MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
UZHHOROD NATIONAL UNIVERSITY
FACULTY OF MEDICINE
DEPARTMENT OF BIOCHEMISTRY AND PHARMACOLOGY

Biochemistry test bank
Part 2. Metabolism of major classes of biomolecules. Molecular biology and genetics.

Self-preparation manual for medieal students

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Методична розробка для студентів складено у відповідності з вимогами освітньо-професійної програми підготовки магістра.

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FOREWORD

In order to improve the preparation of students of higher medical educational institutions for practical classes in biochemistry and better understending of theoretical material, test bank in the discipline have been arranged. This manual provides tests of following topics: metabolism of major classes of biomolecules (carbohydrates, lipids, amino acids, nucleotides) and its regulation, fundamentals of molecular biology and molecular genetics. The tests are divided into five chapters, each of which includes tasks of different types of difficulty: multiple choice questions, theoretical questions, situational tasks and questions of higher difficulty levels. It is important that the organization of situational tasks is related to clinical cases and practical medicine.

Biological chemistry is a fundamental medical discipline. A perfect understanding of the theoretical material is the basis for the study of clinical disciplines, interpretation of laboratory parameters and future medical practice.

Chapter I. Carbohydrate metabolism and its regulation.

List of the exam questions:

1. Carbohydrates – definition and classification. List the functions of carbohydrates. Structure and biological role of mono-, di- and polysaccharides and their derivatives.
2. The digestion and absorption of carbohydrates. Lactose intolerance.
3. Glycolysis – definition, biological role. Glycolysis reactions, the preceding stage and the glycolytic oxidation-reduction stage. Regulation of glycolysis.
4. The anaerobic and aerobic degradation of glucose - definition, energy balance. Lactate dehydrogenase reaction. Shuttle mechanisms. The Pasteur effect.
5. Gluconeogenesis – definition, biological role. Irreversible reactions of glycolysis. Bypassed reactions of gluconeogenesis. Cory cycle. Noncarbohydrate precursors of gluconeogenesis.
6. Glycogen metabolism and its regulation. Glycogen storage diseases.
7. Pentose phosphate pathway, its biological role and regulation. Drug-induced hemolytic anemia. Sorbitol pathway.
8. Metabolism of fructose and galactose. Hereditary fructose intolerance. Galactosemia.
9. Regulation of blood glucose level. Disturbances of hormonal regulation of carbohydrate metabolism. Diabetes mellitus. Hypoglycemia.
10. Glycoproteins and proteoglycans, their biological role. Mucopolysaccharidoses.

Multiple Choice Questions:

1. People, who for a long time remained in hypodynamic state, develop intense pain in the muscles after a physical exertion. What is the most likely cause of this pain?

A. Accumulation of lactic acid in muscles
B. Intensive breakdown of muscle proteins
C. Accumulation of creatinine in muscles
D. Decreased content of lipids in muscles
E. Increased content of ADP in muscles

2. Blood test of the patient revealed albumine content of 20 g/l and increased activity of lactate dehydrogenase isoenzyme 5 (LDH5). These results indicate disorder of the following organ:

A. Liver
B. Kidneys
C. Heart
D. Lungs
E. Spleen

3. Human red blood cells contain no mitochondria. What is the main pathway for ATP production in these cells?

A. Anaerobic glycolysis
B. Aerobic glycolysis
C. Oxidative phosphorylation
D. Creatine kinase reaction
E. Cyclase reaction

4. 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. Aerobic glycolysis
B. Anaerobic glycolysis
C. Lipolysis
D. Gluconeogenesis
E. Glycogen biosynthesis

5. 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. Glycolysis
B. Gluconeogenesis
C. Pentose phosphate pathway
D. Lipogenesis
E. Glycogenesis

6. Diseases of respiratory system and circulatory disorders impair the transport of oxygen, thus causing 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. Lactic acid
B. Pyruvic acid
C. Glutamic acid
D. Citric acid
E. Fumaric acid

7. 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. LDH1
B. LDH2
C. LDH3
D. LDH4
E. LDH5

8. Researchers isolated 5 isoenzymic forms of lactate dehydrogenase from the human blood serum and studied their properties. What property indicates that the isoenzymic forms were isolated from the same enzyme?
A. Catalyzation of the same reaction
B. The same molecular weight
C. The same physicochemical properties
D. Tissue localization
E. The same electrophoretic mobility

9. Some students developed myodynia after continuous physical activity during physical education. The reason for such condition was accumulation of lactic acid in the skeletal muscles. It was generated in the students' bodies after activation of the following process:
A. Glycolysis
B. Gluconeogenesis
C. Pentose-phosphate cycle
D. Lipolysis
E. Glycogeny

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

11. Cytoplasm of the myocytes contains a lot of dissolved metabolites resulting from glucose oxidation. Name the metabolite that turns directly into lactate:
A. Pyruvate
B. Oxaloacetate
C. Glycerophosphate
D. Glucose-6-phosphate
E. Fructose-6-phosphate

12. A patient presents high activity of LDH1,2, aspartate aminotransferase, creatine phosphokinase. In what organ (organs) is the development of a pathological process the most probable?
A. In the heart muscle (initial stage of myocardium infarction)
B. In skeletal muscles (dystrophy, atrophy)
C. In kidneys and adrenals
D. In connective tissue
E. In liver and kidneys

13. As a result of exhausting muscular work a worker has largely reduced buffer capacity of blood. What acidic substance that came to blood caused this phenomenon?
A. Lactate
B. Pyruvate
C. 1,3-bisphosphoglycerate
D. 3-phosphoglycerate
E. -

14. A 7-year-old girl has signs of anemia. Laboratory examination revealed pyruvate kinase deficiency in erythrocytes. What process disturbance plays the main role in anemia development?
A. Anaerobic glycolysis
B. Oxidative phosphorylation
C. Tissue respiration
D. Peroxide decomposition
E. Amino acids desamination

15. Desulfiram is widely used in medical practice to prevent alcocholism. It inhibits aldehyde dehydrogenase. Increased level of what metabolite causes aversion to alcochol?
A. Acetaldehyde
B. Ethanol
C. Malonyl aldehyde
D. Propionic aldehyde
E. Methanol

16. 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. Myocardial infarction
B. Skeletal muscle dystrophy
C. Diabetes mellitus
D. Viral hepatitis
E. Acute pancreatitis

17. A patient presents with hypoxia. What metabolic process activates when oxygen supply is insufficient?
A. Anaerobic glycolysis
B. Urea cycle
C. Pentose-phosphate pathway
D. Oxidative decarboxylation of keto acids

E. Tricarboxylic acid cycle

18. A patient was found to have an increased blood serum LDH-1 activity. In which organ is the pathological process localized?
A. Heart
B. Liver
C. Kidneys
D. Stomach
E. Muscles

19. Under anaerobic conditions during glycolysis ATP is synthesized by the way of substrate phosphorylation. This process uses energy of other highenergy compounds. Specify one of such compounds:
A. Phosphoenol pyruvate
B. Glucose 6-phosphate
C. Lactate
D. Pyruvate
E. Glucose

20. Red blood cells for proper function need energy in form of ATP. What process provides the red blood cell with required amount of ATP?
A. Anaerobic glycolysis
B. Aerobic oxidation of glucose
C. Tricarboxylic acid cycle
D. в-oxidation of fatty acids
E. Pentosophosphate pathway

21. During consumption of cakes or sweets in mixed saliva a transient increase in lactate level takes place. Activation of what biochemical process causes this effect?
A. Anaerobic glycolysis
B. Tissue respiration
C. Aerobic glycolysis
D. Gluconeogenesis
E. Microsomal oxidation

22. Glycolysis - a universal pathway in the living cell. The enzymes of glycolysis are located in the:
A. Cytoplasm of every living cell
B. Cytoplasm of red blood cell only
C. Mitochondria of striated muscle cell
D. Nuclei of liver cells
E. Lysosomal vesicles

23. The enzyme pyruvate kinase catalyses the transfer of high energy phosphate from phosphoenol pyruvate to ADP. Pyruvate kinase requires __ ions for maximum activity:
A. Mg^{2+}
B. Ba^{2+}
C. Fe^{2+}
D. Br^{-}
E. Cl^{-}

24. A 58-year-old man is brought to emergency after he was found unconscious. Examination of patient revealed general weakness, hypoglycemia, blood pH = 7,24. Hypoglycemia is likely related to his alcohol use. Excessive intake of ethanol increases the ratio:
A. $NADH/NAD^{+}$
B. $NADPH/NADP^{+}$
C. NAD+/NADH
D. FADH2/FAD
E. E. FAD/FADH2

