
D. Calcium.
E. *Antithrombin.

22. A man has been bitten by a snake. Choking breaks out, hemoglobin appears in the urine. There is hemolysis of erythrocytes in the blood. The action of toxic serpentine poison results in:
A. Formation of triglycerides.
B. Acidosis.
C. Polyuria.
D. Development of alkalosis.
E. *Formation of lysolecithin.

23. What protein, assigned for transport, does hemoglobin bind to in the reticuloendothelial system of the liver?
A. Ceruloplasmin.
B. Abumin.
C. Ferritin.
D. Transferrin.
E. *Haptoglobin.

24. What components of the rest nitrogen fraction are prevailing in blood under the condition of plasma nitrogen rise produced by tissue catabolism?
A. Ketone bodies, proteins.
B. Lipids, carbohydrates.
C. Uric acid, choline.
D. Porphyrins, bilirubin.
E. *Amino acids, urea.

25. It was determined that the concentration of potassium in the patient's blood plasma was 8.0 mM/1. This clinical status is characterized by:
A. Increase of arterial pressure.

B. Tachycardia.
C. Bradycardia.
D. Decrease of arterial pressu re.
E. *Arrhythmias, heart arrest.

26. A 43-year-old work woman of a chemical plant complains of general weakness, weight loss, apathy, and somnolence. Chronic lead poisoning is confirmed by laboratory tests – hypochromic anemia is revealed. In the blood the level of protoporphyrin is increased and the level of 5-amino-levulenate is reduced, which testifies to the disorder of the synthesis of:
A. DNA.
B. Mevalonic acid.
C. RNA.
D. Protein.
E. *Heme.

27. Different substances, including polysaccharide of natural origin, are used as anticoagulants. Choose the polysaccharide of natural origin.
A. Dextran.
B. Hyaluronic acid.
C. Dermatane sulfate.
D. Chondroitine sulfate.
E. *Heparin.

28. A patient is found having a marked increase of skin sensitivity to sunbeams. After excretion, his urine becomes darkred. What is the most probable cause of such state?
A. Alkaptonuria.
B. Hemolytic icterus.
C. Albinism.
D. Pellagra.
E. *Porphyria.

29. 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. Intestine.
C. Stomach.
D. Kidney.
E. *Pancreas.

30. A 3-months child has developed a severe form of hypoxia manifested by dyspnea and cyanosis. What way of hemoglobin formation is broken?
A. Replacement of hemoglobin F with hemoglobin M.
B. Replacement of hemoglobin F with hemoglobin S.
C. Replacement of hemoglobin F with glycosylated hemoglobin.
D. Replacement of hemoglobin F with methemoglobin.

E. *Replacement of hemoglobin F with hemoglobin A.

31. The level of pH and content of hydrocarbonate Ions in the patient's blood is reduced. It means that the alkaline reserve of the blood is decreased. The concentrations of lactate and pyruvate in the blood and urine are increased. What type of acid-base balance disorder is observed?
A. Metabolic alkalosis.
B. Respiratory acidosis.
C. Breathing alkalosis.
D. Respiratory alkalosis.
E. *Metabolic acidosis.

32. Intoxication can occur as a result of the increase of carbon monoxide concentration in the air. Thus, transport of oxygen from the lungs to tissues performed by hemoglobin is disturbed. What hemoglobin derivative appears in this case?
A. Methemoglobin.
B. Oxyhemoglobin.
C. Hemochromogen.
D. Carbhemoglobin.
E. *Carboxyhemoglobin.

33. A 37-year-old patient suffers from frequent bleedings of minor damages against the background of prolonged antibiotic therapy. The decreased activity of blood coagulation factors II, VII, X, as well as the rise of blood clotting duration were displayed in the patient's blood. The deficiency of what vitamin has led to these changes?
A. Vitamin D.
B. Vitamin A.
C. Vitamin C.
D. Vitamin E.
E. *Vitamin K.

34. After repairing a car in a garage, a car driver was brought to a clinic with symptoms of poisoning with exhaust fumes. The concentration of what type of hemoglobin is increased in his blood?
A. Glycosylated hemoglobin.
B. Methemoglobin.
C. Carbhemoglobin.
D. Oxyhemoglobin.
E. *Carboxyhemoglobin.

35. Vikasol, a synthetic analogue of vitamin K, was recommended to a 6-year-old child for the prevention of postoperative bleeding. What kind of posttranslational changes of blood coagulation factors is

activated under the influence of vikasol?
A. Glycosylation.
B. Phosphorylation of serine radicals.
C. Restricted proteolysis.
D. Polymerization.
E. *Carboxylation of glutamate.

36. Patient experienced increased susceptibility of the skin to the sunlight. His urine after some time became dark-red. What is the most likely cause of this?
A. Pellagra.
B. Albinism.
C. Hemolytic jaundice.
D. Alkaptonuria.
E. *Porphyria.

37. From the group of children who were eating sweet sappy watermelon two kids developed the signs of poisoning: rapid weakness, dizziness, headache, vomiting, edema, tachycardia, cyanosis of mouth, ears, tips of the fingers cyanosis. High concentration of nitrates was detected. What is the leading mechanism of the pathogenesis of the poisoning in the two children?
A. Block cytochrome oxidase.
B. Insufficiency of superoxide dismutase.
C. Insufficiency of catalase.
D. Insufficiency glutathione pyroxidase.
E. *Insufficiency of met-Hb-reductase.

38. Substitution of the glutamic acid on valine was revealed while examining initial molecular structure. For what inherited pathology is this typical?
A. Thalassemia.
B. Favism.
C. Hemoglobinosis.
D. Minkowsky-Shauffard disease.
E. *Sickle-cell anemia.

39. Pathological changes of the liver and brain were revealed in a 27-year-old patient. The copper concentration is abruptly decreased in blood plasma and increased in the urine. Wilson's disease was diagnosed. Activity of what enzyme in the blood serum should be examined to prove diagnosis?
A. Carboanhydraze.
B. Alcoholdehydrogenaze.
C. Xanthioxidase.
D. Leucinzminoopeptidaze.
E. *Ceruloplasmin.

40. Index of pH of the blood changed and became 7,3 in the

patient with diabetes mellitus. Detecting of the components of what buffer system is used while diagnosing disorder of the acid-base equilibrium?
A. Oxyhemoglobin.
B. Hemoglobin.
C. Protein.
D. Phosphate.
E. *Bicarbonate.

41. Buffer capacity of blood was decreased in the worker due to exhausting muscular work. By entry of what acid substance to the blood can this state be explained?
A. 1, 3-bisphosphoglycerate.
B. 3-phosphoglycerate.
C. a-ketoglutarate.
D. Pyruvate.
E. *Lactate.

42. A 62-year-old female patient complains about frequent pains in the region of thorax and vertebral column, rib fractures. A physician suspected myelomatosis (plasmocytoma). Which of the following laboratory indices will be of the greatest diagnostic importantce?
A. Hyperalbuminemia.
B. Hypoproteinemia.
C. Hypoglobulinemia.
D. Proteinuria.
E. *Paraproteinemia.

43. The high level of lactate dehydrogenase (LDH) isozymes concentration showed the increase of LDH-1 and LDH-2 in a patient's blood plasma. Point out the most probable diagnosis:
A. Diabetes mellitus.
B. Skeletal muscle dystrophy.
C. Viral hepatitis.
D. Acute pancreatitis.
E. *Myocardial infarction.

44. A patient, who suffers from congenital erythropoietic porphyria, has skin photosensitivity. The accumulation of what compound in the skin can cause it?
A. Heme.
B. Uroporphyrinogen II.
C. Protoporphyrin.
D. Coproporphyrinogen III.
E. *Uroporphyrinogen I.

45. The concentration of albumins in human blood sample is lower than normal. This leads to edema of tissues. What blood function is damaged?
A. Maintaining the body temperature.
B. All answers are correct.

C. Maintaininig the blood sedimentation system.
D. Maintaininig the pH level.
E. *Maintaininig the oncotic blood pressure.

46. A worker has decreased buffer capacity of blood due to exhausting muscular work. The influx of what acid substance in the blood can cause this symptom?
A. 3-phosphosphoglycerate.
B. 1,3-bisphosphoglycerate.
C. Pyruvate.
D. a-ketoglutarate.
E. *Lactate.

47. A pregnant woman had been having toxicosis with severe repeated vomiting for 24 hours. At the end of the day there appeared tetanic convulsions and fluid loss. What shift of acid-base state caused these changes?
A. Gaseous acidosis.
B. Excretory acidosis.
C. Metabolic acidosis.
D. Gaseous alkalosis.
E. *Excretory alkalosis.

48. Diabetes mellitus causes ketosis as a result of activated oxidation of fatty acids. What disorders of acid-base balance may be caused by excessive accumulation of ketone bodies in blood?
A. Respiratory acidosis.
B. Metabolic alkalosis.
C. Any changes won't happen.
D. Respiratory alkalosis.
E. *Metabolic acidosis.

49. After taking poor-quality food a patient developed repeated episodes of diarrhea. On the next day he presented with decreased arterial pressure, tachycardia, extrasystole. Blood pH is 7,18. These abnormalities were caused by the development of:
A. Gaseous alkalosis.
B. Nongaseous alkalosis.
C. Metabolic alkalosis.
D. Gaseous acidosis.
E. *Nongaseous acidosis.

50. A patient complains about dyspnea provoked by the physical activity. Clinical examination revealed anaemia and presence of the paraprotein in the zone of gamma-globulins. To confirm the myeloma diagnosis, it is necessary to determine the following index in the patient's urine:
A. Bilirubin.
B. Haemoglobin.
C. Antitrypsin.

D. Ceruloplasmin.
E. *Bence Jones protein.

51. A patient who had myocardial infarction was administerred 75 mg of acetylsalicinic acid a day. What is the purpose of this administration?
A. Temperature reduction.
B. Pain relief.
C. Inflammation reduction.
D. Coronary vessel dilatation.
E. *Reduction of thrombocyte aggregation.

52. Disorder of the airway passage in small and middle bronchi was revealed in the patient. What disorder of the acid-base equilibrium can be detected in the blood?
A. Metabolic alkalosis.
B. Respiratory alkalosis.
C. Metabolic acidosis.
D. Non respiratory acidosis.
E. *Respiratory acidosis.

53. After a surgery a 36-year-old woman was given an intravenous injection of concentrated albumin solution. This has induced intensified water movement in the following direction:
A. From the cells to the intercellular fluid.
B. No changes of water movement will be observed.
C. From the intercellular fluid to the cells.
D. From the capillaries to the intercellular fluid.
E. *From the intercellular fluid to the capillaries.

54. A thirty-year-old woman presented with progressive shortness of breath. She denied the use of cigarettes. A family history revealed that her sister had suffered from unexplained lung disease. Which one of the following etiologies most likely explains this patient's pulmonary symptoms?
A. Deficiency of proline hydroxylase.
B. Increase collaginase activity.
C. Deficiency in dietary vitamin C.
D Decreased elastase activity.
E. *Deficiency of α1-antitrypsin.

55. Which one of the following statements concerning the binding of oxygen by hemoglobin is correct?
A. The Bohr effect results in a lower affinity for oxygen at higher pH values.
B. Carbon dioxide increases the oxygen affinity of hemoglobin by

binding to the amino terminal groups of the polypeptide chains.
C. Oxyhemoglobin and deoxyhemoglobin have the same affinity for protons (H^+).
D. The hemoglobin tetramer binds four molecules of 2,3-BPG.
E. *The oxygen affinity of hemoglobin increases as the percent saturation increases.

56. Which one of the following statements concerning the ability of acidosis to precipitate a crisis in sickle cell disease is correct?
A. Acidosis decreases the ability of 2,3-BPG to bind to hemoglobin.
B. Acidosis increases the affinity of hemoglobin for oxygen.
C. Acidosis favors the conversion of hemoglobin from the taut to the relaxed conformation.
D. Acidosis shifts the oxygen-dissociation curve to the left.
E. *Acidosis decreases the solubility of HbS.

4.3. Biochemistry of liver and kidneys

1. A child manifested yellowish skin and mucous membranes on the second day after birth. The cause of such states is temporal deficiency of:
A. Heme oxygenase.
B. Sulfotransferase.
C. Heme synthetase.
D. Blliverdin reductase.
E. *UDP-glucuronyltransferase.

2. Most of the nitrogen is excreted from the body in the form of urea. The decrease of activity of what liver enzyme results in inhibiting of urea synthesis and accumulation of ammonia in blood and tissues?
A. Pepsin.
B. Aspartate aminotransferase.
C. Urease.
D. Amylase.
E. *Carbamoyl phosphate synthase.

3. The increase of total bilirubin content at the expense of indirect (free) fraction was detected in the blood plasma of a patient suffering from icterus. There is also a high level of stercobilin in the feces and urine. The level of direct

(linked) bilirubin in the blood plasma is within the normal range. What type of icterus is observed in this case?
A. Mechanical.
B. Hepatic.
C. Gilbert disease.
D. Jaundice of newborns.
E. *Hemolytic.

4. A 46-year-old woman, suffering from cholelithiasis developed icterus. The urine became dark-yellow, and the feaces discolored. The concentration of what substance in the blood serum would rise mostly?
A. Non-conjugated bilirubin.
B. Urobilinogen.
C. Biliverdin.
D. Mesobilirubin.
E. *Conjugated bilirubin.

5. Yellowish skin and mucous membranes of a premature newborn are observed on the second day after delivery. The provisional deficiency of what enzyme is the cause of this state?
A. Aminolevulenate synthase.
B. Biliverdin reductase.
C. Heme oxygenase.
D. Heme synthase.
E. *UDP-glucuronyltransferase.

6. A patient with complaints of general weakness, stomachache and bad appetite was admitted to a clinic. A doctor suspected jaundice. In the blood serum the total bilirubin content is 77,3 μmol/1, the direct bilirubin content is 70,76 μmol/1/1. What type of icterus is the most credible in this case?
A. Hemolytic jaundice.
B. Acute hepatitis.
C. Liver cirrhosis.
D. Hepatic jaundice.
E. *Mechanical jaundice.

7. Liver cirrhosis of a patient was diagnosed. Determination of which of the compounds excreted with urine characterizes the state of antitoxic function of the liver?
A. Amino acids.
B. Ammonia salts.
C. Creatinine.
D. Uric acid.
E. *Hippuric acid.

8. Detoxification of xenobiotics (pharmaceutical drugs, epoxides, arenoxides, aldehydes, nitro derivates etc.) as well as of endogenous metabolites (estradiol, prostaglandins, and leukotrienes) takes place in the

liver by means of their conjugation with:
A. Phosphoadenosine.
B. Aspartate.
C. Glycine.
D. S-Adenosylmethionine.
E. *Glutathione.

9. A patient has yellow coloring of the skin, dark urine, and yellow-colored feaces. The increase of concentration of what substance will be observed in the blood serum?
A. Conjugated bilirubin.
B. Biliverdin.
C. Mesobilirubin.
D. Verdoglobin.
E. *Non-conjugated bilirubin.

10. The increase of conjugated (direct) bilirubin is revealed in the patient's blood plasma, and the simultaneous increases of nonconjugated (indirect) bili-rubin level as well as the dramatic decrease of stercobilinogen content in the feaces and urine are discovered. What type of icterus takes place?
A. Hemolytic.
B. Hepatic.
C. Gilbert disease.
D. Jaundice of a newborn.
E. *Posthepatic.

11. A 20-year-old patient is diagnosed with inherited deficiency of UDP-glucuronyl-transferase. The increased concentration of what blood component confirms the diagnosis?
A. Stercobilinogen.
B. Direct (conjugated) bilirubin.
C. Urobilin.
D. Indican.
E. *Indirect (non-conjugated) bilirubin.

12. Yellowish skin and mucous membranes of a patient are observed after blood transfusion. There are also increased levels of total and indirect bilirubin in the blood, urobilin in the urine, and stercobilin in the feces. What type of jaundice is observed in this case?
A. Jaundice of newborns.
B. Inherited jaundice.
C. Posthcpatic jaundice.
D. Hepatic jaundice.
E. *Hemolytic jaundice.