25. Under anaerobic conditions ATP are synthesized. ATP is produced by the process of:
A. Substrate phosphorylation
B. Oxidative phosphorylation
C. Photosynthetic phosphorylation
D. Transfer of phosphate group from fructose-bisphosphate upon ADP
E. Deamination of amino acids

26. Lactate dehydrogenase is an oligomeric molecule which contains the next number of subunits:
A. Four
B. Three
C. Two
D. Six
E. Eight

27. Which of the following statements about the glycolytic intermediate, fructose-6- phosphate is correct?
A. In glycolysis fructose-6-phosphate is an aldol but is not itself split by the aldol reaction until phosphorylated to fructose-1:6-bisphosphate
B. In glycolysis fructose-6-phosphate is converted to glucose-6-phosphate and can then be split by the aldol reaction into an aldehyde and a ketone
C. In glycolysis fructose-6-phosphate is an aldol so once phosphorylated to fructose-1:6-bisphosphate cannot be split by the aldol reaction into an aldehyde and a ketone
D. In glycolysis fructose-6-phosphate is formed from glucose-6-phosphate and is split by the aldol reaction into an aldehyde and a ketone
E. -

28. Glucokinase can be characterized by one of the next statements:
A. It has a much higher Michaelis constant (Km) for glucose than does hexokinase
B. ATP is activator of this enzyme
C. The reaction that this enzyme catalyses produces a high energy phosphate

D. It is the major regulatory enzyme of glycolysis
E. It is located in mitochondria

29. Most of the reactions of glycolysis are reversible. However, the three steps are irreversible. Specify these enzymes:
A. Hexokinase, phosphofructokinase and pyruvate kinase
B. Pyruvate kinase, phosphoglycerate kinase, phosphoglycerate mutase
C. Phosphofructokinase, phosphohexose isomerase, enolase
D. Glucokinase, enolase, phosphoglycerate mutase
E. Phosphohexose isomerase, phosphoglycerate mutase, hexokinase,

30. One mole of glucose in glycolytic pathway in anaerobic conditions produces:
A. Two moles of lactate
B. Three moles of lactate
C. Four moles of lactate
D. One moles of lactate
E. Five moles of lactate

31. In some anaerobic bacteria the pyruvate produced by glycolysis is converted to the ethyl alcohol (alcoholic fermentation). What is the biological significance of this process?
A. NAD^+ replenishment
B. Lactate production
C. ADP production
D. Providing the cells with NADPH
E. ATP production

32. Which of the following enzyme-catalysed reactions has a product containing a newly formed high energy phosphate bond?
A. 2-Phosphoglycerate to phosphoenolpyruvate
B. 3-Phosphoglycerate to 2-phosphoglycerate
C. The phosphorylation of glucose
D. Dihydroxyacetone phosphate to glyceraldehydes phosphate
E. Fructose-1,6-bisphosphate→to→glyceral-dehydes-3-phosphate→and dihydroxyacetone phosphate

33. The following is an enzyme required for glycolysis:
A. Pyruvate kinase
B. Pyruvate dehydrogenase
C. Pyruvate carboxylase
D. Glucose-6-phosphatose
E. Glycerokinase

34. As a result of anaerobic glycolysis glucose is converted to:
A. Lactic acid
B. Citric acid
C. Glycogen
D. Succinic acid
E. Acetoacetic acid

35. Chose the correct statement of phosphofructokinase properties:
A. AMP is an activator of this enzyme
B. The reaction that this enzyme catalyzes produces a high energy phosphate bond without the involvement of ADP or ATP
C. It is not regulatory enzyme of glycolysis
D. The substrate of this enzyme is glucose-6-phosphate
E. This enzyme catalyzes the interconversion of dihydroxyacetone phosphate and glyceraldehydes-3-phosphate

36. Alcoholic fermentation occurs in yeast and several bacterial species. In this process product of pyruvate decarboxylation is:
A. Acetaldehyde
B. Ethanol
C. Lactate
D. Phosphoenolpyruvate
E. Glucose

37. Which of the following is a substrate for aldolase activity in glycolytic pathway?
A. Fructose-1,6- bisphosphate
B. Glucose-1,6-bisphosphate
C. Glucose-6-phosphate
D. Fructose-6-phosphate
E. Glyceraldehyde-3-phosphate

38. The oxidation of lactic acid to pyruvic acid requires the following vitamin derivative as the hydrogen carrier:
A. NAD^+
B. FAD
C. FMN
D. Coenzyme A
E. Lithium pyrophosphate

39. Glycolysis is also referred to as:
A. Embden-Meyerhof-Parnas pathway
B. Lineweaver-Burk pathway
C. Krebs-Henseleit pathway
D. Chargaff pathway
E. Watson-Crick pathway

40. The combination of subunits in lactate dehydrogenase molecule makes it possible to create the next number of isoenzymes:
A. Five
B. Four

C. Six
D. Three
E. Eight

41. Which of the following enzymes is not involved in glycolysis:
A. Glucose oxidase
B. Glucokinase
C. Hexokinase
D. Aldolase
E. Enolase

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

43. During glycolysis fructose-1,6-bisphosphate is decomposed by the enzyme:
A. Aldolase
B. Hexokinase
C. Enolase
D. Fructokinase
E. Disphosphofructophosphatase

44. Which mammalian cell does not have aerobic pathway of glucose catabolism?
A. Red blood cell
B. Nerve cell
C. Sperm cell
D. Ovum
E. Liver cell

45. The irreversible reactions of glycolysis include that catalyzed by:
A. Phosphofructokinase
B. Phosphohexose isomerase
C. Fructose-bisphosphate aldolase
D. Glyceraldehyde-3-phosphate dehydrogenase
E. Phosphoglycerate kinase

46. In yeast cells occurs a process which is similar to glycolysis - alcohol fermentation. In course of this process through several stages from pyruvate is produced:
A. Ethanol
B. Acetaldehyde
C. Lactate
D. Pyruvate
E. Glyceraldehyde

47. The major metabolic product produced under normal circumstances by erythrocytes and by muscle cells during intense exercise is recycled through liver in the Cori cycle. The metabolite is:
A. Lactate
B. Alanine
C. Oxaloacetate
D. Glycerol
E. NADH

48. A 24-year-old man presented with symptoms of shortness of breath, weakness and fatigue. His hemoglobin level was 7g/dl. Red blood cell isolated from the patient showed abnormally low-level of lactate. A deficiency of which of the following enzymes would be the most likely cause for patient's anemia?
A. Pyruvate kinase
B. Glucokinase
C. Hexokinase
D. Phosphofructokinase
E. Phosphoglucose isomerase

49. Which out of the following enzymes cleaves a carbon-carbon bond in the pathway of glycolysis?
A. Aldolase
B. Glyceraldehyde-3-phosphate dehydrogenase
C. Enolase
D. Phosphoglycerate mutase
E. Phosphoglycerate kinase

50. Phosphoglycerate kinase functions in carbohydrate metabolism to produce ATP via: A. Substrate level phosphorylation
B. Oxidative phosphorylation
C. Oxidative decarboxylation
D. Phosphorolysis
E. Oxidative deamination

51. 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. Glucose-6-phosphate dehydrogenase
B. Hexokinase
C. Fructokinase
D. Pyruvate kinase
E. Lactate dehydrogenase

52. 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. Pyruvic acid
B. Malate

C. Methylmalonic acid
D. Uric acid
E. Phenyl pyruvate

53. 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. Counteraction to lipid peroxidation
B. Activation of microsomal oxidation
C. Neutralization of xenobiotics
D. Oxidation of glucose into lactate
E. Increase of lipid peroxidation

54. An infant, who was on synthetic formula feeding, developed signs of vitamin B1 deficiency. What reactions does this vitamin take part in?
A. Keto acids oxidative decarboxylation
B. Amino acids transamination
C. Amino acids decarboxylation
D. Proline hydroxylation
E. Redox reactions

55. It has been determined that one of a pesticide components is sodium arsenate that blocks lipoic acid. Enzyme activity can be impaired by this pesticide. Name this enzyme:
A. Pyruvate dehydrogenase complex
B. Microsomal oxidation
C. Methemoglobin reductase
D. Glutathione peroxidase
E. Glutathione reductase

56. 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. Aerobic glycolysis
B. Anaerobic glycolysis
C. Lipolysis
D. Gluconeogenesis
E. Glycogen biosynthesis

57. 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 1-phosphate
B. Glucose 1-phosphate
C. Glucose 6-phosphate
D. Fructose 1,6-biphosphate
E. Fructose 6-phosphate

58. A patient has an increased pyruvate concentration in blood, most of it is excreted with the urine. What kind of avitaminosis has this patient?
A. B1
B. E
C. B3
D. B6
E. B2

59. A 3 year old child with fever was given aspirin. It resulted in intensified erythrocyte hemolysis. Hemolytic anemia might have been caused by congenital insufficiency of the following enzyme:
A. Glucose 6-phosphate dehydrogenase
B. Glucose 6-phosphatase
C. Glycogen phosphorylase
D. Glycerol phosphate dehydrogenase
E. Y-glutamiltransferase

60. A child's blood presents high content of galactose, glucose concentration is low. There are such presentations as cataract, mental deficiency, adipose degeneration of liver. What disease is it?
A. Galactosemia
B. Diabetes mellitus
C. Lactosemia
D. Steroid diabetes
E. Fructosemia

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

62. 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 B1
B. Vitamin C
C. Vitamin A
D. Vitamin E
E. Vitamin B6

63. A child has got galactosemia. Concentration of glucose in blood has not considerably changed. Deficiency of what enzyme caused this illness?
A. Galactose-1-phosphate uridyltransferase
B. Amylo-1,6-glucosidase
C. Phosphoglucomutase
D. Galactokinase

E. Hexokinase

64. Purine ring biosynthesis occurs in ribose-5-phosphate through gradual accumulation of nitrogen and carbon atoms and closing of the rings. The source of ribose phosphate is the process of:
A. Pentose phosphate cycle
B. Glycolysis
C. Glyconeogenesis
D. Gluconeogenesis
E. Glycogenolysis

65. Vitamin B1 deficiency has a negative effect on a number of processes. This is caused by the dysfunction of the following enzyme:
A. Pyruvate dehydrogenase complex
B. Aminotransferase
C. Succinate dehydrogenase
D. Glutamate
E. Lactate dehydrogenase

66. Oxidative decarboxylation of pyruvic acid is catalyzed by a multienzyme complex with several functionally linked coenzymes. Name this complex:
A. Thymidine diphosphate (TDP), flavin adenine dinucleotide (FAD), coenzyme A (CoASH), nicotine amide adenine dinucleotide (NAD), lipoic acid
B. Flavin adenine dinucleotide (FAD), tetrahydrofolicacid, pyridoxal-5-phosphate, thymidine diphosphate (TDP), choline
C. Nicotine amide adenine dinucleotide (NAD), pyridoxal-5-phosphate, thymidine diphosphate (TDP), methylcobalamin, biotin
D. Coenzyme A (CoASH), flavin adenine dinucleotide (FAD), pyridoxal- 5phosphate, tetrahydrofolic acid, carnitine
E. Lipoic acid, tetrahydrofolic acid, pyridoxal-5-phosphate, methylcobalamin

67. Sulfanilamides are applied as antimicrobal agents in clinical practice. Sulfanilamide treatment, however, can result in hemolytic anemia development in patients that suffer from genetic defect of the following enzyme of pentose phosphate metabolism in erythrocytes:
A. Glucose-6-phosphate dehydrogenase
B. Hexokinase
C. Transketolase
D. Transaldolase
E. Pyruvate kinase

68. Pyruvic acid as an intermediate metabolite of carbohydrate, lipid and amino acid metabolism can undergo oxidative decarboxylation. The cause of this process is the lack of the following nutrient in the diet:
A. Thiamin
B. Pyridoxine
C. Ascorbic acid
D. Citrine
E. Pangamic acid

69. It is known that the pentose phosphate pathway occuring in the adipocytes of adipose tissue acts as a cycle. What is the main function of this cycle in the adipose tissue?
A. NADPH2 generation
B. Ribose-phosphate production
C. Xenobiotic detoxification
D. Energy generation
E. Glucose oxidation to end products

70. The following enzyme is required for the hexose monophosphate shunt pathway:
A. Glucose-6-phosphate dehydrogenase
B. Glucose-6-phosphatase
C. Phosphorylase
D. Phosphofructokinase
E. Pyruvate dehydrogenase

71. Pyruvate dehydrogenase complex and a-ketoglutarate dehydrogenase complex require the following for their oxidative decarboxylation:
A. TPP , Lipoamide, CoASH, FAD, NAD^+
B. CoASH and lipoic acid
C. NAD^+ and FAD
D. CoASH and TPP
E. TPP

72. 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. Pentose phosphate pathway
B. Glycolysis
C. Gluconeogenesis
D. Glycogenosis
E. Glycogenolysis

73. Ribulose 5 phosphate (RU5P) is converted to ribose 5 phosphate (R5P) by the enzyme?
A. Ribose-5-phosphate isomerase
B. Ribose 5 phosphate dehydrogenase
C. Ribulose 5 phosphate dehydrogenase
D. Ribulose-5-phosphate isomerase
E. Aldolase

74. Galactose is phosphorylated by galactokinase to form:
A. Galactose-1-phosphate
B. Galactose-6-phosphate
C. Galactose-1,6-diphosphate

D. Glucose-6-phosphate
E. All of these

75. Individuals who eat fresh fava beans are protected to a certain extent from malaria. Which enzyme deficiency takes place under these conditions?
A. Glucose-6-phosphate dehydrogenase
B. Transketoase
C. Pyruvate dehydrogenase
D. Ribulosephoshate isomerase
E. Transaldolase

76. The pentose phosphate pathway sometimes referred to as:
A. Hexose monophosphate shunt
B. Hexose bisphosphate shunt
C. Embden-Meyerhof-Parnas pathway
D. Chargaff pathway
E. Krebs-Henseleit pathway

77. Lipoic acid is a cofactor of the next enzyme complex:
A. Pyruvate dehydrogenase
B. Succinate dehydrogenase
C. Lactate dehydrogenase
D. Cytochrome oxidase
E. Transketolase

78. Pyruvate decarboxylase (one of enzymes of pyruvate dehydrogenase complex) contains as coenzyme:
A. Thiamine pyrophopsphate
B. Ascorbic acid
C. Folic acid
D. Pyridoxine
E. Tocoferol

79. Two important products of pentose phosphate pathway are:
A. NADPH and pentose sugars
B. Glucose and NADH
C. Pentose sugars and sedoheptulose
D. Pentose sugars and 4 membered sugars
E. NADH and pentose sugars

80. Transketolase (one of enzymes of pentose phosphate pathway) contains as coenzyme:
A. TPP
B. Tocoferol
C. Pyridoxine
D. NAD
E. Folic acid

81. 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. Galactose
B. Saccharose
C. Maltose
D. Fructose
E. Glucose

82. Which of the following enzymes catalyze reaction: Fructose + ATP ^ Fructose-1- phosphate + ADP:
A. Fructokinase
B. Pyruvate kinase
C. Galactokinase
D. Hexokinase
E. Glucokinase

83. Dehydrogenase enzymes of the hexose-monophosphate shunt are:
A. $NADP^+$ specific
B. NAD^+ specific
C. Biotin specific
D. FAD specific
E. FMN specific

84. In a patient are manifested symptoms of intoxication with arsenic compounds. What metabolic process is damaged taking into account that arsen containing substances inactivate lipoic acid?
A. Oxidative decarboxylation of pyruvate
B. Microsomal oxidation
C. Coupling of oxidation and phopsphorylation
D. Neutralization of superoxide anions
E. Fatty acids biosynthesis

85. Before pyruvic acid enters the TCA cycle it must be converted to:
A. Acetyl CoA
B. a-ketoglutarate
C. Lactate
D. Citrate
E. Glucose

86. Which from listed below vitamins is involved in the oxidative decarboxylation pyruvate?
A. Lipoic acid
B. Tocoferol
C. Ascorbic acid
D. Pyridoxine
E. Folic acid

87. The oxidative phase of pentose phosphate pathway is very active in cells such as red blood cells or hepatocytes. Which of the following products is the end product of this phase?