13. A newborn child is found to have physiological jaundice. The level of free bilirubin in the blood considerably exceeds the normal range. The deficiency of what enzyme is this status conditioned by?

A. Heme oxygenase.
B. Transaminase.
C. Xanthine oxidase.
D. Adenosine deaminase.
E. *UDP-glucuronyltransferase.

14. For the treatment of jaundice, barbiturates that induce the synthesis of UDP-glucuronyltransferase are prescribed. The curative effect of barbiturates is conditioned by the formation of:
A. Heme.
B. Indirect (non-conjugated) bilirubin.
C. Biliverdin.
D. Protoporphyrin.
E. *Direct (conjugated) bilirubin.

15. Hepatic detoxification of natural metabolites and xenobiotics in the patient's liver is broken. Name the cytochrome, the activity of which is presumably decreased:
A. Cytochrome c_1.
B. Cytochrome oxidase.
C. Hemoglobin.
D. Cytochrome b.
E. *Cytochrome P_{450}.

17. A newborn child manifests symptoms of icterus. The introduction of low doses of phenobarbital (the inductor of the synthesis of UDP-glucuronyltransferase) promoted the improvement of the child's clinical state. Which of the biochemical processes listed below in activated by the Phenobarbital induced enzyme?
A. Gluconeogenesis.
B. Microsomal oxidation.
C. Tissue respiration.
D. Glycogen synthesis.
E. *Conjugation.

18. After a disease a 16-year-old boy is presenting with decreased function of protein synthesis in the liver as a result of vitamin K deficiency. This may cause disorder of:
A. Erythrocyte sedimentation rate.
B. Osmotic blood pressure.
C. Anticoagulant production.
D. Erythropoietin production.
E. *Blood coagulation.

19. A patient presents with itching of skin, scleras and mucous membranes. Blood plasma total bilirubin is increased, stercobilin is increased in feaces, urobilin is increased in urine. What type of jaundice is it?
A. Gilbert's disease.
B. Cholestatic.
C. Haemolytic.
D. Obturational.

E. *Parenchymatous.

20. A 48-year-old patient was admitted to the hospital with complaints about weakness, irritability, sleep disturbance. Objectively: skin and scleras are of yellow color. In blood: increased concentration of total bilirubin with prevailing direct bilirubin. The feces are acholic. The urine is dark (contains bile pigments). What type of jaundice is it?

A. Haemolytic.
B. Crigler-Najjar syndrome.
C. Parenchymatous.
D. Gilbert's syndrome.
E. *Mechanic.

21. A patient manifests ketonuria. What disease is recognized by the augmented concentration of ketone bodies in the urine?

A. Tuberculosis of the kidney.
B. Acute glomerular inflammation.
C. Urolithlasis.
D. Myocardial infarction.
E. *Diabetes mellitus.

22. The anymented urine secretion of what substance can cause the development of nephrolithiasis?

A. Amino acids and indican.
B. Sulfates and chlorides.
C. Sulfates and urea.
D. Carbonates, hydrocarbonates and citrate.
E. *Urates and phosphates.

23. A patient developed glucosuria. The level of glucose in the blood is within the normal range. The clinical situation observed is the result of the disorder of:

A. Gluconeogenesis.
B. Catabolism of glycogen of kidneys.
C. Function of pancreas.
D. Glycolysis.
E. *Function of kidney tubules.

24. Periodic renal colic attacks are observed in the woman with primary hyperparathyroidism. Ultrasonic examination revealed small stones in the kidneys. What is the cause of the formation of the stones?

A. Hyperuricemia.
B. Hyperphosphatemia.
C. Hypercholesterinemia.
D. Hypocaliemia.
E. *Hypercalcemia.

25. Chronic glomerulonephritis was diagnosed in a 34-year-old patient 3 years ago. Edema has developed in the last 6 months. What caused it?

A. Hyperosmolarity of plasma.
B. Hyperaldosteronism.
C. Disorder of albuminous kidneys function.
D. Hyperproduction.
E. *Proteinuria.

26. A 58-year-old patient with acute cardiac insufficiency has decreased volume of daily urine - oliguria. What is the mechanism of this phenomenon?
A. Drop of oncotic blood pressure.
B. Reduced permeability of renal filter.
C. Rise of hydrostatic blood pressure in capillars.
D. Decreased number of functioning glomerules.
E. *Decreased glomerular filtration.

27. A 35-year-old woman with chronic renal disease has developed osteoporosis. Deficiency of which from the below mentioned substances cause such complication?
A. D_2.
B. Cholesterol.
C. D_3.
D. 25-OH-D_3.
E. *1,25 $(OH)_2D_3$.

4.4. Biochemistry of muscles and connective tissues

1. A 40-year-old man ran 10 km per 60 minutes. What changes of energy exchange will take place in his muscular tissue?
A. Glyconeogenesis intensification.
B. Proteolysis intensification.
C. Glycogenolysis intensifycation.
D. Glycosis intensification.
E. *Increase of fatty acids oxidation rate.

2. An untrained person who has not been practicing physical exercises for a long time complains of muscle pain which accompanies intensive manual work. What is the probable reason of the pain syndrome?
A. Decreasing of lipids level in muscles.
B. Increased disintegration of muscle proteins.
C. Accumulation of creatinine in muscles.
D. Increase of ATP level in muscles.
E. *Accumulation of lactate in muscles.

3. A presumptive diagnosis of a patient is myocardial

infarction. A typical sign of this disease is a significant increase of blood activity of the following enzyme:
A. Glucose-6-phosphate dehydrogenase.
B. Catalase.
C. Arginase.
D. α-Amylase.
E. *Creatine kinase.

4. An 18-year-old patient has muscle dystrophy diagnosed. The rise of what blood serum component concentration is the most prospective diagnostic index of the pathology?
A. Alanine.
B. Myoglobin.
C. Myosin.
D. Lactate.
E. *Creatine.

5. Marked increase of activity of MB-forms of CPK (creatine-phosphokinase) and LDH-1 were revealed on the examination of the patient's blood. What is the most likely pathology?
A. Hepatitis.
B. Cholecystitis.
C. Pancreatitis.
D. Rheumatism.
E. *Myocardial infarction.

6. After a sprint an untrained person develops muscle hypoxia. This leads to the accumulation of the following metabolite in muscles:
A. Glucose-6-phosphate.
B. Ketone bodies.
C. Acetyl CoA.
D. Oxaloacetate.
E. *Lactate.

7. Aerobic oxidation of substrates is typical of a cardiac muscle. Which of the following is the major oxidation substrate of a cardiac muscle?
A. Amino acids.
B. Triacylglycerols.
C. Glycerol.
D. Glucose.
E. *Fatty acids.

8. Gluconeogenesis is activeted in the liver after intensive physical training. What substance is utilized in gluconeogenesis first of all in this case:
A. Glucose.
B. Glutamate.
C. Alanine.
D. Pyruvate.
E. *Lactate.

9. A patient with serious damage of muscular tissue was admitted to the traumatological department. What biochemical

urine index will be increased in this case?
A. Common lipids.
B. Uric acid.
C. Glucose.
D. Mineral salts.
E. *Creatinine.

10. The rise of hyaluronidase activity is detected in the patient's blood serum. The determination of what biochemical index of blood serum will help to confirm the assumption for this pathology of the connective tissue?
A. Galactose.
B. Bilirubin.
C. Uric acid.
D. Glucose.
E. *Sialic acids.

11. A 63-year-old woman manifests symptoms of rheumatoid arthritis. The increase in level of which laboratory indexes of blood would be the most essential for the verification of the diagnosis?
A. Acid phosphatase.
B. Lipoproteins.
C. Glycosydase.
D. General cholesterol.
E. *Total glycosaminoglycans.

12. A 38-year-old woman suffers from rheumatism in its active phase. The determination of which of the following laboratory indexes is essential for diagnostics in case of the pathology?
A. Urea.
B. Uric acid.
C. Transferrin.
D. Creatinine.
E. *C-reactive protein.

13. Synovial fluid is known to decrease the friction of joints' surfaces. Under rheumatism or arthritis its viscosity goes down because of the deploymerization (destruction) of:
A. Albumin.
B. Glycogen.
C. Collagen.
D. Heparin.
E. *Hyaluronic acid.

14. A 36-year-old patient suffers from collagenose. The increase of which metabolite would be most probably detected in his urine?
A. Indican.
B. Urobilinogen.
C. Creatinine.
D. Urea.
E. *Hydroxyproline.

15. The collagen molecule is known to contain such amino

acids as hydroxyproline and hydroxylysine. Which of the following substances take part in the hydroxylation of proline and lysine during the synthesis?
A. Aspartic acid.
B. Folic acid.
C. Pantothenic acid.
D. Glutamic acid.
E. *Ascorbic acid.

16. Destruction of protein and polysaccharide components of connective tissue occurs in cases of parodontal disease. Which of the following proteins does connective tissue include?
A. Antitrypsin.
B. Albumin.
C. Transferrin.
D. Ceruloplasmin.
E. *Collagen.

17. A patient suffering from collagenose manifests signs of connective tissue destruction. The rise of blood concentration of what substances confirms the presumptive diagnosis of the disease?
A. Isoforms of LDH.
B. Creatine and creatinine.
C. Urates.
D. Transaminases.
E. *Oxyproline and oxylysine.

18. The increase of concentrations of oxyproline, oxylysine, and C-reactive protein is revealed in the patient's blood serum. The exacerbation of which pathology occurs?
A. Entcrocolitis.
B. Pancreatitis.
C. Hepatitis.
D. Bronchitis.
E. *Rheumatism.

19. A 53-yenr-old man had Pagct's disease diagnosed. The sharp increase of oxyproline level was detected in the patient's daily urine output that first and foremost testifies to the stimulation of the disintegration of:
A. Keratin.
B. Fibrinogen.
C. Albumin.
D. EIastin.
E. *Collagen.

20. Increased breaking of vessels, enamel and dentine destruction in scurvy patients are caused by disorder of collagen maturing. What stage of modification of procollagen is disordered in this avitaminosis?
A. Formation of polypeptide chains.

B. Removal of C-ended peptide from procollagen.
C. Glycosylation of hydroxylysine residues.
D. Detaching of N-ended peptide.
E. *Hydroxylation of proline.

21. Collagen, elastin and reticulin belong to the fibrillar elements of connective tissue. Indicate the aminoacid which constitutes only collagen, and identification of which in biological fluids is used for the diagnosing of the connective tissue diseases.
A. Glycine.
B. Proline.
C. Lysine.
D. Phenylalanine.
E. *Hydroxyproline.

22. In contracting skeletal muscle, a sudden elevation of the cytosolic Ca^{2+} concentration will result in:
A. Activation of cAMP-dependent protein kinase.
B. Dissociation of cAMP-dependent protein kinase into catalytic and regulatory subunits.
C. Inactivation of phosphorylase kinase caused by the action of a protein phosphatase.
D. Conversion of cAMP to AMP by phosphodiesterase.
E. *Activation of phosphorylase kinase.

23. A seven-month-old child "fell over" while crawling, and now presents with a swollen leg. At age one month, the infant has multiple fractures in various states of healing (right clavicle, right humerus, right radius). At age seven months, the infant has a fracture of a bowed femur, secondary to minor trauma. The bones are thin, have few trabecula, and thin cortices. A careful family history ruled out nonaccidental trauma (child abuse) as a cause of the bone fractures. The child is most likely to have a defect in:
A. fibrillin.
B. elastin.
C. type III collagen.
D. type IV collagen.
E. *type I collagen.

24. Which one of the following statements about the major collagen type found in skin or bond is correct?
A. One third of the amino acids of collagen is hydroxyproline.
B. Glycine is found only in the C-and N-terminal extensions.
C. Synthesis occurs in the extracellular matrix.

D. Collagen fibrils are held together solely by noncovalent forces.
E. *The procollagen molecule contains nonhelical C- and N-terminal extensions.

PART V

Step-1 2013

1. A patient diagnosed with focal tuberculosis of the upper lobe of the right lung had been taking isoniazid as a part of combination therapy. After some time, the patient reported of muscle weakness, decreased skin sensitivity, blurred vision, impaired motor coordination. Which vitamin preparation should be used to address these phenomena ?

A. Vitamin C.
B. Vitamin B12.
C. Vitamin D.
D. Vitamin A.
E. *Vitamin B_6.

2. A 60-year-old male patient has a 9-year history of diabetes and takes insulin Semi-lente for the correction of hyperglycemia. 10 days ago he began taking anaprilin for hypertension. One hour after administration of the antihypertensive drug the patient developed hypoglycemic coma. What is the mechanism of hypoglycemia in case of anaprilin use ?

A. Increase of insulin Semilente half-life.
B. Decrease in glucose absorption.
C. Reduction of glucagon half-life.
D. Increase of bioavailability of insulin Semilente.
E. *Inhibition of glycogenolysis.

3. Pterin derivatives (aminopterin and methotrexate) are the inhibitors of dihydrofolate reductase, so that they inhibit the regeneration of tetrahydrofolic acid from dihydrofolate. These drugs inhibit the intermolecular tranfer of monocarbon groups, thus suppressing the synthesis of the following polymer:

A. Protein.
B. Homopolysaccharides.
C. Gangliosides.
D. Glycosaminoglycans.
E. *DNA.

4. A 60-year-old patient with a long history of stenocardia takes coronarodilator agents. He has also been administered acetylsalicylic acid to reduce platelet aggregation. What is the mechanism of antiplatelet action of acetylsalicylic acid ?

A. It enhances the activity of platelet adenylate cyclase.
B. It has membrane stabilizing effect.

C. It reduces the activity of phosphodiesterase.
D. It enhances the synthesis of prostacyclin.
E. *It reduces the activity of cyclooxygenase.

5. On the fifth day after the acute blood loss a patient has been diagnosed with hypo-chromic anemia. What is the main mechanism of hypochromia development ?
A. Impaired globin synthesis.
B. Impaired iron absorption in the intestine.
C. Increased destruction of red blood cells in the spleen.
D. Increased excretion of body iron.
E. *Release of immature red blood cells from the bone marrow.

6. A patient with diabetes developed a diabetic coma due to the acid-base imbalance. Specify the kind of this imbalance:
A. Respiratory acidosis.
B. Metabolic alkalosis.
C. Gaseous alkalosis.
D. Non-gaseous alkalosis.
E. *Metabolic acidosis.

7. Electrophoretic study of a blood serum sample, taken from the patient with pneumonia, revealed an increase in one of the protein fractions. Specify this fraction:
A. α1-globulins.
B. α2-globulins.
C. Albumins.
D. β- globulins.
E. *γ- globulins.

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 allosteric enzymes.
B. They inhibit the absorption of folic acid.
C. They are involved in redox processes.
D. They are allosteric enzyme inhibitors.
E. *They are antivitamins of para-amino benzoic acid.

9. A 42-year-old male patient with gout has an increased blood uric acid concentration. In order to reduce the level of uric acid the doctor administered him allopurinol. Allopurinol is the competitive inhibitor of the following enzyme:
A. Hypoxanthine-phosphoribo-syltransferase.

B. Adenine phosphoribosyl-transferase.
C. Guanine deaminase.
D. Adenosine deaminase.
E. *Xanthine oxidase.

10. Measurements of the arterial pCO_2 and pO_2 during an attack of bronchial asthma revealed hypercapnia and hypoxemia respectively. What kind of hypoxia occurred in this case ?
A. Circulatory.
B. Hemic.
C. Tissue.
D. Histotoxic.
E. *Respiratory.

11. A patient with respiratory failure has blood pH of 7,35. pCO_2 test revealed hyper-capnia. Urine pH test revealed an increase in the urine acidity. What form of acid-base imbalance is the case ?
A. Compensated metabolic acidosis.
B. Decompensated respiratory alkalosis.
C. Compensated respiratory alkalosis.
D. Decompensated metabolic acidosis.
E. *Compensated respiratory acidosis.

12. A patient with jaundice has high total bilirubin that is mainly indirect (unconjugated), high concentration of stercobilin in the stool and urine. The level of direct (conjugated) bilirubin in the blood plasma is normal. What kind of jaundice can you think of ?
A. Mechanical.
B. Neonatal jaundice.
C. Gilbert's disease.
D. Parenchymal (hepatic).
E. *Hemolytic.

13. Glycogen polysaccharide is synthesized from the active form of glucose. The immediate donor of glucose residues during the glycogenesis is:
A. Glucose-6-phosphate.
B. ADP-glucose.
C. Glucose-1-phosphate.
D. Glucose-3-phosphate.
E. *UDP-glucose.

14. A number of diseases can be diagnosed by evaluating activity of blood transaminases. What vitamin is one of cofactors of these enzymes ?
A. B_2.
B. B_5.
C. B_1.
D. B_8.
E. *B_6.

15. A patient has normally coloured stool including a large amount of free fatty acids. The reason for this is a disturbance of the following process:
A. Fat hydrolysis.
B. Lipase secretion.
C. Choleresis.
D. Biliary excretion.
E. *Fat absorption.

16. By the decarboxylation of glutamate in the CNS an inhibitory mediator is formed. Name it:
A. Glutathione.
B. Histamine.
C. Asparagine.
D. Serotonin.
E. *GABA.

17. A comatose patient was taken to the hospital. He has a history of diabetes mellitus. Objectively: Kussmaul breathing, low blood pressure, acetone odor of breath. After the emergency treatment the patient's condition improved. What drug had been administered to the patient ?
A. Glibenclamide.
B. Adrenaline.
C. Isadrinum.
D. Furosemide.
E. *Insulin.

18. A hospital has admitetd a patient complaining of abdominal bloating, diarrhea, flatulence after eating protein foods. These signs are indicative of the impaired digestion of proteins and their increased degradation. Which of the following compounds is the product of this process ?
A. Agmatine.
B. Putrescine.
C. Bilirubin.
D. Cadaverine.
E. *Indole.

19. An unconscious patient was taken by ambulance to the hospital. On objective examination the patient was found to have no reflexes, periodical convulsions, irregular breathing. After laboratory examination the patient was diagnosed with hepatic coma. Disorders of the central nervous system develop due to the accumulation of the following metabolite:
A. Histamine.
B. Urea.
C. Bilirubin.
D. Glutamine.
E. *Ammonia.

20. It is known that the monoamine oxidase (MAO) enzyme plays an important part in the metabolism of catecholamine neurotransmitters. In what way does the enzyme inactivate these neurotransmitters (norepinephrine, epinephrine, dopamine) ?
A. Carboxylation.
B. Hydrolysis.
C. Removal of a methyl group.
D. Addition of an amino group.
E. *Oxidative deamination.

21. At the end of the working day a worker of a hot work shop has been delivered to a hospital. The patient complains of a headache, dizziness, nausea, general weakness. Objectively: the patient is conscious, his skin is hyperemic, dry, hot to the touch. Heart rate is of 130/min. Respiration is rapid, superficial. What disorder of thermoregulation is most likely to have occurred in this patient?
A. Increased heat transfer and reduced heat production.
B. Reduced heat production with no changes to the heat transfer.
C. Increased heat production with no changes to the heat transfer.
D. Increased heat transfer and heat production.
E. *Reduced heat transfer.

22. Enzymatic jaundices are accompanied by abnormal activity of UDP-glucuronyl transferase. What compound is accumulated in blood serum in case of these pathologies ?
A. Conjugated bilrubin.
B. Choleglobin.
C. Hydrobilirubin.
D. Dehydrobilirubin.
E. *Unconjugated bilirubin.

23. Infectious diseases are treated with antibiotics (streptomycin, erythromycin, chloramphenicol). They inhibit the following stage of protein synthesis:
A. Splicing.
B. Replication.
C. Transcription.
D. Processing.
E. *Translation.

24. Diseases of the respiratory system and circulatory disorders impair the transport of oxygen, thus leading to hypoxia. Under these conditions the energy metabolism is carried out by anaerobic glycolysis. As a result, the following substance is

generated and accumulated in blood:
A. Citric acid.
B. Glutamic acid.
C. Fumaric acid.
D. Pyruvic acid.
E. *Lactic acid.

25. 6 hours after the myocardial infarction a patient was found to have elevated level of lactate dehydrogenase in blood. What isoenzyme should be expected in this case ?
A. LDH_4.
B. LDH_3.
C. LDH_5.
D. LDH_2.
E. *LDH_1.

26. A 46-year-old female is scheduled for a maxillofacial surgery. It is known that the patient is prone to high blood coagulation. What natural anticoagulant can be used to prevent blood clotting ?
A. Fibrinolysin.
B. None of the above-listed substances.
C. Hirudin.
D. Sodium citrate.
E. *Heparin.

27. A 50-year-old patient with food poisoning is on a drip of 10% glucose solution. It not only provides the body with necessary energy, but also performs the function of detoxification by the production of a metabolite that participates in the following conjugation reaction:
A. Hydroxylation.
B. Glycosylation.
C. Methylation.
D. Sulfation.
E. *Glucuronidation.

28. Due to the use of poor-quality measles vaccine for preventive vaccination, a 1-year-old child developed an autoimmune renal injury. The urine was found to contain macromolecular proteins. What process of urine formation was disturbed ?
A. Secretion.
B. Secretion and filtration.
C. Reabsorption.
D. Reabsorption and secretion.
E. *Filtration.

29. Deficiency of linoleic and linolenic acids in the body leads to the skin damage, hair loss, delayed wound healing, thrombocytopenia, low resistance to infections. These changes are most likely to be caused by the impaired

synthesis of the following substances:
A. Catecholamines.
B. Interferons.
C. Corticosteroids.
D. Interleukins.
E. *Eicosanoids.

30. An experiment proved that UV-irradiated skin cells of patients with xeroderma pigmentosum restore the native structure of DNA slower than the cells of healthy people due to the defect in repair enzyme. What enzyme takes part in this process ?
A. Primase.
B. DNA gyrase.
C. RNA ligase.
D. DNA polymerase.
E. *Endonuclease.

31. A hypertensive patient had been keeping to a salt-free diet and taking antihypertensive drugs together with hydrochlorothiazide for a long time. This resulted in electrolyte imbalance. What disorder of the internal environment occurred in the patient ?
A. Metabolic acidosis.
B. Hypermagnesemia.
C. Hyperkalemia.
D. Increase in circulating blood volume.
E. *Hypochloremic alkalosis.

32. Children with Lesch-Nyhan syndrome have a severe form of hyperuricemia accompanied by the formation of tophi, urate calculi in the urinary tracts, as well as serious neuro-psychiatric disorders. The cause of this disease is the reduced activity of the following enzyme:
A. Thymidylate synthase.
B. Xanthine oxidase.
C. Dihydrofolate reductase.
D. Carbamoyl phosphate synthetase.
E. *Hypoxanthine-guanine-phosphoribosyltransferase.

33. A 26-year-old woman at 40 weeks pregnant has been delivered to the maternity ward. Objectively: the uterine cervix is opened, but the contractions are absent. The doctor has administered her a hormonal drug to stimulate the labor. Name this drug:
A. Testosterone.
B. Estrone.
C. Hydrocortisone.
D. ACTH.
E. *Oxytocin.

34. Due to the blockage of the common bile duct (which was radiographically confirmed), the biliary flow to the duodenum was stopped. We should expect the impairment of:
A. Protein absorption.
B. Secretion of hydrochloric acid.
C. Salivation inhibition.
D. Carbohydrate hydrolysis.
E. *Fat emulsification.

35. At the stage of translation in the rough endoplasmic reticulum, the ribosome moves along the mRNA. Amino acids are joined together by peptide bonds in a specific sequence, and thus polypeptide synthesis takes place. The sequence of amino acids in a polypeptide corresponds to the sequence of:
A. rRNA anticodons.
B. tRNA nucleotides.
C. rRNA nucleotides.
D. tRNA anticodons.
E. *mRNA codons.

36. A patient with signs of osteoporosis and urolithiasis has been admitted to the endocrinology department. Blood test revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:
A. Calcitonin.
B. Aldosterone.
C. Calcitriol.
D. Cortisol.
E. *Parathyroid hormone.

37. A 30-year-old female exhibits signs of virilism (growth of body hair, balding temples, menstrual disorders). This condition can be caused by the overproduction of the following hormone:
A. Oestriol.
B. Relaxin.
C. Oxytocin.
D. Prolactin.
E. *Testosterone.

38. A patient who had been continuously taking drugs blocking the production of angiotensin II developed bradycardia and arrhythmia. A likely cause of these disorders is:
A. Hypernatremia.
B. Hypercalcemia.
C. Hypokalemia.
D. Hypocalcemia.
E. *Hyperkalemia.

39. A female patient complains of vision impairment. On examination she was found to

have obesity, fasting hyperglycemia. What complication of diabetes can cause vision impairment ?
A. Glomerulopathy.
B. Atherosclerosis.
C. Macroangiopathy.
D. Neuropathy.
E. *Microangiopathy.

Step-1 2014

1. Malaria is treated with structural analogs of vitamin B2 (riboflavin). These drugs disrupt the synthesis of the following enzymes in plasmodium:
A. Aminotransferase.
B. Peptidase.
C. NAD-dependent dehydrogenase.
D. Cytochrome oxidase.
E. *FAD-dependent dehydrogenase.

2. In a young man during exercise, the minute oxygen uptake and carbon dioxide emission equalled to 1000 ml. What substrates are oxidized in the cells of his body?
A. Fats.
B. Carbohydrates and proteins.
C. Carbohydrates and fats.
D. Proteins.
E. *Carbohydrates.

3. A 53-year-old male patient is diagnosed with Paget's disease. The concentration of oxyproline in daily urine is sharply increased, which primarily means intensified disintegration of:
A. Fibrinogen.
B. Hemoglobin.
C. Keratin.
D. Albumin.
E. *Collagen.

4. Cyanide is a poison that causes instant death of the organism. What enzymes found in mitochondria are affected by cyanide?
A. Cytochrome B5.
B. NAD+-dependent dehydrogenase.
C. Cytochrome P-450.
D. Flavin enzymes.
E. *Cytochrome oxidase (aa3).

5. Increased HDL levels decrease the risk of atherosclerosis. What is the mechanism of HDL antiatherogenic action?
A. They supply tissues with cholesterol.
B. They activate the conversion of cholesterol to bile acids.

C. They promote absorption of cholesterol in the intestine.
D. They are involved in the breakdown of cholesterol.
E. *They remove cholesterol from tissues.

6. It has been found out that one of pesticide components is sodium arsenate that blocks lipoic acid. Which enzyme activity is impaired by this pesticide?
A. Microsomal oxidation.
B. Glutathione peroxidase.
C. Glutathione reductase.
D. Methemoglobin reductase.
E. *Pyruvate dehydrogenase complex.

7. Feces of a patient contain high amount of undissociated fats and have grayish-white color. Specify the cause of this phenomenon:
A. Hypovitaminosis.
B. Hypoactivation of pepsin by hydrochloric acid.
C. Enteritis.
D. Irritation of intestinal epithelium.
E. *Obturation of bile duct.

8. A 46-year-old female patient consulted a doctor about pain in the small joints of the upper and lower limbs. The joints are enlarged and shaped like thickened nodes. Serum test revealed an increase in urate concentration. This might be caused by a disorder in metabolism of:
A. Amino acids.
B. Pyrimidines.
C. Carbohydrates.
D. Lipids.
E. *Purines.

9. A biochemical urine analysis has been performed for a patient with progressive muscular dystrophy. In the given case muscle disease can be confirmed by the high content of the following substance in urine:
A. Porphyrin.
B. Urea.
C. Hippuric acid.
D. Creatinine.
E. *Creatine.

10. Human red blood cells do not contain mitochondria. What is the main pathway for ATP production in these cells?
A. Oxidative phosphorylation.
B. Cyclase reaction.
C. Creatine kinase reaction.
D. Aerobic glycolysis.
E. *Anaerobic glycolysis.

11. Examination of a 52-year-old female patient has revealed a decrease in the amount of red blood cells and an increase in free hemoglobin in the blood plasma (hemoglobinemia). Color index is 0,85. What type of anemia is being observed in the patient?
A. Hereditary hemolytic.
B. Acute hemorrhagic.
C. Anemia due to diminished erythropoiesis.
D. Chronic hemorrhagic.
E. *Acquired hemolytic.

12. Urine analysis has shown high levels of protein and erythrocytes in urine. This can be caused by the following:
A. Oncotic pressure of blood plasma.
B. Hydrostatic primary urine pressure in capsule.
C. Hydrostatic blood pressure in glomerular capillaries.
D. Effective filter pressure.
E. *Renal filter permeability.

13. A patient is diagnosed with hereditary coagulopathy that is characterised by factor VIII deficiency. Specify the phase of blood clotting during which coagulation will be disrupted in the given case:
A. Fibrin formation.
B. Accelerin formation.
C. Thrombin formation.
D. Clot retraction.
E. *Thromboplastin formation.

14. Those organisms which in the process of evolution failed to develop protection from H_2O_2 can exist only in anaerobic conditions. Which of the following enzymes can break hydrogen peroxide down?
A. Flavin-dependent oxidase.
B. Oxygenase and hydroxylase.
C. Cytochrome oxidase, cytochrome B5.
D. Oxygenase and catalase.
E. *Peroxidase and catalase.

15. A patient has a critical impairment of protein, fat and hydrocarbon digestion. Most likely it has been caused by low secretion of the following digestive juice:
A. Bile.
B. Saliva.
C. Gastric juice.
D. Intestinal juice.
E. *Pancreatic juice.

16. Prolonged fasting causes hypoglycemia which is amplified by alcohol consumption, as the following process is inhibited:

A. Glycogenolysis.
B. Lipolysis.
C. Glycolysis.
D. Proteolysis.
E. *Gluconeogenesis.

17. A 39-year-old female patient with a history of diabetes was hospitalized in a precomatose state for diabetic ketoacidosis. This condition had been caused by an increase in the following metabolite level:
A. Alpha-ketoglutarate.
B. Citrate.
C. Malonate.
D. Aspartate.
E. *Acetoacetate.

18. A patient with homogentisuria has signs of arthritis, ochronosis. In this case, the pain in the joints is associated with the deposition of:
A. Carbonates.
B. Oxalates.
C. Urates.
D. Phosphates
E. *Homogentisates.

19. A patient with hereditary hyperammonemia due to a disorder of ornithine cycle has developed secondary orotaciduria. The increased synthesis of orotic acid is caused by an increase in the following metabolite of ornithine cycle:
A. Citrulline.
B. Urea.
C. Ornithine.
D. Argininosuccinate.
E. *Carbamoyl phosphate.

20. A 49-year-old male patient with acute pancreatitis was likely to develop pancreatic necrosis, while active pancreatic proteases were absorbed into the blood stream and tissue proteins broke up. What protective factors of the body can inhibit these processes?
A. Cryoglobulin, interferon.
B. Hemoplexin, haptoglobin.
C. Immunoglobulin.
D. Ceruloplasmin, transferrin.
E. *α2-macroglobulin, α1-antitrypsin.

21. A 53-year-old male patient complains of acute pain in the right hypochondrium. Objective examination revealed scleral icterus. Laboratory tests revealed increased ALT activity, and stercobilin was not detected in the stool. What disease is characterized by these symptoms?
A. Hepatitis.
B. Chronic colitis.
C. Chronic gastritis.

D. Hemolytic jaundice.
E. *Cholelithiasis.

22. A patient has insufficient blood supply to the kidneys, which has caused the development of pressor effect due to the constriction of arterial resistance vessels. This is the result of the vessels being greately affected by the following substance:
A. Angiotensinogen.
B. Renin.
C. Catecholamines.
D. Norepinephrine.
E. *Angiotensin II.