A. Ribulose-5-phoshate
B. 6-Phospho-gluconate
C. Pyruvate
D. Glyceraldehyde-3-phosphate
E. Fructose-6-phoshate

88. Which from listed below pathways is responsible for the synthesis of ribose-5- phosphate, a component of nucleic acids:
A. Pentose phosphate pathway
B. Embden-Meyerhof-Parnas pathway
C. Oxidative decarboxylation of pyruvate
D. Glycolysis
E. Krebs cycle

89. Which of the following substances inhibit pentose phosphate pathway:
A. $NADPH^+$
B. Mg^{2+}
C. NAD^+
D. FAD
E. ADP

90. NADPH serves to regenerate in red cells to prevent their lysis:
A. Glutathione
B. NADP
C. Cysteine
D. Carnitine
E. Cholesterol

91. There are several pathways for glucose transformation and utilization, one of them is pentose phosphate pathway, which actively proceeds in liver, adrewnal cortex, red blood cells. What is the main aim of this pathway?
A. NADPH2 generation and production of pentoses
B. Acetyl-CoA production
C. Synthesis of glycogen and fat
D. FADH2 generation
E. NADH2 and gluconioc acid production

92. Our body can get pentoses from:
A. HMP shunt
B. Glycolytic pathway
C. Uromic acid pathway
D. TCA cycle
E. Gluconeogenesis

93. Transketolase activity is affected in:
A. Thiamine deficiency
B. Pyridoxine deficiency
C. Ascorbic acid deficiency
D. Biotin deficiency
E. PABA deficiency

94. Which of the following symptoms would be seen in a patient with a severe deficiency of thiamine?
A. A decreased level of transketolase activity in red blood cells
B. A decrease in blood level of lactate
C. Xerophthalmia
D. A low level of cell transaminase activity
E. An increased clotting time of blood

95. Oxidative decarboxylation of pyruvate requires:
A. CoASH
B. Pyridoxal phosphate
C. Biotin
D. Cytochromes
E. $NADP^+$

96. The glucoso-6-phosphate dehydrogenase deficiency causes hemolytic anemia due to lack of:
A. NADPH
B. NADP
C. Pentoses
D. ATP
E. Cholesterol

97. The total number of moles of ATP produced by the aerobic oxidation of 1 mol of glucose is:
A. 38
B. 58
C. 2
D. 12
E. 52

98. How many molecules of ATP are produced in oxidative decarboxylation of pyruvate: A. 6
B. 4
C. 2
D. 12
E. 38

99. During aerobic oxidation of glucose, 6 molecules of ATP are produced by substrate level phosphorylation. Name the enzyme catalyze substrate level phosphorylation:
A. Phosphoglycerate kinase, pyruvate kinase, succinate thiokinase
B. Hexokinase, phosphofructokinase, citrate synthase
C. Isocitrate dehydrogenase, aldolase, enolase
D. Transketolase, glucokinase, galactokinase
E. Transketolase, fumarase, malate dehydrogenase

100. A 30-years old woman is training for her first marathon, and her coach has her keeping a pace that allows her to stay below her anaerobic threshold. By

avoiding anaerobic muscle glycolysis, the pyruvate produced in the muscle does not accumulate because it is converted to which one of the following?

A. Acetyl CoA
B. Alanine
C. Ethanol
D. Lactic acid
E. Fructose

101. During intensive muscle work there is a large amount of 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. Alanine
B. Arginine
C. Lysine
D. Ornithine
E. Aspartate

102. A 40-year-old woman suffers from Cushing's disease - steroid diabetes. On biochemical examination she has hyperglycemia and hypochloremia. What process activates in the first place in such patients?

A. Gluconeogenesis
B. Glycogenolysis
C. Glucose reabsorption
D. Glucose transport to the cells
E. Glycolysis

103. 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. Liver
B. Brain
C. Lungs
D. Muscles
E. Stomach

104. 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. Citric acid cycle and gluconeogenesis
B. Glycolysis and glycogenolysis
C. Glycogenesis and glycogenolysis
D. Lipolysis and lipogenesis
E. Pentose-phosphate pathway and glycolysis

105. A child with point mutation presents with absence of glucose 6-phosphatase, hypoglycemia, and hepatomegaly. What pathology are these signs characteristic of?

A. Von Gierke's disease (Glycogen storage disease type I)
B. Cori's disease (Glycogen storage disease type III)
C. Addison's disease (Primary adrenal insufficiency)
D. Parkinson's disease
E. McArdle's disease (Glycogen storage disease type V)

106. Characteristic sign of glycogenosis is muscle pain during physical work. Blood examination usually reveals hypoglycemia. This pathology is caused by congenital deficiency of the following enzyme:

A. Glycogen phosphorylase
B. Glucose 6-phosphate dehydrogenase
C. a-amylase
D. Y—amylase
E. Lysosomal glycosidase

107. Pancreas is known as a mixed gland. Endocrine functions include production of insulin by beta cells. This hormone affects metabolism of carbohydrates. What is its effect on the activity of glycogen phosphorylase (GP) and glycogen synthase (GS)?

A. It inhibits GP and activates GS
B. It activates both GP and GS
C. It inhibits both GP and GS
D. It activates GP and inhibits GS
E. It does not affect the activity of GP and GS

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

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

109. 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. Glucose-6-phosphatase
B. Amyloid-1,6-glycosidase
C. Phosphoglucomutase
D. Glycogen phosphorylase
E. Glucokinase

110. Glycogen polysaccharide is synthesized from the active form of glucose. The immediate donor of glucose residues during the glycogenesisis:

A. UDP-glucose

B. Glucose-1-phosphate
C. ADP-glucose
D. Glucose-6-phosphate
E. Glucose-3-phosphate

111. During starvation muscle proteins break up into free amino acids. These compounds will be the most probably involved into the following process:
A. Gluconeogenesis in liver
B. Gluconeogenesis in muscles
C. Synthesis of higher fatty acids
D. Glycogenolysis
E. Decarboxylation

112. A patient ill with neurodermatitis has been taking prednisolone for a long time. Examination revealed high rate of sugar in his blood. This complication is caused by the drug influence upon the following link of carbohydrate metabolism:
A. Gluconeogenesis activation
B. Glycogenogenesis activation
C. Intensification of glucose absorption in the bowels
D. Inhibition of glycogen synthesis
E. Activation of insulin decomposition

113. A child is languid, apathetic. Liver is enlarged and liver biopsy revealed a significant excess of glycogene. Glucose concentration in the bloodstream is below normal. What is the cause of low glucose concentration?
A. Low (absent) activity of glycogene phosphorylase in liver
B. Low (absent) activity of hexokinase
C. High activity of glycogen synthetase
D. Low (absent) activity of glucose 6-phosphatase
E. Deficit of a gene that is responsible for synthesis of glucose 1-phosphaturidine transferase

114. The gluconeogenesis is activated in the liver after intensive physical trainings .What substance is utilized in gluconeogenesis first of all in this case:
A. Lactate
B. Pyruvate
C. Glucose
D. Glutamate
E. Alanine

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

116. 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. Glycosaminoglycans
B. Amino acids
C. Glucose
D. Lipids
E. Urea

117. Avidin - an egg white protein inhibits reception of biotin (carboxylase coenzyme) by the body. What reaction will be blocked by avidin administration?
A. CO2 attachment to pyruvate
B. NH3 attachment to glutamate
C. NH3 detachment from glutamine
D. Detachment of phosphate residuals
E. Beta-oxidation of fatty acids

118. Information transfer from peptide hormones to intracellular second messengers occures involving adenylate cyclase. What reaction is catalyzed by adenylate cyclase?
A. Cyclic adenosine monophosphate production
B. ATP breakdown into ADP and inorganic phosphate
C. ATP synthesis from adenosine monophosphate and pyrophosphate
D. ADP breakdown with adenosine monophosphate and inorganic phosphate production
E. ATP breakdown into adenosine monophosphate and pyrophosphate

119. Addison's (bronze) disease is treated with glucocorticoids. Their effect is provided by the potentiation of the following process:
A. Gluconeogenesis
B. Glycolysis
C. Pentose phosphate cycle
D. Glycogenolysis
E. Ornithine cycle

120. Food rich in carbohydrates at first increases the blood sugar and then decreases its rate due to the insulin action. What process is activated by this hormone?
A. Synthesis of glycogen
B. Gluconeogenesis
C. Breakdown of glycogen
D. Breakdown of proteins

E. Breakdown of lipids

121. Caffeine inhibits phosphodiesterase which converts cAMP to AMP. The most typical feature of caffeine intoxication is the reduced intensity of:
A. Glycogen synthesis
B. Protein phosphorylation
C. Pentose phosphate pathway
D. Glycolysis
E. Lipolysis

122. Alpha-cells of pancreas stimulate synthesis of the glucagon hormone that is involved into the carbohydrate metabolism. It has the following effect on liver processes:
A. Activates glycogenolysis
B. Activates alcoholic fermentation
C. Inhibits glycogenolysis
D. Inhibits glycolysis
E. Activates lypogenesis

123. A child has mental and physical retardation, grave damage of internal connective tissue. Urine analysis reveals keratan sulfates. What metabolic process is disturbed?
A. Glycosaminoglycans
B. Collagen
C. Elastin
D. Fibronectin
E. Hyaluronic acid