23. A patient is diagnosed with iron-deficiency sideroachrestic anemia, progression of which is characterised by skin hyperpigmentation, pigmentary cirrhosis, heart and pancreas affection. Iron level in the blood serum is increased. What disorder of iron metabolism causes this disease?
A. Increased iron assimilation by body.
B. Excessive iron intake with food.
C. Disorder of iron absorption in bowels.
D. B_{12} avitaminosis.
E. *Failure to assimilate iron leading to iron accumulation in tissues.

24. According to the results of glucose tolerance test, the patient has no disorder of carbohydrate tolerance. Despite that, glucose is detected in the patients's urine (5 mmol/l). The patient has been diagnosed with renal diabetes. What renal changes cause glucosuria in this case?
A. Increased glucose secretion.
B. Exceeded glucose reabsorption threshold.
C. Increased glucose filtration.
D. Increased activity of glucose reabsorption enzymes.
E. *Decreased activity of glucose reabsorption enzymes.

25. In case of alkaptonuria, homogentisic acid is excreted in urine in large amounts. The development of this disease is associated with a disorder of metabolism of the following amino acid:
A. Methionine.
B. Alanine.
C. Asparagine.
D. Phenylalanine.
E. *Tyrosine.

26. In the course of an experiment adenohypophysis of an animal has been removed. The resulting atrophy of thyroid gland and adrenal cortex has been caused by deficiency of the following hormone:
A. Thyroxin.
B. Thyroid hormones.
C. Somatotropin.
D. Cortisol.
E. *Tropic hormones.

27. Degenerative changes in posterior and lateral columns of spinal cord (funicular myelosis) caused by methyl-malonic acid accumulation occur in patients with B12 - deficiency anemia. This results in synthesis disruption of the following substance:
A. Acetylcholine.
B. Serotonin.
C. Norepinephrine.
D. Dopamine.
E. *Myelin.

28. A patient who had been taking diclofenac sodium for arthritis of mandibular joint developed an acute condition of gastric ulcer. Such side effect of this medicine is caused by inhibition of the following enzyme:
A. Phosphodiesterase.
B. Monoamine oxidase.
C. Lipoxygenase.
D. Cyclooxygenase-2 (COX-2).
E. *Cyclooxygenase-1 (COX-1).

29. Patients with erythropoietic porphyria (Gunther's disease) have teeth that fluoresce with bright red color when subjected to ultraviolet radiation; their skin is light-sensitive, urine is red-colored. What enzyme can cause this disease, when it is deficient?
A. Delta-aminolevulinate synthase.
B. Uroporphyrinogen I synthase.
C. Ferrochelatase.
D. Uroporphyrinogen decarboxylase.
E. *Uroporphyrinogen III cosynthase

30. A 55-year-old male had been delivered to the resuscitation unit unconscious. Relatives reported him to have mistakenly drunk an alcoholic solution of unknown origin. On examination the patient was diagnosed with methanol intoxication. What antidote should be used in this case?
A. Acetylcysteine.
B. Protamine sulfate.
C. Naloxone.

D. Teturamum.
E. *Ethanol.

31. Symptoms of pellagra (vitamin PP deficiency) is particularly pronounced in patients with low protein diet, because nicotinamide precursor in humans is one of the essential amino acids, namely:
A. Threonine.
B. Arginine.
C. Lysine.
D. Histidine.
E. *Tryptophan.

32. For biochemical diagnostics of myocardial infarction it is necessary to measure activity of a number of enzymes and their isoenzymes. What enzymatic test is considered to be the best to prove or disprove the diagnosis of infarction in the early period after the chest pain is detected?
A. LDH_2 lactate dehydrogenase isoenzyme.
B. Aspartate aminotransferase cytoplasmic isoenzyme.
C. LDH_1 lactate dehydrogenase isoenzyme.
D. Creatine kinase isoenzyme CK-MM.
E. *Creatine kinase isoenzyme CK-MB.

33. A newborn baby has numerous hemorrhages. Blood coagulation tests reveal increased prothrombin time. The child is most likely to have a disorder of the following biochemical process:
A. Conversion of methylmalonyl CoA to succinyl CoA.
B. Hydroxylation of proline.
C. Conversion of homocysteine to methionine.
D. Degradation of glutathione.
E. *Production of gamma-carboxyglutamate.

34. A 67-year-old male patient consumes eggs, pork fat, butter, milk and meat. Blood test results: cholesterol - 12,3 mmol/l, total lipids - 8,2 g/l, increased low-density lipoprotein fraction (LDL). What type of hyperlipoproteinemia is observed in the patient?
A. Hyperlipoproteinemia type IIb.
B. Hyperlipoproteinemia type I.
C. Cholesterol, hyperlipoproteinemia.
D. Hyperlipoproteinemia type IV.
E. *Hyperlipoproteinemia type IIa

35. Nucleolar organizers of the 13-15, 21, 22 human

chromosomes contain about 200 cluster genes that synthesize RNA. These regions of chromosomes bear the information on the following type of RNA:
A. snRNA.
B. tRNA.
C. tRNA.
D. mRNA.
E. *rRNA.

36. Steatosis is caused by the accumulation of triacylglycerols in hepatocytes. One of the mechanisms of this disease development is a decrease in the utilization of VLDL neutral fat. What lipotropics prevent the development of steatosis?
A. Alanine, B_1, PP.
B. Valine, B_3, B_2.
C. Arginine, B_3.
D. Isoleucine, B_1, B_2.
E. *Methionine, B_6, B_{12}.

37. A patient has severe blood loss caused by an injury. What kind of dehydration will be observed in this particular case?
A. Normosmolar.
B. None.
C. Hyperosmolar.
D. Hyposmolar.
E. *Isoosmolar.

38. Decarboxylation of glutamate induces production of gamma-aminobutyric acid (GABA) neurotransmitter. After breakdown, GABA is converted into a metabolite of the citric acid cycle, that is:
A. Fumarate.
B. Malate.
C. Oxaloacetate.
D. Citric acid.
E. *Succinate.

39. A patient has been admitted to the contagious isolation ward with signs of jaundice caused by hepatitis virus. Which of the symptoms given below is strictly specific for hepatocellular jaundice?
A. Hyperbilirubinemia.
B. Urobilinuria.
C. Bilirubinuria.
D. Cholemia.
E. *Increase of ALT, AST level.

40. A 36-year-old female patient has a history of 52-hypovitaminosis. The most likely cause of specific symptoms (epithelial, mucosal, cutaneous, corneal lesions) is the defi- ciency of:
A. Cytochrome oxidase.
B. Cytochrome A1.
C. Cytochrome C.
D. Cytochrome B.

E. *Flavin coenzymes.

41. Disruption of nerve fiber myelinogenesis causes neurological disorders and mental retardation. These symptoms are typical for hereditary and acquired alterations in the metabolism of:
A. Cholesterol.
B. Higher fatty acids.
C. Phosphatidic acid.
D. Neutral fats.
E. *Sphingolipids.

42. A patient complains of photoreception disorder and frequent acute viral diseases. He has been prescribed a vitamin that affects photoreception processes by producing rhodopsin, the photosensitive pigment. What vitamin is it?
A. Pyridoxine hydrochloride.
B. Tocopherol acetate.
C. Cyanocobalamin.
D. Thiamine.
E. *Retinol acetate.

43. A child has a history of hepatomegaly, hypoglycemia, seizures, especially on an empty stomach and in stressful situations. The child is diagnosed with Gierke disease. This disease is caused by the genetic defect of the following enzyme:
A. Glucokinase.
B. Phosphoglucomutase.
C. Glycogen phosphorylase.
D. Amyloid-1,6-glycosidase.
E. *Glucose-6-phosphatase.

44. A public utility specialist went down into a sewer well without protection and after a while lost consciousness. Ambulance doctors diagnosed him with hydrogen sulfide intoxication. What type of hypoxia developed?
A. Respiratory.
B. Tissue.
C. Overload.
D. Circulatory.
E. *Hemic.

45. In cancer patients who have been continuously receiving methotrexate, the target cells of tumor with time become insensitive to this drug. In this case, gene amplification of the following enzyme is observed:
A. Thiaminase.
B. Thioredoxin reductase.
C. Deaminase.
D. Decarboxylase.
E. *Dihydrofolate reductase.

46. A patient has the oxyhemoglobin dissociation

curve shifted to the left. What blood changes induce this condition?
A. Alkalosis, hypocapnia, temperature rise.
B. Acidosis, hypercapnia, temperature drop.
C. Acidosis, hypercapnia, temperature rise.
D. Acidosis, hypocapnia, temperature rise.
E. *Alkalosis, hypocapnia, temperature drop.

Step-1 2015

1. Characteristic sign of glycogenolysis is muscle pain during physical work. Blood examination usually reveals hypoglycemia. This patho-logy is caused by congenital deficiency of the following enzyme:
A. Lysosomal glycosidase.
B. Glucose 6-phosphate dehydrogenase.
C. α-Amylase.
D. γ-Amylase.
E. *Glycogen phosphorylase.

2. A 46-year-old female patient has continuous history of progressive muscular (Duchenne's) dystrophy. Which blood enzyme changes will be of diagnostic value in this case?
A. Adenylate cyclase.
B. Lactate dehydrogenase.
C. Pyruvate dehydrogenase.
D. Glutamate dehydrogenase.
E. *Creatine phosphokinase.

3. A patient has decreased concentration of magnesium ions that are required for ribosomes connection to granular endoplasmic reticulum. This condition is known to disrupt the process of protein biosynthesis. Disruption occurs at the following stage:
A. Processing.
B. Transcription.
C. Replication.
D. Amino acids activation.
E. *Translation.

4. Untrained people often have muscle pain after sprints as a result of lactate accumulation. This can be caused by intensification of the following biochemical process:
A. Glycogenesis.
B. Gluconeogenesis.
C. Pentose phosphate pathway.
D. Lipogenesis.
E. *Glycolysis.

5. It has been found out that one of a pesticide component is

sodium arsenate that blocks lipoic acid. Which enzyme activity is impaired by this pesticide?
A. Glutathione reductase.
B. Microsomal oxidation.
C. Methemoglobin reductase.
D. Glutathione peroxidase.
E. *Pyruvate dehydrogenase complex.

6. A 16-year-old adolescent is diagnosed with hereditary UDP (uridine diphosphate) glucuronyltransferase deficiency. Laboratory tests revealed hyperbilirubinemia caused mostly by increased blood content of the following substance:
A. Biliverdine.
B. Conjugated bilirubin.
C. Urobilinogen.
D. Stercobilinogen.
E. *Unconjugated bilirubin.

7. Prior to glucose utilization in cells it is transported inside cells from extracellular space through plasmatic membrane. This process is stimulated by the following hormone:
A. Adrenalin.
B. Glucagon.
C. Thyroxin.
D. Aldosterone.
E. *Insulin.

8. After implantation of a cardiac valve a young man systematically takes indirect anticoagulants. His state was complicated by hemorrhage. What substance content has decreased in blood?
A. Ceruloplasmin.
B. Haptoglobin.
C. Heparin.
D. Creatin.
E. *Prothrombin.

9. To an emergency ward a 7-year-old child was delivered in the condition of allergic shock caused by a bee sting. High concentration of histamine is observed in blood. Production of this amine is the result of the following reaction:
A. Reduction.
B. Hydroxylation.
C. Dehydrogenation.
D. Deaminization.
E. *Decarboxylation.

10. A 65-year-old man suffering from gout complains of pain in his kidneys. Ultrasonic examination revealed kidney stones. A certain substance in increased concentration can cause kidney stones formation. Name this substance:
A. Cystine.

B. Cholesterol.
C. Bilirubin.
D. Urea.
E. *Uric acid.

11. Glomerular filtration of a person, who has been starving for a long time, has increased by 20%. The most likely cause of filtration changes in the given conditions is:
A. Increase of renal plasma flow.
B. Increase of systemic blood pressure.
C. Increase of renal filter permeability.
D. Increase of filtration factor.
E. *Decrease of blood plasma oncotic pressure.

12. For people adapted to high external temperatures profuse sweating is not accompanied by loss of large volumes of sodium chloride. This is caused by the effect the following hormone has on the perspiratory glands:
A. Natriuretic.
B. Vasopressin.
C. Cortisol.
D. Tgyroxin.
E. *Aldosterone.

13. Along with normal hemoglobin types there can be pathological ones in the organism of an adult. Name one of them:
A. HbO_2.
B. HbF.
C. HbA_1.
D. HbA_2.
E. *HbS.

14. Emotional stress causes activation of hormon-sensitive triglyceride lipase in the adipocytes. What secondary mediator takes part in this process?
A. Ions of Ca^{2+}.
B. Cyclic guanosine monophosphate.
C. Adenosine monophosphate.
D. Diacylglycerol.
E. *Cyclic adenosine monophosphate.

15. A patient has been diagnosed with alkaptonuria. Choose an enzyme that can cause this pathology when deficient:
A. Dioxyphenylalanine decarboxylase.
B. Phenylalanine hydroxylase.
C. Glutamate dehydrogenase.
D. Pyruvate dehydrogenase.
E. *Homogentisic acid oxidase.

16. During regular check-up a child is detected with interrupted mineralization of

the bones. What vitamin deficiency can be the cause?
A. Cobalamin.
B. Riboflavin.
C. Tocopherol.
D. Folic acid.
E. *Calciferol.

17. An infant has pylorospasm, weakness, hypodynamia, convulsions as a result of frequent vomiting. What kind of acid-base disbalance is it?
A. Gaseous alkalosis.
B. Excretory acidosis.
C. Metabolic acidosis.
D. Exogenous nongaseous acidosis.
E. *Excretory alkalosis.

18. Monoamine oxidase inhibitors are widely used as psychopharmacological drugs. They change the level of nearly all neurotransmitters in synapses, with the following neurotransmitter being the exception:
A. Serotonin.
B. Noradrenaline.
C. Adrenaline.
D. Dopamine.
E. *Acetylcholine.

19. Examination of a 42-year-old patient revealed a tumour of adenohypophysis. Objectively: the patient's weight is 117 kg, he has moon-like hyperemic face, redblue striae of skin distension on his belly. Osteo-porosis and muscle dystrophy are present. AP is 210/140 mm Hg. What is the most probable diagnosis?
A. Essential hypertension.
B. Cushing's syndrome.
C. Conn's disease.
D. Diabetes mellitus.
E. *Cushing's disease.

20. When blood circulation in the damaged tissue is restored, lactate accumulation stops and glucose consumption decelerates. These metabolic changes are caused by activation of the following process:
A. Glycogen biosynthesis.
B. Anaerobic glycolysis.
C. Lipolysis.
D. Gluconeogenesis.
E. *Aerobic glycolysis.

21. A 4-year-old child with hereditary renal lesion has signs of rickets; vitamin D concentration in blood is normal. What is the most probable cause of rickets development?
A. Lack of calcium in food.
B. Increased excretion of calcium.

C. Hyperfunction of parathyroid glands.
D. Hypofunction of parathyroid glands.
E. *Impaired synthesis of calcitriol.

22. A doctor was addressed by a 30-yearold man. There is a probability of the patient being HIV-positive. To clarify the diagnosis the doctor proposed to perform polymerase chain reaction. The basic process in this kind of investigation is:
A. Chromosome mutation.
B. Transcription.
C. Genetic recombination.
D. Genomic mutation.
E. *Gene amplification.

23. A 30-year-old man with diabetes mellitus type I was hospitalised. The patient is comatose. Laboratory tests revealed hyperglycemia and ketonemia. What metabolic disorder can be detected in this patient?
A. Normal acid-base balance.
B. Metabolic alkalosis.
C. Respiratory acidosis.
D. Respiratory alkalosis.
E. *Metabolic acidosis.

24. A 15-year-old patient has fasting plasma glucose level 4,8 mmol/l, one hour after glucose challenge it becomes 9,0 mmol/l, in 2 hours it is 7,0 mmol/l, in 3 hours it is 4,8 mmol/l. Such parameters are characteristic of:
A. Cushing's disease.
B. Diabetes mellitus type 1.
C. Diabetes mellitus type 2.
D. Healthy person.
E. *Subclinical diabetes mellitus.