124. One of the means of regulating enzyme activity in a human body is the covalent modification. Glycogen phosphorylase and glycogen synthetase activity is regulated by the following type of covalent modification:
A. Phosphorylation-dephosphorylation
B. ADP-ribosylation
C. Methylation
D. Hydrolysis
E. Sulfonation

125. A patient with rheumatoid arthritis has been given hydrocortisone for a long time. He has developed hyperglycemia, polyuria, glycosuria, thirst. These complications of treatment result from the activation of the following process:
A. Gluconeogenesis
B. Glycogenolysis
C. Glycogenesis
D. Glycolysis
E. Lipolysis

126. Degeneration of glycogen in liver is stimulated by glucagon. What secondary messenger (mediator) is thus formed in the cell?
A. c-AMP
B. c-GMP
C. CO
D. NO
E. Triacylglycerol

127. It is known that many hormones act through the adenylate cyclase system causing the enzyme activation by phosphorylation. What enzyme is activated by hormonal signals and catalyzes glycogen breakdown?
A. Phosphorylase
B. Phosphotransferase
C. Glucomutase
D. Phosphatase
E. Tyrosinase

128. It has been revealed that intense physical exercise causes activation of gluconeogenesis in liver of experimantal rats. Which substance is glucose precursor in this case?
A. Pyruvate
B. Glycogen
C. Palmitate
D. Urea
E. Stearate

129. A 34-year-old patient has low endurance of physical loads. At the same time skeletal muscles have increased concentration of glycogen. This is caused by the reduced activity of the following enzyme:
A. Glycogen phosphorylase
B. Glucose-6-phosphate dehydrogenase
C. Phosphofructokinase
D. Glycogen synthase
E. Glucose-6-phosphatase

130. Chronic overdosage of glucocorticoids leads to the development of hyperglycemia. What process of carbohydrate metabolism is responsible for this effect?
A. Gluconeogenesis
B. Glycogenolysis
C. Aerobic glycolisis
D. Pentose-phosphate cycle
E. Glycogenesis

131. The patient exhausted by starvation presents with intensification of the following process in the liver and kidneys:
A. Gluconeogenesis
B. Urea synthesis
C. Bilirubin synthesis
D. Hippuric acid synthesis
E. Uric acid synthesis

132. Mucin aggregates retain water, which results in their viscosity and protective action.
It is possible because mucin structure contains:
A. Glycosaminoglycans

B. Homopolysaccharides
C. Disaccharides
D. Oligosaccharides
E. Glucose

133. After introduction of adrenaline the patient's blood glucose level increased. It is caused by intensified:
A. Glycogenolysis in the liver
B. Glycogenolysis in the muscles
C. Glycolysis in the liver
D. Glycolysis in the skeletal muscles
E. Glycogen synthesis

134. Breakdown of cyclic adenosine monophosphate (cAMP) and cyclic guanosine monophosphate (cGMP) into simple, non-cyclic nucleoside monophosphates is catalyzed by the following enzyme:
A. Phosphodiesterase
B. Glycogen phosphorylase
C. Glucose 6-phosphatase
D. Protein kinase
E. Adenylate cyclase

135. What types of linkages are present between the glucose units of glycogen?
A. a-1-4 and a-1-6 linkages
B. e—1—6 linkages only
C. a-1-4 linkages only
D. e—1—4 and P-1-6 linkages
E. e-1-4 linkages only

136. The greatest quantity of the body glycogen can be found in which of the following human tissue?
A. Liver
B. Kidney
C. Stomach
D. Cardiac muscle
E. Brain

137. Activity of enzymes of glycogen metabolism is regulated in the next way:
A. Covalent modification by phosphorylation-dephosphorylation
B. By dissotiation into subunits
C. By limited proteolysis
D. By isomerization of reaction products
E. By a noncompetitive inhibition

138. Phosphorolysis of carbohydrates plays a key role in a mobilization of polysaccharides. Under the action of phosphorylase from glycogen is produced the next substance:
A. Glucose -1-phosphate
B. Glucose
C. Fructose 6-phosphate
D. Glucose 6-phosphate
E. Glucose 1,6-bis-phosphate

139. Which one of the following is a rate limiting enzyme of gluconeogenesis?
A. Pyruvate carboxylase
B. Phosphoglucomutase
C. Pyruvate kinase
D. Phsophofructokinase
E. Hexokinase

140. Insulin exhibits the next effect on glycogen metabolism:
A. Stimulation of glycogenesis by activation of glycogen synthase
B. Stimulation of glycogen breakdown by activation of phosphorylase
C. Stimulation of glycogen utilization in muscle cells
D. Suppression of glycogen breakdown by inhibition of debranching enzyme
E. Activation of glycogenolysis by activation of phosphorylase a

141. Glycogen synthesis takes place under the action of several enzymes. Indicate, what enzyme provides the formation of 1,6-glycosidic bonds in glycogen molecule?
A. Glycosyl 4,6-transferase
B. Glycogen synthase
C. Hexokinase
D. Glucokinase
E. Glucose 1-phosphate uridil transferase

142. The carbohydrate reserved in human body is:
A. Glycogen
B. Lactose
C. Inulin
D. Glucose
E. Starch

143. Which of the following is a precursor for glucose synthesis via gluconeogenesis?
A. Glycerol
B. Cortisone
C. Glucagon
D. Cholesterol
E. Leucin

144. Lactate formed in muscles can be utilised through:
A. Cori's cycle
B. Rapoport-Luebeling cycle
C. Citric acid cycle
D. Glucose-alanine cycle
E. Tricarboxylic acid cycle

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

146. The characteristic enzymes of gluconeogensis are found in the cytosol, except for:
A. Pyruvate carboxlyase, which is in the mitrochondria
B. Glucose-6-phosphatase, which is in the mitrochondria
C. Fructose-1,6-bisphosphatase, which is in the mitochondria
D. Fructose-1,6-bisphosphatase, which is in the glycogen granule
E. Pyruvate carboxylase, which is in the glycogen granule

147. Which of the following supports gluconeogenesis?
A. Pyruvate + ATP + HCO3 = oxaloacetate + ADP + Pi + H^+
B. Lysine degradation
C. Leucine degradation
D. Acetyl CoA + oxaloacetate + H2O = citrate + CoA
E. a-ketoglutarate + aspartate = glutamate + oxaloacetate

148. The branching enzyme acts on the glycogen when the glycogen chain has been lengthened to between glucose units:
A. 1 and 6
B. 2 and 7
C. 3 and 9
D. 6 and 11
E. 5 and 10

149. a -D-Glucuronic acid is present in
A. Hyaluronic acid
B. Chondroitin sulphate
C. Heparin
D. All of these

150. A carbohydrate found in DNA is
A. Ribose
B. Deoxyribose
C. Ribulose
D. All of these

151. A polymer of glucose synthesized by the action of leuconostoc mesenteroids in a sucrose medium is
A. Dextrans
B. Dextrin
C. Limit dextrin
D. Inulin

152. A positive Seliwanoff's test is obtained with
A. Glucose
B. Fructose
C. Lactose
D. Maltose

153. A sugar alcohol is
A. Mannitol
B. Trehalose
C. Xylulose
D. Arabinose

154. a-D-glucose and в -D-glucose are
A. Stereoisomers
B. Epimers
C. Anomers
D. Keto-aldo pairs

155. Active transport of sugar is depressed by the agent\:
A. Oxaloacetate
B. Fumarate
C. Malonate
D. Succinate

156. Addis test is the measure of
A. Impairment of the capacity of the tubule to perform osmotic work
B. Secretory function of liver
C. Excretory function of liver
D. Activity of parenchymal cells of liver

157. ADH test is based on the measurement of
A. Specific gravity of urine
B. Concentration of urea in urine
C. Concentration of urea in blood
D. Volume of urine in ml/minute

158. All of the following statements about the enzymic complex that carries out the synthesis of ATP during oxidative phosphorylation are correct except
A. It is located on the matrix side of the inner mitochondrial membrane
B. It is inhibited by oligomycin
C. It can exhibit ATPase activity
D. It can bind molecular O2

159. An allosteric enzyme responsible for controlling the rate of T.C.A cycle is
A. Malate dehydrogenase
B. Isocitrate dehydrogenase
C. Fumarase
D. Aconitase

160. An amphibolic pathway among the following is
A. HMP shunt
B. Glycolysis
C. Citirc acid cycle
D. Gluconeogenesis

161. Animal fat is in general
A. Poor in saturated and rich in polyunsaturated fatty acids
B. Rich in saturated and poor in polyunsaturated fatty acids
C. Rich in saturated and polyunsaturated fatty acids
D. Poor in saturated and polyunsaturated fatty acids

162. Bence-Jones protein precipitates at
A. 20°-40° C
B. 40--60° C
C. 60°-80° C
D. 80°-100° C

163. Catalytic activity of salivary amylase requires the presence of
A. Chloride ions
B. Bromide ions
C. Iodide ions
D. All of these

164. Citrate is converted to isocitrate by aconitase which contains
A. Ca++
B. Fe++
C. Zn++
D. Mg++

165. Compared to the resting state, vigorously contracting muscle shows
A. An increased conversion of pyruvate to lactate
B. Decreased oxidation of pyruvate of CO2 and water
C. A decreased NADH/NAD+ ratio
D. Decreased concentration of AMP

166. Congenital galactosaemia can lead to
A. Mental retardation
B. Premature cataract
C. Death
D. All of the above

167. Cyclic AMP is formed from ATP by the enzyme adenylate cyclase which is activated by the hormone\:
A. Insulin
B. Epinephrine
C. Testosterone
D. Progesterone

168. Dehydrogenases involved in HMP shunt are specific for
A. NADP+
B. NAD+
C. FAD
D. FMN

169. Dihydroxyacetone phosphate and glyceraldehyde-3-phosphate are intercoverted by
A. Triose isomerase
B. Phosphotriose isomerase
C. Diphosphotriose isomerase
D. Dihydroxyacetone phosphorylase

170. During starvation, ketone bodies are used as a fuel by
A. Erythrocytes
B. Brain
C. Liver
D. All of these

171. Erythromycin contains
A. Dimethyl amino sugar
B. Trimethyl amino sugar
C. Sterol and sugar
D. Glycerol and sugar

172. Ethanol decreases gluconeogenesis by
A. Inhibiting glucose-6-phosphatase
B. Inhibiting PEP carboxykinase
C. Converting NAD+ into NADH and decreasing the availability of pyruvate
D. Converting NAD+ into NADH and decreasing the availability of lactate

173. Fixation of specific gravity of urine to\n1.010 is found in
A. Diabetes insipidus
B. Compulsive polydypsia
C. Cystinosis
D. Chronic glomerulonephritis

174. Fructose is present in hydrolysate of
A. Sucrose
B. Inulin
C. Both of the above
D. None of these

175. Glucokinase
A. Is widely distributed and occurs in most mammalian tissues
B. Has a high km for glucose and hence is important in the phosphorylation of glucose primarily after ingestion of a carbohydrate rich meal
C. Is widely distributed in Prokaryotes
D. None of these

176. Gluconeogenesis is increased in the following condition\:
A. Diabetes insipidus
B. Diabetes Mellitus
C. Hypothyroidism

D. Liver diseases

177. Glucose absorption may be decreased in
A. Oedema
B. Nephritis
C. Rickets
D. Osteomalitis

178. Glycogen synthetase activity is depressed by
A. Glucose
B. Insulin
C. Cyclic AMP
D. Fructokinase

179. Glycogen while being acted upon by ac tive phosphorylase is converted first to
A. Glucose
B. Glucose 1-phosphate and Glycogen with 1 carbon less
C. Glucose-6-phosphate and Glycogen with 1 carbon less
D. 6-Phosphogluconic acid

180. Glycogenin is
A. Uncoupler of oxidative phosphorylation
B. Polymer of glycogen molecules
C. Protein primer for glycogen synthesis
D. Intermediate in glycogen breakdown

181. Heavy proteinuria occurs in
A. Acute glomerulonephritis
B. Acute pyelonephritis
C. Nephrosclerosis
D. Nephrotic syndrome

182. Hexokinase has a high affinity for glucose than
A. Fructokinase
B. Galactokinase
C. Glucokinase
D. All of the above

183. Impaired renal function is indicated when the amount of PSP excreted in the first 15 minutes is
A. 20%
B. 35%
C. 40%
D. 45%

184. In amylopectin the intervals of glucose units of each branch is
A. 10-20
B. 24-30
C. 30-40
D. 40-50

185. In the diet of a diabetic patient, the recommended carbohydrate intake should preferably be in the form of
A. Monosaccharides
B. Dissaccharides
C. Polysaccharides
D. All of these

186. Isomers differing as a result of variations in configuration of the —OH and —H on carbon atoms 2, 3 and 4 of glucose are known as
A. Epimers
B. Anomers
C. Optical isomers
D. Steroisomers

187. Keratan sulphate is found in abundance in
A. Heart muscle
B. Liver
C. Adrenal cortex
D. Cornea

188. Maltose can be formed by hydrolysis of
A. Starch
B. Dextrin
C. Glycogen
D. All of these

189. Mucopolysaccharides are
A. Hamopolysaccharides
B. Hetropolysaccharides
C. Proteins
D. Amino acids

190. Normal specific gravity of urine is
A. 1.000-1.010
B. 1.012-1.024
C. 1.025-1.034
D. 1.035-1.045

191. Number of stereoisomers of glucose is
A. 4
B. 8
C. 16
D. None of these

192. Obesity increases the risk of
A. Hypertension
B. Diabetes mellitus
C. Cardiovascular disease
D. All of these

193. Osazones are not formed with the
A. Glucose
B. Fructose
C. Sucrose
D. Lactose

194. Out of 24 mols of ATP formed in TCA cycle, 2 molecules of ATP can be formed at "substrate level" by which of the following reaction ?
A. Citric acid^ Isocitric acid
B. Isocitrate^ Oxaloacetate
C. Succinic acid^ Fumarate

D. Succinylcat^ Succinic acid

195. Physiological glycosuria is met with in
A. Renal glycosuria
B. Alimentary glycosuria
C. Diabetes Mellitus
D. Alloxan diabetes

196. Polyuria can occur in
A. Diabetes mellitus
B. Diarrhoea
C. Acute glomerulonephritis
D. High fever

197. Repeating units of hyaluronic acid are
A. N-acetyl glucosamine and D-glucuronic acid
B. N-acetyl galactosamine and D-glucuronic acid
C. N-acetyl glucosamine and galactose
D. N-acetyl galactosamine and L- iduronic acid

198. Rothera test is not given by
A. в-hydroxy butyrate
B. bile salts
C. Glucose
D. None of these

199. Serum cholesterol is decreased in
A. Endemic goitre
B. Thyrotoxicosis
C. Myxoedema
D. Cretinism

200. Specific gravity of urine increases in
A. Diabetes mellitus
B. Chronic glomerulonephritis
C. Compulsive polydypsia
D. Hypercalcemia

201. Specific gravity of urine is decreased in
A. Diabetes mellitus
B. Acute glomerulonephritis
C. Diarrhoea
D. Chronic glomerulonephritis

202. Specific gravity of urine is raised in all of the following except
A. Diabetes mellitus
B. Diabetes insipidus
C. Dehydration
D. Acute glomerulonephritis

203. The 4 rate limiting enzymes of gluconeogenesis are
A. Glucokinase, Pyruvate carboxylae phosphoenol pyruvate carboxykinase and glucose-6-phosphatase
B. Pyruvate carboxylase, phosphoenol pyruvate carboxykinase, fructose1,6 diphosphatase and glucose-6-phosphatase
C. Pyruvate kinase, pyruvate carboxylase, phosphoenol pyruvate carboxykinase and glucose-6-phosphatase
D. Phospho fructokinase, pyruvate carboxylase, phosphoenol pyruvate carboxykinase and fructose 1, 6 diphosphatase

204. The approximate number of branches in amylopectin is
A. 10
B. 20
C. 40
D. 80

205. The branching enzyme acts on the glycogen when the glycogen chain has been lengthened to between glucose units\:
A. 1 and 6
B. 2 and 7
C. 3 and 9
D. 6 and 11

206. The constituent unit of inulin is
A. Glucose
B. Fructose
C. Mannose
D. Galactose

207. The following is actively absorbed in the intestine\:
A. Fructose
B. Mannose
C. Galactose
D. None of these

208. The general test for detection of carbohydrates is
A. Iodine test
B. Molisch test
C. Barfoed test
D. Osazone test

209. The glycolysis is regulated by
A. Hexokinase
B. Phosphofructokinase
C. Pyruvate kinase
D. All of these

210. The glycosaminoglycan which does not contain uronic acid is
A. Dermatan sulphate
B. Chondroitin sulphate
C. Keratan sulphate
D. Heparan sulphate

211. The glycosaminoglycan which does not contain uronic acid is
A. Hyaluronic acid
B. Heparin
C. Chondroitin sulphate
D. Dermatan sulphate

212. The heptose ketose sugar formed as a result of chemical reaction in HMP shunt\:
A. Sedoheptulose
B. Galactoheptose
C. Glucoheptose
D. Mannoheptose