25. A 28-year-old patient undergoing treatment in a pulmonological department has been diagnosed with pulmonary emphysema caused by splitting of alveolar septum by tissular tripsin. The disease is caused by the congenital deficiency of the following protein:
A. Transferrin.
B. α2-macroglobulin.
C. Cryoglobulin.
D. Haptoglobin.
E. *α1-proteinase inhibitor.

26. A patient, who has been suffering for a long time from intestine disbacteriosis, has increased hemorrhaging caused by disruption of post-translational modification of blood-coagulation factors II, VII, IX, and X in the liver.

What vitamin deficiency is the cause of this condition?
A. P.
B. B_{12}.
C. B_9.
D. C.
E. *K.

27. A 43-year-old patient suffers from acute pancreatitis with disrupted common bile duct patency. What condition can develop in this case?
A. Portal hypertension.
B. Hemolytic jaundice.
C. Hepatocellular jaundice.
D. Hepatic coma.
E. *Mechanical jaundice.

28. Lymphocytes and other cells of our body synthesize universal antiviral agents as a response to viral invasion. Name these protein factors:
A. Tumor necrosis factor.
B. Interleukin – 2.
C. Cytokines.
D. Interleukin – 4.
E. *Interferon.

29. A 6-year-old child suffers from delayed growth, disrupted ossification processes, decalcifycation of the teeth. What can be the cause?
A. Vitamin C deficiency.
B. Decreased glucagon production.
C. Insulin deficiency.
D. Hyperthyroidism.
E. *Vitamin D deficiency.

30. Cholesterol content in blood serum of a 12-year-old boy is 25 mmol/l. Anamnesis states hereditary familial hypercholesterolemia caused by synthesis disruption of receptor-related proteins for:
A. Middle-density lipoproteins.
B. High-density lipoproteins.
C. Chylomicrons.
D. Very low-density lipoproteins.
E. *Low-density lipoproteins.

31. Obesity is a common disease. The aim of its treatment is to lower content of neutral fats in the body. What hormonsensitive enzyme is the most important for intracellular lipolysis?
A. Monoacylglycerol lipase.
B. Protein kinase.
C. Adenylate kinase.
D. Diacylglycerol lipase.
E. *Triacylglycerol lipase.

32. A patient is diagnosed with chronic atrophic gastritis attended by deficiency of Castle's intrinsic factor. What

type of anemia does the patient have?

A. Protein-deficiency anemia.
B. Iron refractory anemia.
C. Hemolytic anemia.
D. Iron-deficiency anemia.
E. *B_{12}-deficiency anemia.

33. A patient is diagnosed with cardiac infarction. Blood test for cardiospecific enzymes activity was performed. Which of the enzymes has three isoforms?

A. Pyruvate kinase.
B. Lactate dehydrogenase.
C. Aspartate transaminase.
D. Alanine transaminase.
E. *Creatine kinase.

34. Biochemical analysis of an infant's erythrocytes revealed evident glutathione peroxidase deficiency and low concentration of reduced glutathione. What pathological condition can develop in this infant?

A. Iron-deficiency anemia.
B. Pernicious anemia.
C. Megaloblastic anemia.
D. Sicklemia.
E. *Hemolytic anemia.

Step-1 2016

1. The process of metabolism in the human body produces active forms of oxygen, including superoxide anion radical O_2^-. This anion is inactivated by the following enzyme:

A. Glutathione reductase.
B. Catalas.e
C. Peroxidase.
D. Glutathione peroxidase.
E. *Superoxide dismutase.

2. A patient suffers from disrupted patency of the airways at the level of small and medium-sized bronchial tubes. What changes of acid-base balance can occur in the patient?

A. Acid-base balance remains unchanged.
B. Respiratory alkalosis.
C. Metabolic acidosis.
D. Metabolic alkalosis.
E. *Respiratory acidosis.

3. Upon toxic damage of hepatic cells resulting in disruption of liver function the patient developed edemas. What changes of blood plasma are the main cause of edema development?

A. Decrease of globulin content.

B. Increase of globulin content.
C. Decrease offibrinogen content.
D. Increase of albumin content.
E. *Decrease of albumin content.

4. A 15-year-old boy has been diagnosed with acute viral hepatitis. What blood value should be determined to confirm acute affection of hepatic cells?
A. Protein fraction content.
B. Unconjugated and conjugated bilirubin content.
C. Erythrocytes sedimentation rate (ESR).
D. Cholesterol content.
E. *Aminotransferase activity (AST, ALT).

5. An infant born prematurely 2 days ago presents with yellow coloring of skin and mucosa. Such a condition in the infant is caused by temporary deficiency of the following enzyme:
A. Biliverdine reductase.
B. Aminolevulinate synthase.
C. Heme oxygenase.
D. Heme synthetase.
E. *UDP-glucuronyl transferase.

6. A 50-year-old woman diagnosed with cardiac infarction has been delivered into an intensive care ward. What enzyme will be the most active during thefirst two days?
A. LDH_5.
B. Alanine aminotransferase.
C. Alanine aminopeptidase.
D. LDH_4.
E. *Aspartate aminotransferase.

7. Parents of a sick 5-year-old girl visited a genetic consultation. Karyotype investigation revealed 46 chromosomes. One chromosome of the 15th pair was abnormally long, having a part of the chromosome belonging to the 21st pair attached to it. What mutation occurred in this girl?
A. Duplication.
B. Deletion.
C. Inversion.
D. Deficiency.
E. *Translocation.

8. A patient consulted a doctor with complaints of dyspnea occurring after physical exertion. Physical examination revealed anemia, paraprotein was detected among gamma globulins. What value should be determined in the patient's urine to confirm the diagnosis of myeloma?
A. Antitrypsin.
B. Bilirubin.
C. Hemoglobin.

D. Ceruloplasmin.
E. *Bence Jones protein.

9. A 7-year-old child in the state of allergic shock caused by a bee sting has been delivered into an emergency ward. High concentration of histamine was observed in blood. Production of this amine was the result of the following reaction:
A. Reduction.
B. Hydroxylation.
C. Dehydrogenation.
D. Deaminization.
E. *Decarboxylation.

10. Human red blood cells contain no mitochondria. What is the main pathway for ATP production in these cells?
A. Cyclase reaction.
B. Aerobic glycolysis.
C. Oxidative phosphorylation.
D. Creatine kinase reaction.
E. *Anaerobic glycolysis.

11. Atria of an experimental animal were superdistended with blood, which resulted in decreased reabsorption of Na^+ and water in renal tubules. This can be explained by the influence of the following factor on kidneys:
A. Vasopressin.
B. Aldosterone.
C. Renin.
D. Angiotensin.
E. *Natriuretic hormone.

12. A patient with insulin-dependent diabetes mellitus has been administered insulin. After a certain period of time the patient developed fatigue, irritability, excessive sweating. What is the main mechanism of such presentations developing?
A. Decreased glyconeogenesis.
B. Increased glycogenolysis.
C. Increased ketogenesis.
D. Increased lipogenesis.
E. *Carbohydrate starvation of the brain.

13. Autopsy of a 40-year-old woman, who died of cerebral hemorrhage during hypertensic crisis, revealed: upperbody obesity, hypertrichosis, hirsutism, stretchmarks on the skin of thighs and abdomen. Pituitary basophil adenoma is detected in the anterior lobe. What diagnosis is the most likely?
A. Hypothalamic obesity.
B. Essential hypertension.
C. Alimentary obesity.
D. Simmonds' disease.
E. *Cushing's disease.

14. The key reaction of fatty acid synthesis is production of malonyl-CoA. What metabolite is the source of malonyl-CoA synthesis?
A. Citrate.
B. Succinyl-CoA.
C. Acyl-CoA.
D. Malonate.
E. *Acetyl-CoA.

15. Histological specimen of an ovary demonstrates a spherical structure composed of large glandular cells containing lutein. What hormone is produced by the cells of this structure?
A. Aldosterone.
B. Estrogens.
C. Testosterone.
D. Corticosterone.
E. *Progesterone.

16. A patient, who has been subsisting exclusively on polished rice, has developed polyneuritis due to thiamine deficiency. What substance is an indicator of such avitaminosis, when it is excreted with urine?
A. Phenyl pyruvate.
B. Malate.
C. Methylmalonic acid.
D. Uric acid.
E. *Pyruvic acid.

17. Cells of a person working in the Chornobyl Exclusion Zone have undergone a mutation in DNA molecule. However, with time the damaged interval of DNA molecule has been restored to its initial structure with a specific enzyme. In this case the following occurred:
A. Translation.
B. Replication.
C. Transcription.
D. Reverse transcription.
E. *Repair.

18. A 60-year-old man suffering from chronic hepatitis frequently observes nasal and gingival hemorrhages, spontaneous hemorrhagic rashes on the skin and mucosa. Such presentations result from:
A. Decreased blood content of cholinesterase.
B. Increased blood content of aminotransferases.
C. Decreased synthesis of serum albumins.
D. Increased blood content of macroglobulins and cryoglobulins.
E. *Decreased synthesis of prothrombin and fibrinogen.

19. Leading symptoms of primary hyperparathyroidism are osteoporosis and renal

damage resulting in urolithiasis development. What substances is the basis of uroliths in such cases?
A. Cholesterol.
B. Uric acid.
C. Cystine.
D. Bilirubin.
E. *Calcium phosphate.

20. Examination of a 56-year-old woman with a history of type 1 diabetes mellitus revealed a disorder of protein metabolism that is manifested by aminoacidemia in the laboratory blood test values, and clinically by the delayed wound healing and decreased synthesis of antibodies. Which of the following mechanisms causes the development of aminoacidemia?
A. Increase in low-density lipoprotein level.
B. Albuminosis.
C. Decrease in the concentration of amino acids in blood.
D. Increase in the oncotic pressure in the blood plasma.
E. *Increased proteolysis.

21. After an extended treatment with sulfanamides a patient has developed macrocytic anemia. Production of active forms of the following vitamin is disrupted in such a condition:
A. Cyanocobalamin.
B. Thiamine.
C. Riboflavin.
D. Pyridoxine.
E. *Folic acid.

22. A woman resting in the countryside has been stung by a bee. Immediately after she developed pain in the stung area. In a few minutes there developed a vesicle, erythema and intense itch; later - urticaria and expiratory dyspnea. What factors resulted in the patient developing expiratory dyspnea?
A. Adrenaline.
B. Hageman's factor.
C. Lysosomal enzymes.
D. Noradrenaline.
E. *Histamine.

23. A 3-year-old girl with mental retardation has been diagnosed with sphingomyelin lipidosis (Niemann-Pick disease). In this condition synthesis of the following substance is disrupted:
A. Gangliosides.
B. Glycosyltransferase.
C. Sphingosine.
D. Ceramides.
E. *Sphingomyelinase.

24. Exophthalmus observed during thyrotoxicosis is caused by accumulation of highly water-binding substances within the retrobulbar tissues. Name these substances:
A. Phospholipids.
B. Cholesterol.
C. ATP.
D. Creatine.
E. *Glycosaminoglycans.

25. A patient presents with dry peeling skin, frequent cases of acute respiratory diseases, xerophthalmia. What vitamin preparation should be prescribed in this case?
A. Ergocalciferol.
B. Thiamine.
C. Cyanocobalamin.
D. Menadione (Vikasolum).
E. *Retinol acetate.

26. Prescription of penicillin G sodium salt has caused development of neurotoxic effects (hallucinations, convulsions). Such reaction is the result of antagonism with the following neurotransmitter:
A. Acetylcholine.
B. Dopamine.
C. Serotonin.
D. Adenosine.
E. *GABA.

27. Activation of a number of hemostatic factors occurs through their joining with calcium ions. What structural component allows for adjoining of calcium ions?
A. Monoamine-dicarboxylic acids.
B. Gamma-aminobutyric acid.
C. Gamma-oxybutyric acid.
D. Hydroxyproline.
E. *Gamma-carboxyglutamic acid.

28. Fructosuria is known to be connected with inherited deficiency of fructose 1-phosphate aldolase. What product of fructose metabolism will accumulate in the organism resulting in toxic action?
A. Fructose 6-phosphate.
B. Glucose 1-phosphate.
C. Glucose 6-phosphate.
D. Fructose 1,6-biphosphate.
E. *Fructose 1-phosphate.

29. Coenzyme A participates in numerous important metabolic reactions. It is a derivative of the following vitamin:
A. Ubiquinone.
B. Thiamine.
C. Niacin.
D. Calciferol.
E. *Pantothenic acid.

30. A patient with diabetes mellitus suffers from persistently nonhealing surgical wound, which is a sign of disrupted tissue trophism. What is the cause of such disorder?
A. Anemia.
B. Hypoglycemia.
C. Ketonemia.
D. Increased lipid catabolism.
E. *Disruption of protein metabolism regulation.

31. When investigating human saliva, it is necessary to assess its hydrolytic properties. What substance should be used as a substrate in the process?
A. Amino acids.
B. Proteins.
C. Fats.
D. Fiber.
E. *Starch.

Step-1 2017

1. Protective function of saliva is based on several mechanisms, including the presence of enzyme that has bactericidal action and causes lysis of complex capsular polysaccharides of staphylococci and streptococci. Name this enzyme:
A. Beta-glucuronidase.
B. Alpha-amylase.
C. Oligo-1,6-glucosidase.
D. Collagenase.
E. *Lysozyme.

2. A pregnant woman with several miscarriages in anamnesis is prescribed a therapy that includes vitamin preparations. What vitamin facilitates carrying of a pregnancy?
A. Rutin.
B. Folic acid.
C. Cyanocobalamin.
D. Pyridoxal phosphate.
E. *Alpha-tocopherol.

3. A 3-year-old boy with pronounced hemorrhagic syndrome has no antihemophilic globulin A (factor VIII) in the blood plasma. Hemostasis has been impaired at the following stage:
A. Blood clot retraction.
B. External mechanism of prothrombinase activation.
C. Conversion of prothrombin to thrombin.
D. Conversion offibrinogen tofibrin.
E. *Internal mechanism of prothrombinase activation.

4. A child with point mutation presents with absence of glucose 6-phosphatase, hypoglycemia, and hepatomegaly. What pathology are these signs characteristic of?
A. McArdle's disease (Glycogen storage disease type V).
B. Cori's disease (Glycogen storage disease type III).
C. Addison's disease (Primary adrenal insufficiency).
D. Parkinson's disease.
E. *Von Gierke's disease (Glycogen storage disease type I).

5. Blood test of the patient revealed albumine content of 20 g/l and increased activity of lactate dehydrogenase isoenzyme 5 (LDH_5). These results indicate disorder of the following organ:
A. Spleen.
B. Kidneys.
C. Heart.
D. Lungs.
E. *Liver.

6. A 46-year-old woman suffering from cholelithiasis developed jaundice. Her urine became dark yellow, while feces are lightcolored. What substance will be the most increased in concentration in the blood serum in this case?
A. Urobilinogen.
B. Unconjugated bilirubin.
C. Biliverdine.
D. Mesobilirubin.
E. *Conjugated bilirubin.

7. A traumatology unit received a patient with crushed muscular tissue. What biochemical indicator of urine will be raised in this case?
A. Uric acid.
B. Total lipids.
C. Glucose.
D. Mineral salts.
E. *Creatinine.

8. A 30-year-old woman first developed pain, swelling, and skin redness in the area of joints about a year ago. Provisional diagnosis is rheumatoid arthritis. One of the likely causes of this disease is change in the structure of the following connective tissue protein:
A. Troponin.
B. Mucin.
C. Myosin.
D. Ovalbumin.
E. *Collagen.