213. The major sugar of insect hemolymph is
A. Glycogen
B. Pectin
C. Trehalose
D. Sucrose

214. The most abundant carbohydrate found in nature is
A. Starch
B. Glycogen
C. Cellulose
D. Chitin

215. The most important epimer of glucose is
A. Galactose
B. Fructose
C. Arabinose
D. Xylose

216. The oxidation of lactic acid to pyruvic acid requires the following vitamin derivative as the hydrogen carrier.
A. Lithium pyrophosphate
B. Coenyzme A
C. NAD+
D. FMN

217. The polysaccharide found in the exoskeleton of invertebrates is
A. Pectin
B. Chitin
C. Cellulose
D. Chondroitin sulphate

218. The reaction catalysed by phosphofruc tokinase
A. Is activated by high concentrations of ATP and citrate
B. Uses fruitose-1-phosphate as substrate
C. Is the rate-limiting reaction of the glycolytic pathway
D. Is inhibited by fructose 2, 6-bisphosphate

219. The reaction succinyl COA to succinate requires
A. CDP
B. ADP
C. GDP
D. NADP+

220. The specific gravity of urine normally ranges from
A. 0.900-0.999
B. 1.003-1.030
C. 1.000-1.001
D. 1.101-1.120

221. The sugar found in DNA is
A. Xylose
B. Ribose
C. Deoxyribose
D. Ribulose

222. The sugar found in milk is
A. Galactose
B. Glucose
C. Fructose
D. Lactose

223. The sugar found in RNA is
A. Ribose
B. Deoxyribose
C. Ribulose
D. Erythrose

224. The tissues with the highest total glycogen content are
A. Muscle and kidneys
B. Kidneys and liver
C. Liver and muscle
D. Brain and Liver

225. Uridine diphosphate glucose (UDPG) is
A. Required for metabolism of galactose
B. Required for synthesis of glucuronic acid
C. A substrate for glycogen synthetase
D. All of the above

226. Which of the following enzymes in Glycolytic pathway is inhibited by fluoride?
A. Glyceraldehyde-3-p dehydrogenase
B. Phosphoglycerate kinase
C. Pyruvate kinase
D. Enolase

227. Which of the following hormones is not involved in carbohydrate metabolism?
A. Cortisol
B. ACTH
C. Glucogen
D. Vasopressin

228. Which of the following is a heteroglycan?
A. Dextrins
B. Agar
C. Inulin
D. Chitin

229. Which of the following statements regarding T.C.A cycle is true?
A. It is an anaerobic process
B. It occurs in cytosol
C. It contains no intermediates for Gluconeogen esis
D. It is amphibolic in nature

230. Worldwide, the most common vitamin deficiency is that of
A. Ascorbic acid
B. Folic acid
C. Vitamin A
D. Vitamin D

231. Condition of a patient with diabetes mellitus sharply deteriorated after a regular injection of insulin. The patient became anxious and broke out in cold sweat; tremor of the extremities, general weakness, and dizziness appeared. What medicine can remove these symptoms?
A. Adrenaline
B. Tolbutamide
C. Caffeine
D. Noradrenaline
E. Glibutid (Buformin)

232. Ketosis develops in the patients with diabetes mellitus, as the result of activation of fatty acids oxidation processes. What acid-base imbalance can result from accumulation of excessive ketone bodies in the blood?
A. Metabolic acidosis
B. Metabolic alkalosis
C. No imbalance occurs
D. Respiratory acidosis
E. Respiratory alkalosis

233. A 40-year-old woman suffers from Cushing's disease - steroid diabetes. On biochemical examination she has hyperglycemia and hypochloremia. What process activates in the first place in such patients?
A. Gluconeogenesis
B. Glycogenolysis
C. Glucose reabsorption
D. Glucose transport to the cells
E. Glycolysis

234. An unconscious patient was brought into the hospital. The smell of acetone can be detected from the patient's mouth. Blood glucose - 25 mmol/L, ketone bodies 0.57 mmol/L. What hormone deficiency can result in the development of this condition?
A. Insulin
B. Thyroxin
C. Glucocorticoids
D. Aldosterone
E. Somatotropin

235. Examination of a 56-year-old woman with a history of type 1 diabetes 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. Increased proteolysis
B. Albuminosis
C. Decrease in concentration of blood amino acids
D. Increase in plasma oncotic pressure
E. Increase in low-density lipoproteins level

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

237. 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. Carbohydrate starvation of the brain
B. Increased glycogenolysis
C. Increased ketogenesis
D. Increased lipogenesis
E. Decreased glyconeogenesis

238. Pancreas is known as a mixed gland. Endocrine functions include production of insulin by beta cells. This hormone affects metabolism of carbohydrates. What is its effect on the activity of glycogen phosphorylase (GP) and glycogen synthase (GS)?
A. It inhibits GP and activates GS
B. It activates both GP and GS
C. It inhibits both GP and GS
D. It activates GP and inhibits GS
E. It does not affect the activity of GP and GS

239. 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. Disruption of protein metabolism regulation
B. Hypoglycemia
C. Ketonemia
D. Increased lipid catabolism
E. Anemia

240. 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. Insulin
B. Glucagon
C. Thyroxin
D. Aldosterone
E. Adrenalin

241. 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. Subclinical diabetes mellitus
B. Diabetes mellitus type 1
C. Diabetes mellitus type 2
D. Healthy person
E. Cushing's disease

242. 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. Acetoacetate
B. Citrate
C. Alpha-ketoglutarate
D. Malonate
E. Aspartate

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

244. A patient ill with neurodermatitis has been taking prednisolone for a long time. Examination revealed high rate of sugar in his blood. This complication is caused by the drug in fluence upon the following link of carbohydrate metabolism:
A. Gluconeogenesis activation
B. Glycogenogenesis activation
C. Intensification of glucose absorption in the bowels
D. Inhibition of glycogen synthesis
E. Activation of insulin decomposition

245. Patients who suffer from severe diabetes and don't receive insulin have metabolic acidosis. This is caused by increased concentration of the following metabolites:
A. Ketone bodies
B. Fatty acids
C. Unsaturated fatty acids
D. Triacylglycerols
E. Cholesterol

246. 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. Glycosylation
B. Phosphorylation
C. ADP-ribosylation
D. Methylation
E. Limited proteolysis

247. A patient is ill with diabetes mellitus accompanied by hyperglycemia on an empty stomach (7,2 millimole/l). The hyperglycemia rate can be retrospectively estimated (over the last 4-8 weeks before the examination) on the ground of the rate of the following blood plasma protein:
A. Glycated hemoglobin
B. Albumin
C. Fibrinogen
D. C-reactive protein
E. Ceruloplasmin

248. A patient was delivered to the hospital by an emergency team. Objectively: grave condition, unconscious, adynamy. Cutaneous surfaces are dry, eyes are sunken, face is cyanotic. There is tachycardia and smell of acetone fromthe mouth. Analysis results: blood glucose 20,1 micromole/l (standard is 3,3-5,5 micromole/l), urine glucose - 3,5% (standard is - 0). What is the most probable diagnosis?
A. Hyperglycemic coma
B. Hypoglycemic coma
C. Acute heart failure
D. Acute alcoholic intoxication
E. Anaphylactic shock

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

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

251. When investigating human saliva it is necessary to assess its hydrolytic properties. What substance should be used as a substrate in the process?
A. Starch
B. Proteins
C. Fats
D. Fiber
E. Amino acids

252. A 60 year old patient was found to have a dysfunction of main digestive enzyme of saliva. This causes the disturbance of primary hydrolysis of:
A. Carbohydrates
B. Fats
C. Proteins
D. Cellulose
E. Lactose

253. The 49-year-old female patient suffering long-term from pancreatic diabetes has developed the following symptoms after administering insulin: weakness, facial pallor, palpitation, anxiety, double vision, numbness of lips and tongue apex. Glucose molar concentration in blood was 2,5 mmol/l. What complication has developed in the patient?
A. Hypoglycemic coma
B. Hyperosmolar coma
C. Hyperglycemic coma
D. Hyperketonemic coma
E. Uremic coma

254. The 13-year-old female patient having suffered from measles complains of dry mouth, thirst, body weight loss, polyuria, her glucose concentration in blood is 16 mmol/l. What disease can be suspected?
A. Type I pancreatic diabetes
B. Type II pancreatic diabetes
C. Diabetes insipidus
D. Steroidogenic diabetes
E. Glycogenosis

255. Addison's (bronze) disease is treated with glucocorticoids. Their effect is provided by the potentiation of the following process:
A. Gluconeogenesis
B. Glycolysis
C. Pentose phosphate cycle
D. Glycogenolysis
E. Ornithine cycle