9. During removal of the hyperplastic thyroid gland of a 47-year-old woman, the parathyroid gland was

damaged. One month after the surgery the patient developed signs of hypoparathyroidism: frequent convulsions, hyperreflexia, laryngospasm. What is the most likely cause of the patient's condition?
A. Hyperkalemia.
B. Hyponatremia.
C. Hyperchlorhydria.
D. Hypophosphatemia.
E. *Hypocalcemia.

10. On examination the patient presents with hirsutism, moon-shaped face, stretch marks on the abdomen. BP is 190/100 mm Hg, blood glucose is 17,6 mmol/l. What pathology is such clinical presentation characteristic of?
A. Hyperfunction of the insular apparatus.
B. Hyperthyroidism.
C. Hypothyroidism.
D. Gonadal hypofunction.
E.*Adrenocortical hyperfunction.

11. Nitrogen is being excreted from the body mainly as urea. When activity of a certain enzyme in the liver is low, it results in inhibition of urea synthesis and nitrogen accumulation in blood and tissues. Name this enzyme:
A. Pepsin.
B. Aspartate aminotransferase.
C. Urease.
D.Amylase.
E. *Carbamoyl phosphate synthetase.

12. Blood of the patients with diabetes mellitus shows increased content of free fatty acids. Name the most likely cause of this:
A. Decreased activity of plasma phosphatidylcholine-cholesterol-acyltransferase.
B. Accumulation of palmitoyl-CoA in cytosol.
C. Activation of ketone bodies utilization.
D. Activation of apoA1, apoA2, and apoA4 apolipoprotein synthesis.
E. *Increased activity of adipose triglyceride lipase.

13. T-lymphocytes are determined to be affected with HIV. In this case viral enzyme reverse transcriptase (RNA-dependent DNA-polymerase) catalyzes the synthesis of:
A. Informational RNA based on the viral protein matrix.
B. Viral RNA based on the DNA matrix.
C. Viral protein based on the viral RNA matrix.

D. Viral DNA based on the DNA matrix.
E. *DNA based on the viral RNA matrix.

14. To lose some weight a woman has been limiting the amount of products in her diet. 3 months later she developed edemas and her diuresis increased. What dietary component deficiency is the cause of this?
A. Minerals.
B. Fats.
C. Carbohydrates.
D. Vitamins.
E. *Proteins.

15. A 40-year-old woman with Cushing's disease presents with steroid diabetes. On biochemical examination she has hyperglycemia and hypochloremia. What process activates in thefirst place in such patients?
A. Glycolysis.
B. Glycogenolysis.
C. Glucose reabsorption.
D. Glucose transportation into a cell.
E. *Gluconeogenesis.

16. Depression and emotional disturbances results from the lack of noradrenaline, serotonin, and other biogenic amines in the brain. Their content in the synapses can be increased through administration of antidepressants that inhibit the following enzyme:
A. Phenylalanine 4-monooxygenase.
B. Diamine oxidase.
C. L-amino acids oxidase.
D. D-amino acid oxidase.
E. *Monoamine oxidase.

17. A 2-year-old child presents with acute psychomotor retardation, vision and hearing impairment, sharp enlargement of the liver and spleen. The child is diagnosed with hereditary Niemann-Pick disease. What genetic defect is the cause of this disease?
A. Xanthine oxidase deficiency.
B. Glucose 6-phosphatase deficiency.
C.Amylo-1,6-glucosidase deficiency
D.Acid lipase deficiency
E. *Sphingomyelinase deficiency.

18. A patient presents with steatorrhea. This disorder can be linked to disturbed supply of the intestine with the following substances:
A. Amylase.

B. Carbohydrates.
C. Tripsin.
D. Chymotrypsin.
E. *Bile acids.

19. Cytochrome oxidase is a hemoprotein that is an end component of the mitochondrial respiratory chain. What reaction is catalyzed with this enzyme?
A. Adenosine triphosphate synthesis.
B. Cytochrome synthesis.
C.Transfer of reduced equivalents to ubiquinone.
D.Cytochrome splicing.
E. *Transfer of reduced equivalents to molecular oxygen.

20. It is known that pentose-phosphate pathway actively functions in the erythrocytes. What is the main function of this metabolic pathway in the erythrocytes?
A. Increase of lipid peroxidation.
B. Activation of microsomal oxidation.
C. Neutralization of xenobiotics.
D. Oxidation of glucose into lactate.
E. *Counteraction to lipid peroxidation.

21. Streptomycin and other aminoglycosides prevent the joining of formylmethionyl-tRNA by bonding with the 30S ribosomal subunit. This effect leads to disruption of the following process:
A. Replication initiation in prokaryotes.
B. Translation initiation in eucaryotes.
C. Transcription initiation in prokaryotes.
D. Transcription initiation in eucaryotes.
E. *Translation initiation in prokaryotes.

22. During acute hemorrhage the body loses not only fluid but also electrolytes. What substance solution can be used as a simple blood substitute?
A. Calcium chloride.
B. Sodium bromide.
C. Albumin.
D. Sodium nucleotide.
E. *Sodium chloride.

23. An infant, who was on synthetic formula feeding, developed signs of vitamin B1 deficiency. What reactions does this vitamin take part in?
A. Redox reactions.
B. Amino acids transamination.
C. Amino acids decarboxylation.
D. Proline hydroxylation.

E. *Keto acids oxidative decarboxylation

24. After a severe stress the patient presents with eosinopenia in the blood test. In this case the decreased number of eosinophils can explain changes in the level of the following hormones:
A. Vasopressin.
B. Adrenaline.
C. Insulin.
D. Mineralocorticoids.
E. *Glucocorticoids.

25. Corticosteroid hormones regulate the adaptation processes of the body as a whole to environmental changes and ensure the maintenance of internal homeostasis. What hormone activates the hypothalamo-pituitary-adrenal axis?
A. Thyroliberin.
B. Somatoliberin.
C. Somatostatin.
D. Corticostatin.
E. *Corticoliberin.

26. A 50-year-old inpatient during examination presents with glucosuria and blood glucose of 3,0 mmol/l, which are the most likely to be caused by:
A. Pellagra.
B. Diabetes insipidus.
C. Myxedema.
D. Essential hypertension.
E. *Renal disorder.

27. During examination of a teenager with xanthomatosis the family history of hypercholesterolemia is revealed. What transportable lipids are increased in concentration in case of such a disease?
A. Intermediate-density lipoproteins.
B. Chylomicrons.
C. Very low-density lipoproteins.
D. High-density lipoproteins.
E. *Low-density lipoproteins.

28. During ascent into mountains a person develops increased respiration rate and rapid heart rate. What is the cause of these changes?
A. Increase of air humidity.
B. Increase of CO_2 partial pressure.
C. Increase of blood pH.
D. Increase of nitrogen content in air.
E. *Decrease of O_2 partial pressure.

29. A young family came for a genetic counseling to identify

the father of their child. The husband insists that the child does not resemble him at all and cannot possibly be his. Polymerase chain reaction method for person identification is based on the following:

A. Transduction.
B. Nucleotide deletion.
C. Genetic recombination.
D. Missense mutation.
E. *Gene amplification.

Step-1 2018

1. A 40-year-old woman on examination presents with intensified basal metabolic rate. What hormone present in excess leads to such condition?

A. Somatostatin.
B. Thyrocalcitonin.
C. Glucagon.
D. Aldosterone.
E. *Triiodothyronine.

2. After a case of sepsis a 27-year-old woman developed "bronzed" skin discoloration characteristic of Addison's disease. Hyperpigmentation mechanism in this case is based on increased secretion of:

A. Thyroid-stimulating hormone.
B. Somatotropin.
C. Gonadotropin.
D. β-lipotropin.
E. *Melanocyte-stimulating hormone.

3. A 16-year-old girl presents with no hair on the pubis and in the armpits, her mammary glands are underdeveloped, no menstruations. What hormone imbalance can it be indicative of?

A. Adrenal medulla hyperfunction.
B. Hyperthyroidism.
C. Hypothyroidism.
D. Pancreatic islet failure.
E. *Ovarian failure.

4. In the process of hemoglobin catabolism iron is released and then as a part of special transport protein is returned to the bone marrow, to be used again for hemoglobin synthesis. Name this transport protein:

A. Albumin.
B. Transcobalamin.
C. Haptoglobin.
D. Ceruloplasmin.
E. *Transferrin.

5. The first-aid center has received a victim of a traffic accident diagnosed with closed displaced fracture of the middle third of the thigh. For

repositioning of bone fragments the patient received 10 ml of 2% dithylinum solution intravenously, which resulted in prolonged period of apnoea and muscle relaxation. What enzyme is deficient, resulting in such pharmacogenetic enzymepathy?

A. N-acetyltransferase.
B. Uridine diphosphate glucuronyltransferase.
C. Glucose 6-phosphate dehydrogenase.
D. Methemoglobin reductase.
E. *Pseudocholinesterase.

6. A lab rat has subcutaneously received mercury (II) chloride in the amount of 5 mg/kg; 24 hours later the plasma creatinine concentration increased several times. What mechanism of retention azotemia is observed in this case?

A. Increased creatinine production in the renal tubules.
B. Increased creatinine production in the muscles.
C. Increased creatinine reabsorption.
D. Increased glomerularfiltration.
E. *Decreased glomerularfiltration.

7. Collagenosis patients typically present with connective tissue destruction processes. The presence of these processes can be confirmed by the increase in:

A. Blood urates.
B. Blood creatine and creatinine.
C. LDH-isoenzyme activity in the blood.
D. Transaminase activity in the blood.
E. *Blood oxyproline and oxylysine.

8. A patient presents with acute attack of cholelithiasis. Laboratory examination of the patient's feces will show the following in this case:

A. Starch granules.
B. Positive reaction to stercobilin.
C. Connective tissue.
D. Partially digested cellulose.
E. *Negative reaction to stercobilin.

9. A 42-year-old man with gout presents with high content of uric acid in blood. The patient was prescribed allopurinol to lower the concentration of uric acid. Allopurinol is a competitive inhibitor of the following enzyme:

A. Guanine deaminase.

B. Adenosine deaminase.
C. Adenine phosphoribosyl-transferase.
D. Hypoxanthine phosphoribo-syltransferase.
E. *Xanthine oxidase.

10. Coronary artery thrombo-sis resulted in development of myocardial infarction. What mechanisms of cell damage are leading in this disease?
A. Protein.
B. Lipid.
C. Acidotic.
D.Electroosmoti.
E. *Calcium.

11. People, who for a long time remained in hypodynamic state, develops intense pain in the muscles after a physical exertion. What is the most likely cause of this pain?
A. Increased content of ADP in muscles.
B. Intensive breakdown of muscle proteins.
C. Accumulation of creatinine in muscles.
D. Decreased content of lipids in muscles.
E. *Accumulation of lactic acid in muscles.

12. A patient with hypochromic anemia has hair with split ends and suffers from hair loss. The nails are brittle. Gustatory sensations are affected. What is the mechanism of development of these symptoms?
A. Low production of thyroid hormones.
B. Vitamin B_{12} deficiency.
C. Low production of parathyroid hormone.
D. Vitamin A deficiency.
E. *Iron enzymes deficiency.

13. A patient suffers from hepatic cirrhosis. What substance excreted in urine should be analyzed to characterize the antitoxic function of liver?
A. Amino acids.
B. Ammonium salts.
C. Creatinine.
D. Uric acid.
E. *Hippuric acid.

14. Patients with bile duct obstruction typically present with inhibited blood clotting and develop hemorrhages due to insufficient assimilation of vitamin:
A. C.
B. A.
C. D.
D. E.
E. *K.

15. Due to prolonged stay in the mountains at the altitude of 3000 m above the sea level, a person developed increased oxygen capacity of blood, which was directly caused by intensified production of:
A. 2,3-bisphosphoglycerate.
B. Leukopoietins.
C. Carbaminohemoglobin.
D. Catecholamines.
E. *Erythropoietins.

16. General structure of eukaryotic genes is as follows: exon-intron-exon. Such functionnal structure of a gene leads to certain specifics of the transcription process. What sequence will correspond with precursor mRNA (immature)?
A. Exon-intron.
B. Exon-exon-intron.
C. Exon-exon.
D. Intron-exon.
E. *Exon-intron-exon.

17. ammonia produced in the muscles. What amino acid plays the main role in the transportation of ammonia to the liver and participates in gluconeogenesis reactions?
A. Aspartate.
B. Arginine.
C. Lysine.
D. Ornithine.
E. *Alanine.

18. Encephalopathy has developped in a child with hemolytic disease of the newborn. What substance had increased in the child's blood, resulting in damage to the CNS?
A. Bile acids.
B. Bilirubin-albumin complex.
C. Bilirubin glucuronide.
D. Verdohemoglobin.
E. *Unconjugated bilirubin.

19. A mutation has occurred in a cell in the first exon of the structural gene. The number of nucleotide pairs changed from 290 to 250. Name this type of mutation:
A. Nullisomy.
B. Inversion.
C. Duplication.
D. Translocation.
E. *Deletion.

20. Neutralization of xenobiotics and active endogenous metabolites often occurs via introduction of an oxygen atom into the substrate molecule. What process occurs as the result?
A. Deaminization.
B. Decarboxylation.
C. Transamination.

D. Phosphorilation.
E. *Hydroxylation.

21. During intensive physical exertion, one of the energy sources for the working muscles is glucose produced as the result of gluconeogenesis. This process is the most intensive in the following organ:
A. Stomach.
B. Brain.
C. Lungs.
D. Muscles.
E. *Liver.

22. Ketosis develops in the patients with diabetes mellitus, as the result of activation of fatty acids oxidation processes. What acidbase imbalance can result from accumulation of excessive ketone bodies in the blood?
A. Respiratory alkalosis.
B. Metabolic alkalosis.
C. No imbalance occurs.
D. Respiratory acidosis.
E. *Metabolic acidosis.

23. A woman with hypophyseal diabetes insipidus developed a water-mineral imbalance. What type of water-mineral imbalance develops in such cases?
A. Hyperosmolar hyperhydration.
B. Hypoosmolar dehydration.
C. Isoosmolar dehydration.
D. Hypoosmolar hyperhydration.
E. *Hyperosmolar dehydration.

24. A hereditary disease - homocystinuria - is caused by disturbed transformation of homocysteine into methionine. Accumulated homocysteine forms its dimer (homocystine) that can be found in urine. What vitamin preparation can decrease homocysteine production?
A. VitaminPP.
B. Vitamin C.
C. Vitamin B_1.
D. Vitamin B_2.
E. *Vitamin B_{12}.

25. During hypersensitivity skin test a patient received an allergen subcutaneously, after which the patient developed skin redness, edema, and pain due to histamine action. This biogenic amine is produced as the result of the following transformation of histidine amino acid:
A. Deaminization.
B. Methylation.
C. Phosphorilation.
D. Isomerization.
E. *Decarboxylation.

26. A sick child presents with high content of phenyl pyruvate in urine (normally it is practically absent). Blood phenylalanine level is 350 mg/L (norm - 15 mg/L). What disease are these symptoms characteristic of?
A. Gout.
B. Albinism.
C. Tyrosinosis.
D. Alkaptonuria.
E. *Phenylketonuria.

27. A man is a carrier of HIV that is an RNA virus. The cells of this patient synthesize viral DNA. This process is based on:
A. Translation.
B. Replication.
C. Transcription.
D. Repair.
E. *Reverse transcription.

28. A newborn presents with weak suckling, frequent vomiting, and hypotonia. Blood and urine citrulline are very high. What metabolic process is disturbed?
A. Cori cycle.
B. Tricarboxylic acid cycle.
C. Glycolysis.
D. Gluconeogenesis.
E. *Ornithine cycle.

29. Stool test detects in the patient's feces a large amount of undigested fats. This patient is the most likely to have disturbed secretion of the following enzymes:
A. Gastric protease.
B. Pancreatic amylase.
C. Pancreatic proteases.
D. Bile lipase.
E. *Pancreatic lipases.

30. A 19-year-old young man was examined in the nephrology clinic. High calcium was detected in his secondary urine. What hormone is likely to cause such change, if it is produced in excess?
A. Testosterone.
B. Oxytocin.
C. Adrenaline.
D. Glucagon.
E. *Aldosterone.

31. One of the causes of pernicious anemia is disturbed synthesis of transcorrin – Castle's intrinsic factor – by the parietal cells of the stomach. What substance is called Castle's extrinsic factor?
A. Biotin.
B. Folic acid.
C. Pyridoxine.
D. Riboflavin.
E. *Cobalamin.

32. Congenital pyruvate carboxylase deficiency causes physical and mental retardation in children and leads to early death. It is characterized by lactic acidemia, lactaciduria, and a number of metabolic disorders. Among others, inhibition of the following occurs:

A. Pentose-phosphate pathway and glycolysis.
B. Glycolysis and glycogenolysis.
C. Glycogenesis and glycogenolysis
D. Lipolysis and lipogenesis.
E. *Citric acid cycle and gluconeogenesis.

33. A woman with enteritis accompanied by severe diarrhea presents with loss of water in the extracellular space, increased water content in the cells, and decreasing blood osmolarity. Name this type of water-electrolyte imbalance:

A. Isoosmolar hypohydration.
B. Hyperosmolar hyperhydration.
C. Hyperosmolar hypohydration.
D. Hypoosmolar hyperhydration.
E. *Hypoosmolar hypohydration.

34. A patient is diagnosed with glucocerebroside lipidosis (Gaucher's disease) that manifests as splenomegaly, liver enlargement, affected bone tissue, and neuropathies. What enzyme of complex lipid catabolism is deficient, thus causing this disease?

A. Hyaluronidase.
B. Hexosaminidase.
C. Sphingomyelinase.
D. β-galactosidase.
E. *Glucocerebrosidase.

35. A 7-year-old child presents with marked signs of hemolytic anemia. Biochemical analysis of erythrocytes determined low concentration of NADPH and reduced glutathione. What enzyme is deficient in this case leading to the biochemical changes and their clinical manifestations?

A. Lactate dehydrogenase.
B. Hexokinase.
C. Fructokinase.
D. Pyruvate kinase.
E. *Glucose-6-phosphate dehydrogenase.

36. 8-year-old girl presents with signs of disturbed twilight vision. This condition is caused by the deficiency of vitamin:

A. F.
B. E.
C. D.

D. K.
E. *A.

37. A 25-year-old young man came to the doctor complaining of general weakness, rapid fatigability, irritability, reduced working ability, and bleeding gums. What vitamin is likely to be deficient in this case?
A. Folic acid.
B. Riboflavin.
C. Thiamine.
D. Retinol.
E. *Ascorbic acid.

38. A 52-year-old man presents with fever and pain in the joints. Both of his first metatarsophalangeal articulations are deformed, swollen, and reddened. Blood urea is high. The patient is diagnosed with gout. What is the main developmental factor in the pathogenesis of this disease?
A. Citrullinuria.
B. Argininosuccinic aciduria.
C. Hyperazotemia.
D. Hyperaminoacidemia.
E. *Hyperuricemia.

39. Vascular endothelium is characterized by high metabolic activity and synthesizes vasoactive substances. Among these substances there is a potent vasodilator synthesized from L-arginine. Name this vasodilator:
A. Adrenaline.
B. Histamine.
C. Bradykinin.
D. Acetylcholine.
E. *Nitrogen oxide.

Step-1 2019

1. A 3-year-old child with elevated body temperature has taken aspirin and developed increased hemolysis of erythrocytes. In this case hemolytic anemia can be caused by congenital deficiency of the following enzyme:
A. Gamma-glutamyl transferase.
B. Glucose 6-phosphatase.
C. Glycogen phosphorylase.
D. Glycerol-phosphate dehydrogenase.
E. *Glucose 6-phosphate dehydrogenase.

2. During diabetes mellitus and starvation, the number of acetone bodies in blood increases. These bodies are used as a source of energy and are synthesized from the following substance:
A. Ketoglutarate.

B. Succinyl-CoA.
C. Citrate.
D. Malate.
E. *Acetyl-CoA.

3. A patient with diabetes mellitus after an insulin injection lost his consciousness and developed convulsions. What will be the result of a biochemical test for blood glucose level in this case?
A. 5,5 mmol/L.
B. 3,3 mmol/L.
C. 8,0 mmol/L.
D. 10 mmol/L.
E. *2,5 mmol/L.

4. A 27-year-old patient presents with pathologic changes in the liver and brain. Blood plasma exhibits acute decrease in copper levels, while urine copper levels are elevated. The patient is diagnosed with Wilson disease. To confirm this diagnosis, it is necessary to measure activity of the following enzyme in the patient's blood serum:
A. Alcohol dehydrogenase.
B. Carbonic anhydrase.
C. Xanthine oxidase.
D. Leucine aminopeptidase.
E. *Ceruloplasmin.

5. The Gerontology Institute recommends older people to take vitamin complexes that contain vitaminE. What is the main function of this vitamin?
A. Antidermatitic.
B. Antihemorrhagic.
C. Antiscorbutic.
D. Antineuritic.
E. *Antioxidant.

6. Ammonia is extremely toxic for human CNS. What is the main way of ammonia neutralization in the nervous tissue?
A. Formation of paired compounds.
B. Ammonium salts synthesis.
C. Urea synthesis.
D. Transamination.
E. *Glutamine synthesis.

7. Human genetic apparatus consists of approximately 30 thousand of genes, while the number of antibody variants can be as high as millions. What mechanism leads to formation of new genes that ensure the synthesis of such a number of antibodies?
A. Formation of Okazaki fragments.
B. Gene amplification.
C. DNA replication.
D. DNA repair.

E. *Genetic recombination.

8. Chronic overdose of gluco-corticoids leads to the development of hyperglycemia in a patient. Name the process of carbohydrate metabolism that results in elevated blood glucose levels:
A. Glycogenesis.
B. Glycogenolysis.
C. Aerobic glycolysis.
D. Pentose-phosphate pathway.
E. *Gluconeogenesis.

9. A patient for a long time was on an imbalanced diet low in proteins, which resulted in hepatic fatty infiltration. This condition is likely to develop if a certain substance is absent in a person's diet. Name this substance:
A. Biotin.
B. Alanine.
C. Cholesterol.
D. Acetic acid.
E. *Methionine.

10. A 40-year-old man with pulmonary tuberculosis was prescribed isoniazid. Prolonged taking of this drug can result in development of the following vitamin deficiency:
A. Folic acid.
B. Thiamine.
C. Cobalamin.
D. Biotin.
E. *Pyridoxine.

11. Disturbed activity of trypsin and chymotrypsin leads to disturbed protein breakup in the small intestine. Activity of these enzymes depends on the presence of the following factor:
A. Na^+ salts.
B. Pepsin.
C. Bile acids.
D. Hydrochloric acid.
E. *Enterokinase.

12 Patients with ischemic heart disease are usually prescribed small doses of aspirin. This drug inhibits synthesis of platelet aggregation activator, thromboxane A2. What substance is this activator synthesized from?
A. Glutamic acid.
B. Malonic acid.
C. Acetic acid.
D. Homogentisic acid.
E. *Arachidonic acid.

13. A patient with myocardial infarction in the acute phase has been hospitalized into the cardiology unit. To induce platelet lysis in the patient's coronary vessels during the

early hours of infarction, the following enzyme should be used:
A. Lysozyme.
B. Hyaluronidase.
C. Trypsin.
D. Chymotrypsin.
E. *Streptokinase.

14. In the hematology unit a patient with leukemia was prescribed 5-Fluorouracil. This drug:
A. Catalyzes replication.
B. Stimulates DNase.
C. Inhibits translation.
D. Inhibits transcription.
E. *Inhibits DNA synthesis.

15. A 7-year-old boy is diagnosed with anemia. Laboratory analysis detects pyruvate kinase deficiency in his erythrocytes. What process is disturbed in this boy, playing the main role in anemia development in this case?
A. Anaerobic glycogenolysis.
B. Deaminization of amino acids.
C. Decarboxylation of amino acids.
D. Gluconeogenesis.
E. *Anaerobic glycolysis.

16. Examination of a patient shows decreased leukocyte and erythrocyte count and low hemoglobin levels in peripheric blood, as well as appearance of large cells (megaloblasts). What vitamin deficiency can cause these clinical presentations?
A. Biotin.
B. Niacin.
C. Ascorbic acid.
D. Riboflavin.
E. *Folic acid.

17. Wernicke-Korsakoff syndrome often develops in chronic alcoholics, who have a low-vitamin diet. Decreased transketolase activity can be observed in the course of this disease. What vitamin deficiency causes this development?
A. Riboflavin.
B. Retinol.
C. Niacin.
D. Cobalamin.
E. *Thiamine.

18. A patient was hospitalized in a comatose state. The patient has a 5-yearlong history of diabetes mellitus type 2. Objectively respiration is noisy, deep, with acetone breath odor. Blood glucose is 15,2 mmol/L, concentration of ketone bodies – 100 micromol/L. These signs are characteristic of the

following diabetes complication:
A. Hyperosmolar coma.
B. Hepatic coma.
C. Hyperglycemic coma.
D. Hypoglycemic coma.
E. *Ketoacidotic coma.

19. A laboratory rat with chronic kidney failure presents with osteoporosis, pathologic calcification of the internal organs, and arterial hypertension. These disturbances are associated with increased activity of the following hormone:
A. Adrenaline.
B. Thyroxin.
C. Triiodothyronine.
D. Calcitonin.
E. *Parathyroid hormone.

20. A 3-year-old child has been brought by ambulance to the intensive care unit of the infectious diseases hospital. On examination the child is in severe condition, skin and mucosa are dry, tissue turgor is reduced. The patient's history states that profuse diarrhea and recurrent vomiting were observed throughout the previous day after the child had eaten food products of poor quality. What type of salt and water imbalance is likely to have developed in the patient?
A. Hypoosmolar hyperhydration.
B. Isoosmolar dehydration.
C. Hyperosmolar hyperhydration.
D. Isoosmolar hyperhydration.
E. *Hypoosmolar dehydration.

21. A 39-year-old man presents with hyperkeratosis, disturbed twilight vision, and high risk of infectious processes. What vitamin preparation should he be prescribed?
A. Tocopherol acetate.
B. Pyridoxine hydrochloride.
C. Riboflavin.
D. Ergocalciferol.
E. *Retinol acetate.

22. Domestic accident has resulted in a significant blood loss in the patient, which was accompanied by a drop in blood pressure. What hormones ensure quick restoration of the blood pressure caused by a blood loss?
A. Aldosterone.
B. Cortisol.
C. Reproductive hormones.
D. Oxytocin.
E. *Adrenaline, vasopressin.

23. Prolonged vomiting resulted in dehydration of the patient's body. Under these

conditons, water retention in the body is ensured primarily due to increased secretion of the following hormone:
A. Calcitonin.
B. Aldosterone.
C. Natriuretic hormone.
D. Adrenaline.
E. *Vasopressin.

Step-1 2020

1. A patient has been administered an anti-inflammatory drug that blocks the action of cyclooxygenase. Specify this anti-inflammatory agent:
A. Allopurinol.
B. Thiamin.
C. Analgene.
D. Creatine.
E. *Aspirin.

2. Cells of healthy liver actively synthesize glycogen and proteins. What organelles are the most developed in them?
A. Cell center.
B. Mitochondria.
C. Peroxisomes.
D. Lysosomes.
E. *Granular and agranular endoplasmic reticulum.

3. For the study of serum proteins various physical and physicochemical methods can be used. In particular, serum albumins and globulins can be separated by this method:
A. Spectrography.
B. Refractometry.
C. Dialysis.
D. Polarography.
E. *Electrophoresis.

4. A 30-year-old patient's blood test revealed the following: erythrocyte count is $6 \cdot 10^{12}$/l, hemoglobin is 10,55 mmol/1. Vaquez's disease was diagnosed. Name the leading part of pathogenesis:
A. Hypoxia.
B. Acidosis.
C. B_{12}-deficiency.
D. Iron-deficiency.
E. *Neoplastic erythroid hyperplasia.

5. A therapeutist has an appointment with a 40-year-old patient complaining of recurrent pain attacks in his hallux joints and their swelling. Urine analysis revealed its marked acidity and pink colour. What substances can cause such changes in the urine?
A. Chlorides.

B. Magnesium sulfate.
C. Ammonium salts.
D. Calcium phosphate.
E. *Uric acid salt.

6. A 35-year-old man with peptic ulcer disease has undergone antrectomy. After the surgery secretion of the following gastrointestinal hormone will be disrupted the most:
A. Histamine.
B. Neurotensin.
C. Secretin.
D. Cholecystokinin.
E. *Gastrin.

7. A patient has been hospitalised with provisional diagnosis of virus B hepatitis. Serological reaction based on complementation of antigen with antibody chemically bound to peroxidase or alkaline phosphatase has been used for disease diagnostics. What is the name of the applied serological reaction?
A. Bordet-Gengou test.
B. Antigen-binding assay.
C. Radioimmunoassay technique.
D. Immunofluorescence test.
E. *Immune-enzyme analysis.

8. Pancreas is known as a mixed gland. Endocrine functions include production of insulin by beta cells. This hormone affects the metabolism of carbohydrates. What is its effect upon the activity of glycogen phosphorylase (GP) and glycogen synthase (GS)?
A. It does not affect the activity of GP and GS.
B. It inhibits both GP and GS.
C. It activates both GP and GS.
D. It activates GP and inhibits GS.
E. *It inhibits GP and activates GS.

9. A drycleaner's worker has been found to have hepatic steatosis. This pathology can be caused by the disruption of synthesis of the following substance:
A. Phosphatidic acid.
B. Tristearin.
C. Urea.
D. Cholic acid.
E. *Phosphatidylcholine.

10. A patient underwent a course of treatment for atherosclerosis. Laboratory tests revealed an increase in the anti atherogenic lipoprotein fraction in the blood plasma. The treatment efficacy increase in:
A. VLDL.

B. Chylomicrons.
C. LDL.
D. IDL.
E. *HDL.

11. One of the factors that cause obesity is the inhibition of fatty acids oxidation due to:
A. Excessive consumption of fatty foods.
B. Lack of carbohydrates in the diet.
C. Impaired phospholipid synthesis.
D. Choline deficiency.
E. *Low level of carnitine.

12. The resuscitation unit has admitted a patient in grave condition. It is known that he had mistakenly taken sodium fluoride which blocks cytochrome oxidase. What type of hypoxia developed in the patient?
A. Cardiovascular.
B. Respiratory.
C. Hemic.
D. Hypoxic.
E. *Tissue.

13. Hepatitis B is diagnosed through laboratory tests that determine the presence of HBA-DNA in blood serum of the patient. What reference method is applied for this purpose?
A. ELISA diagnostic method.
B. Hybridization method.
C. Hybridization signal amplification method.
D. ligase chain reaction method.
E. *Polymerase chain reaction.

14. A 37-year-old female patient complains of headache, vertigo, troubled sleep, numbness of limbs. For the last 6 years she has been working at the gas-discharge lamp producing factory in the lead processing shop. Blood test findings: low hemoglobin and RBC level, serum iron concentration exceeds the norm by several times. Specify the type of anemia:
A. Iron-deficiency anemia.
B. Hypoplastic anemia.
C. Minkowsky-Shauffard disease.
D. Metaplastic anemia.
E. *Iron refractory anemia.

15. A 49-year-old man complains of pain in his metatarsophalangeal joints and joint deformation. In blood hyperuricemy can be observed. X ray has revealed metatarsophalangeal joint space narrowing, erosion,

periarticular calcification of the both joints, osteoporosis. Microscopy has revealed inflammatory granulomatous reaction surrounding necrotizing masses in the area of the first metatarsophalangeal joint. Choose the most likely diagnosis:

A. Hyperparathyroidism.
B. Pyrophosphate arthropathy.
C. Urolithiasis.
D. Rheumatoid arthritis.
E. *Gout (podagra).

16. Inherited diseases, such as mucopolysaccharidoses, are manifested in metabolic disorders of connective tissue, bone and joint pathologies. The sign of this disease is the excessive urinary excretion of the following substance:

A. Urea.
B. Amino acids.
C. Glucose.
D. Lipids.
E. *Glycosaminoglycans.

17. A 41-year-old male patient has a history of recurrent attacks of heartbeats (paroxysms), profuse sweating, headaches. Examination revealed hypertension, hyperglycemia, increased basal metabolic rate, and tachycardia. These clinical presentations are typical for the following adrenal pathology:

A. Hyperfunction of the adrenal cortex.
B. Hypofunction of the medulla.
C. Primary aldosteronism.
D. Hypofunction of the adrenal cortex.
E. *Hyperfunction of the medulla.

18. During cell division, DNA replication occurs by a signal from the cytoplasm, and a certain portion of the DNA helix unwinds and splits into two individual strains. What enzyme facilitates this process?

A. RNA polymerase.
B. DNA polymerase.
C. Restrictase.
D. Ligase.
E. *Helicase.

19. A researcher is investigating the relationship between inflammatory mediators. He performs an experiment, investigating the effect of nonsteroidal anti-inflammatory drugs (NSAIDs) on patients with high-grade fever. His research indicates that certain NSAIDs act as competitively reversible inhibitors of the cyclooxygenase (COX) enzy-

mes. It is known that COX catalyzes the formation of prostaglandins from a certain molecule that itself is derived from the cellular phospholipid bilayer by phospholipase A2. Which of the following molecules is a precursor of an inflammatory mediators mentioned above?

A. Proopiomelanocortin.
B. Tyrosine.
C. Cholesterol.
D. Palmitic acid.
E. *Arachidonic acid.

20. A medical student studies a waste disposal system in human epithelial cells. During electronic microscopy he reveals the spherical vesicles, surrounded by a membrane and containing many different hydrolytic enzymes. The main function of these organelles is to provide intracellular digestion and protective reactions of the cell. Which of the following organelles is mentioned above?

A. Centrosomes.
B. Ribosomes.
C. Endoplasmatic reticulum.
D. Mitochondria.
E. *Lysosomes.

21. With total starvation the only source of water for the body is the oxidation process of organic compounds. Which of the following substances under these conditions is the main source of endogenic water?

A. Proteins.
B. Lipoproteins.
C. Carbohydrates.
D. Glycoproteins.
E. *Lipids.

22. A research group is investigating a complex of three enzymes. They have created cultures of myocytes derived from high-performance college athletes and simulated starvation conditions. After the experiment they concluded that during starvation the amount of this complex in the muscle tissue was higher. The complex converts pyruvate into acetyl-coenzyme-which enters the citric acid cycle (Krebs cycle) under aerobic conditions. This reaction also involves the further reduction of NAD^+ molecules into NADH. An activating effect of which of the following enzymes is described above?

A. Lactate dehydrogenase.
B. Phosphofructokinase.
C. Hexokinase.

D. Phosphorylase.
E. *Pyruvate dehydrogenase.

23. A 16-year-old girl concerned about her sexual development comes to the physician. She mentions that she has still not had a menstrual period. However, she is otherwise a healthy girl with no significant, medical problems since birth. On physical examination, her vital signs are stable. She does not have pubic hair and her breast is slightly elevated with areola remaining in contour with surrounding breast. Which of the following is the most likely cause of this abnormal physical development?
A. Hyperthyroidism.
B. Hypothyroidism.
C. Adrenal medulla hyperfunction.
D. Pancreatic islet insufficiency.
E. *Ovarian insufficiency.

24. A 37-year-old man is admitted to a hospital with mental confusion and disorientation. His wife reports he became more irritable and forgetful in the past year. In addition, she notes that he became a vegan a year ago, and currently, his diet consists of starchy foods like potatoes, corn, and leafy vegetables. GI symptoms include anorexia, diarrhea and vomiting. He has glossitis and skin lesions that appear as vesicles over the extremities. Eczema-like lesions around the mouth, as well as desquamation and roughened skin over the hands, are also present. Neurologic examination reveals symmetrical hypesthesia for all types of sensation in both upper and lower extremities in a "gloves and socks" distribution. Deficiency in the diet the of which of the following amino acids is the most likely cause of this condition?
A. Lysine.
B. Arginine.
C. Histidine.
D. Threonine.
E. *Tryptophan.

25. The main function of the human glands is to produce and release substances that perform a specific-function in the body. According to the classification there are endocrine and exocrine glands. But also there are glands that may be classified as both. Which of the following glands

can be endo- and exocrine simultaneously?
A. Sebaceous.
B. Salivary.
C. Lacrimal.
D. Parathyroid.
E. *Gastrointestinal.

26. A 2-year-old child with delayed physical and mental development was brought to the hospital. The child's parents are the most concerned by frequent profuse vomiting that occurs in their child after eating. Laboratory testing detected phenylpyruvic acid in the child's urine. What type of metabolism is disturbed, causing this patology?
A. Lipid metabolism.
B. Phosphorus and calcium metabolism.
C. Carbohydrate metabolism.
D. Water and electrolyte metabolism.
E. *Amino acid metabolism.

27. During your physiology class, the professor asks you to explain the effect of various hormones and neurotransmitters on the metabolism of glucose in the human body. You open your report with the statement that the use of glucose by the cells is preceded by its transport from the intercellular substance into the cell. What hormone is most likely responsible for the glucose uptake by the cell?
A. Adrenaline.
B. Aldosterone.
C. Glucagon.
D. Thyroxine.
E. *Insulin.

28. A 28-year-old man complains of nausea, vomiting, and right-sided subcostal pain. Objectively, his skin and sclerae are icteric, he has elevated body temperature, enlarged liver, dark urine, fecal hypocholia, hyperbilirubinemia (direct and indirect bilirubin), bilirubinuria, urobilinuria, hypoproteinemia, and decreased blood coagulability. What condition can be characterized by these changes?
A. Pre-hepatic hemolytic jaundice.
B. Post-hepatic jaundice.
C. Acute pancreatitis.
D. Acute cholecystisis.
E. *Hepatocellular parenchymal jaundice.

29. A molecular biologist studies various molecules. One of them is a polymeric molecule

essential in various biological roles in coding, decoding, regulation, and expression of genes. It is a helical single-stranded molecule folded onto itself. Which of the following molecules is being studied?
A. DNA.
B. ADP.
C. ATP.
D. HLA.
E. *RNA.

30. A 34-yeat-old man visits his dentist complaining of a toothache. After a dental procedure that involved extraction of several teeth, he developed a severe bleeding lasting more than 15 minutes. He has a history of chromic hepatitis C. What is the most likely cause of the prolonged bleeding in this patient?
A. Hypocalcemia.
B. Hypoalbuminemia.
C. Thrombocytopenia.
D. Hypercalcemia.
E. *Hypofibrinogenemia.

31. 27-year-old woman complains of insomnia, irritability, hand tremor, acute weight loss despite high appetite, and constant fever with body temperature of 37,2–37,5 °C. What endocrine gland is likely to be functionally impaired in this case?
A. Adrenal glands.
B. Neurohypophysis.
C. Parathyroid gland.
D. Pancreas.
E. *Thyroid gland.

32. A 45-yeat-old woman came to her physician with complaints of extreme tiredness and weakness. She says that these symptoms lasts for a month already. Within the last 2 weeks she losts 3 kilograms. Objectively, she is tired-looking thin woman. Skin hyperpigmentation is observed in many areas of her body, most prominently on the face, neck, and the backs of her hands (the areas exposed to light). What hormone is produccd in an excess in this patient, most likely causing the hyperpigmentation?
A. Gonadotropins.
B. Lipotopin.
C. Thyroid-stimulating hormone (TSH).
D. Growth hormone (GH).
E. *Melanocyte-stimulating hormone (MSH).

33. A 50-year-old woman complains of constant thist. She

drinks large amounts of liquid and has increased diuresis. Her blood glucose is 12 mmol/L. Her urine contains glucose. What endocrine organ is likely to be functionally impaired in this patient?

A. Neurohypophysis.
B. Thyroid gland.
C. Parathyroid gland.
D. Adrenal glands.
E. *Pancreas.

34. A 54-year-old woman had a total thyroidectomy lor papillary thyroid carcinoma. 11 hours after operation she complained of tingling around her mouth. On physical examination, the Trousseau's sign and Chvostek's sign are present. Her condition rapidly deteriorates with laryngospasm and focal seizures. The surgeon suspects surgical destruction of the parathyroid glands. What is the most likely cause of this patient's neurological condition?

A. Hypophosphatemia.
B. Hyperkalemia.
C. Hyponatremia.
D. Hyperchloremia.
E. *Hypocalcemia.

Step-1 2021

1. A 49-year-old man complains of pain in his metatarsophalangeal joints and joint deformation. In blood hyperuricemy can be observed. X ray has revealed metatarsophalangeal joint space narrowing, erosion, periarticular calcification of the both joints, osteoporosis. Microscopy has revealed inflammatory granulomatous reaction surrounding necrotizing masses in the area of the first meta-tarsophalangeal joint. Choose the most likely diagnosis:

A. Rheumatoid arthritis.
B. Urolithiasis.
C. Hyperparathyroidism.
D. Pyrophosphate arthropathy.
E. *Gout.

2. T lymphocytes were affected by HIV. In the process, viral enzyme reverse transcriptase (RNA-dependent DNA-poly-merase) catalyzes the synthesis of:

A. Viral RNA on the DNA matrix.
B. Viral protein on the viral RNA matrix.
C. Informational RNA on the viral protein matrix.

D. Viral DNA on the DNA matrix.
E. *DNA on the viral RNA matrix

3. When examining a child, the pediatrician noted that the child presents with delayed physical and mental development. Urinalysis showed an acute increase in the levels of a keto acid that produces qualitative color reaction with ferric chloride. What metabolic disturbance was detected in this case?
A. Alkaptonuria.
B. Cystinuria.
C. Albinism.
D. Tyrosinemia.
E. *Phenylketonuria.

4. There is a large amount of glucose oxidation metabolites dissolved in the cytoplasm of myocytes. Name one such metabolite that converts directly into lactate:
A. Oxaloacetate.
B. Glucose 6-phosphate.
C. Fructose 6-phosphate.
D. Glycerophosphate.
E. *Pyruvate.

5. Some adults develop signs of dyspepsia after drinking milk. What enzyme deficiency is associated with milk intolerance?
A. Lipase.
B. Amylase.
C. Peptidase.
D. Maltase.
E. *Lactase.

6. A 36-year-old man developed angina pectoris attacks immediately after a past case of staphylococcal sepsis. Coronarography detected mural thrombosis without signs of atherosclerosis in the left coronary artery. Thrombus formation occurred in the result of damage to the vascular endothelium and release of:
A. Serotonin.
B. Phospholipase A2.
C. Adenosine diphosphate.
D. Adenosine triphosphate.
E. *Platelet-activating factor.

7. A laboratory rat with chronic kidney failure has osteoporosis, pathologic calcification of the internal organs, and arterial hypertension. These disturbances are associated with the increased activity of the following hormone:
A. Adrenaline.
B. Triiodothyronine.

C. Thyroxin.
D. Calcitonin.
E. *Parathyroid hormone.

8. A patient suffers from disturbed renal function. To check the filtration ability of the kidneys, he was referred for clearance measurement of the following substance:
A. Hydrogen carbonate.
B. Glutamine.
C. Uric acid
D. Indole.
E. *Creatinine.

9. A patient came to the hospital complaining of abdominal distension, diarrhea, and meteorism that occur after eating protein-rich food, which indicates disturbed protein metabolism and intensified protein putrefaction. What substance is the product of this process in the intestine?
A. Agmatine.
B. Putrescine.
C. Bilirubin.
D. Cadaverine.
E. * Indole.

10. A patient has an allergic response with itching, edemas, and skin redness. In the tissues there is an increased concentration of a certain biogenic amine. Name this biogenic amine:
A. Serotonin.
B. Dopamine.
C. Gamma-aminobutyric acid.
D. Tryptamine.
E. *Histamine.

11. Arterial blood pH is 7.4; primary urine pH is 7.4; final urine pH is 5.8. Decreased pH of the final urine results from the secretion of a certain substance in the nephron tubules. Name this substance:
A. Hydrogen carbonate ions.
B. Potassium ions.
C. Urea.
D. Creatinine.
E. *Hydrogen ions.

12. Body fluids, especially urine, of a sick child produce a specific sweet odor. It is associated with the disturbed metabolism of such amino acids as leucine, isoleucine, and valine. What diagnosis will be made by the doctor in this case?
A. Fructosuria.
B. Phenylketonuria.
C. Galactosemia.
D. Alkaptonuria.
E. *Maple syrup urine disease.

13. Name the supramolecular multienzyme complex that is integrated into the lipid layer of inner mitochondrial membrane that creates conditions for redox reactions:
A. Carboxypeptidase.
B. Pyruvate kinase.
C. Hexokinase.
D. G-protein transducer.
E. *Respiratory chain.

14. A certain vitamin is a component of glutamic acid decarboxylase as a coenzyme, takes part in the formation of gamma-aminobutyric acid, and its deficiency manifests as convulsions. Name this vitamin:
A. Folic acid.
B. Ascorbic acid.
C. Cobalamin.
D. Tocopherol.
E. *Pyridoxine.

15. A 26-year-old woman was brought into the maternity department. Considering the term of her pregnancy (40 weeks), she should have gone into labor already. Examination determined that the uterine cervix is open but uterine contractions are absent. The doctor gave her a hormone drug for intensification of labor activity. Name this drug:
A. Hydrocortisone.
B. Testosterone.
C. Adrenocorticotropic hormone.
D. Estrone.
E. *Oxytocin.

16. Mitochondrial destruction is observed in some hereditary diseases (for example, Kearns-Sayre syndrome). What processes can be disturbed, as a result, in the cell?
A. Crossing over.
B. Glycolysis.
C. Amino acid synthesis.
D. Nuclear division.
E. *Adenosine triphosphate synthesis.

17. A 35-year-old woman has a history of two strokes. Her biochemical blood analysis shows increased levels of antiphospholipid autoantibodies. Targeted phospholipids in this case include:
A. Prostaglandin.
B. Ceramide.
C. Sphingosine.
D. Cholesterol.
E. *Cardiolipin.

18. General catabolism pathway of biological macromolecules includes,

besides tricarbonic acid cycle and mitochondrial respiratory chain, the process of pyruvate oxidative decarboxylation. What is the product of pyruvate oxidative decarboxylation?

A. Lactate.
B. Malonyl-CoA.
C. Citrate.
D. Alpha-ketoglutarate.
E. *Acetyl-CoA.

19. A 15-year-old teenager complains of general weakness, dizziness, and rapid fatigability. Examination detected deformed erythrocytes, their number is decreased. The provisional diagnosis of sickle-cell anemia was made. What amino acid replacement in hemoglobin causes the development of this pathological condition?

A. Valine replaced with glutamate.
B. Glutamate replaced with aspartate.
C. Valine replaced with aspartate.
D. Glutamate replaced with alanine.
E. *Glutamate replaced with valine.

20. The process of tissue respiration is accompanied by oxydation of organic compounds and synthesis of macroergic molecules. In what organelles does this process occur?

A. Peroxisomes.
B. Golgi apparatus.
C. Lysosomes.
D. Ribosomes.
E. *Mitochondria.

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Електронне навчальне видання

Збірник тестів
для підготовки до іспиту «КРОК-1»
для студентів спеціальності *222 «Медицина»*
денної форми навчання

Відповідальний за випуск Л. Ф. Суходуб
Редактор Н. М. Іншина
Комп'ютерне верстання Н. М. Іншиної

Формат 60х84/16. Ум. друк. арк. 9,76. Обл.-вид. арк. 8,57.

Видавець і виготовлювач
Сумський державний університет,
вул. Римського-Корсакова, 2, м. Суми, 40007
Свідоцтво суб'єкта видавничої справи ДК № 3062 від 17.12.2007.