256. Food rich in carbohydrates at first increases the blood sugar and then decreases its rate due to the insulin action. What process is activated by this hormone?
A. Synthesis of glycogen
B. Gluconeogenesis
C. Breakdown of glycogen
D. Breakdown of proteins
E. Breakdown of lipids

257. A patient was admitted to a hospital in a state of hypoglycemic coma. It occurs at the following level of blood glucose:
A. 2,5 mmol/l or less
B. 4,0 mmol/l
C. 3,3 mmol/l
D. 4,5 mmol/l
E. 5,5 mmol/l

258. Diabetes and starvation cause the excess production of ketone bodies that are used as an energy source. They are produced from the following compound:
A. Acetyl-CoA
B. Isocitrate
C. Lactate
D. Malate
E. Ketoglutarate

259. Alpha-cells of pancreas stimulate synthesis of the glucagon hormone that is involved into the carbohydrate metabolism. It has the following effect on liver processes:
A. Activates glycogenolysis
B. Activates alcoholic fermentation
C. Inhibits glycogenolysis
D. Inhibits glycolysis
E. Activates lypogenesis

260. A nurse accidentally injected a nearly double dose of insulin to a patient with diabetes mellitus. The patient lapsed into a hypoglycemic coma. What drug should be injected in order to help him out of coma?
A. Glucose
B. Lidase
C. Insulin
D. Somatotropin
E. Noradrenaline

261. A patient has been found to have sugar in the urine. Blood glucose is normal. Arterial pressure is normal. What is the mechanism of glycosuria development in this case?
A. Disturbance of glucose reabsorption in the nephron tubules
B. Insulin deficiency
C. Hyperfunction of adrenal medulla
D. Hyperfunction of thyroid gland
E. Hyperfunction of adrenal cortex

262. After introdiction of adrenaline the patient's blood glucose level increased. It is caused by intensified:
A. Glycogenolysis in the liver

B. Glycogenolysis in the muscles
C. Glycolysis in the liver
D. Glycolysis in the skeletal muscles
E. Glycogen synthesis

263. The concentration of glucose in the blood plasma of a healthy man varies within the following limits:
A. 3.3-5.5 mM/l
B. 1.0-2.0 mM/1
C. 6.0-9.5 mM/1
D. 10.0-25.0 mM/1
E. 2.0-4.0 mM/1

264. 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. Steroid diabetes
B. Insulin-dependent diabetes mellitus
C. Myxoedema
D. Type I glycogenosis
E. Addison's disease

265. In a 57 years old patient suffering from diabetes mellitus ketoacidosis has been developed. Biochemical background of this status is decrease in utilization of acetyl- CoA due to a deficiency of:
A. Oxaloacetate
B. Glutamate
C. a-ketoglutarate
D. Aspartate
E. Succinate

266. In patient S. blood glucose level is over the renal threshold, polyuria is observed, as well as acidosis and ketonuria. What disease can be suggested?
A. Diabetes mellitus
B. Hypercorticism
C. Starvation
D. Hyperthyreosis
E. Addison disease

267. Destruction of pancreatic islets of Langerhans results in the decrease of production of:
A. Glucagon and insulin
B. Parathhormone and cortisone
C. Thyroxyne and calcitonin
D. Insulin and adrenaline
E. Callicrein and angiotensin

268. Insulin is a hormone with _____ concerning carbohydrates metabolism:
A. Anabolic activity
B. Catabolic activity
C. Lypolytic activity
D. Glycogenolytic activity
E. Luteotropic activity

269. Blood glucose level is decreased by:
A. Insulin
B. Glucagone
C. Epinephrine
D. Glucocorticoid hormones
E. Testosterone

270. Renal threshold, polyuria is observed, as well as acidosis and ketonuria. What disease can be suggested?
A. Diabetes mellitus
B. Starvation
C. Hypercorticism
D. Addison disease
E. Hyperthyreosis

271. Glucagon is produced in the next endocrine gland:
A. Langerhans islands, a cells
B. Thymus
C. Medullar part of adrenals
D. Parathyroid gland
E. Pitiutary gland

272. 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. Glucose, ketone bodies
B. Protein, amino acid
C. Protein, creatine
D. Bilirubin, urobilin
E. Blood

273. 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 tolerance to glucose on an empty stomach
C. Determination of rest nitrogen level in the blood
D. Determination of ketone bodies concentration in the urine
E. Determination of glycosylated hemoglobin level

274. Glucose is completely reabsorbed in renal tubules up to the next value of blood glucose level:
A. 10 mmoles/l
B. 6,5 mmoles/l
C. 5,5 mmoles/l
D. 80 mmoles/l
E. 150 mmoles/l

275. Amylolytic enzymes catalyze the hydrolysis of polysaccharides and oligosaccharides. They have an effect upon the following chemical bond:
A. Glycosidic
B. Hydrogen
C. Peptide
D. Amide
E. Phosphodiester

276. The most severe and dangerous complication of diabetes mellitus is hypoglycemic coma that is characterized by loss of consciousness and is lethal, unless efficient emergency treatment is received by patient. What is the main pathogenetic component of hypoglycemic coma?
A. Carbohydrate deficiency and low energy of cerebral neurons
B. Carbohydrate deficiency and low energy of myocardium cells
C. Blood hyperosmia
D. Noncompensated ketoacidosis
E. Respiratory alkalosis

277. Maltose is composed of which two sugars:
A. Glucose and glucose
B. Glucose and fructose
C. Glucose and galactose
D. Galactose and fructose
E. Lactose and galactose

278. Which of the following hormones promotes hypoglycemia:
A. Insulin
B. Epinephrin
C. Glucagon
D. Aldosteron
E. Cortisol

279. A patient has been receiving Theophylline (inhibitor of cyclic adenosine monophosphate phosphodiesterase) for a week. What hormone can increase its action due to such treatment and cause hyperglycemia?
A. Glucagon
B. Testosterone
C. Aldosterone
D. Insulin
E. Estradiol

280. A patient has been found to have sugar in the urine. Blood glucose is normal. Arterial pressure is normal. What is the mechanism of glycosuria development in this case?
A. Disturbance of glucose reabsorption in the nephron tubules
B. Insulin deficiency
C. Hyperfunction of adrenal medulla
D. Hyperfunction of thyroid gland
E. Hyperfunction of adrenal cortex

Situational Tasks:

I. A characteristic feature of glycogenosis is pain in the muscles under time of physical work. It is registered in the blood hypoglycemia. Congenital insufficiency of which enzyme causes this pathology?

2. When feeding a newborn baby milk mothers appeared vomiting, flatulence, diarrhea. About hereditary deficiency of which enzyme should be considered?

3. In a patient who suffers from chronic for a long time enterocolitis, after drinking milk appeared flatulence, diarrhea, colic. With a lack of which enzyme in the intestine is it related?

4. In a child with a point mutation of genes detected lack of glucose-6-phosphatase, hypoglycemia and hepatomegaly. Determine the type of pathology for which are these signs characteristic? Explain this pathology.

5. After prolonged exercise during physical education classes for students have developed muscular crepitus. The reason was the accumulation of skeletal muscle lactic acid. After activating which process it was formed?

6. After restoration of blood circulation in the damaged tissue lactate accumulation stops and decreases glucose uptake rate. By activating which process caused by these metabolic shifts?

7. When running long distances skeletal muscles a trained person uses glucose for the purpose obtaining ATP energy for muscle contraction. Specify the main process of glucose utilization in these conditions.

8. When running short distances in the untrained human muscular hypoxia occurs. Before accumulation what metabolite in muscle does it lead to?

9. At insufficiency of blood circulation in the period of intensive muscle work in the muscles as a result of anaerobic lactic acid accumulates in glycolysis. What is it further fate?

I0. During starvation, muscle proteins break down free amino acids. In which process the most these compounds will be more likely to be involved in such conditions?

I I. The child is weak, apathetic. The liver is enlarged and when liver biopsy revealed a significant excess glycogen. The concentration of glucose in the blood is lower norms. What is the cause of low concentration glucose in the blood of this patient? Explain why?

I2. In analysis of blood at the patient the expressed is found fasting hypoglycemia. In liver biopsies the liver is reduced the amount of glycogen. What enzyme deficiency is there?

I3. Anaerobic breakdown of glucose to lactate is regulated by appropriate enzymes. Indicate which enzyme is the main regulator this process? And what is activator and inhibitor for this enzyme?

I4. A patient who has been suffering from chronic enterocolitis for a long time has flatulence, diarrhea, and colic after drinking milk.
a) With the lack of which enzyme in the intestine is associated with this pathology?
b) What reaction does this enzyme catalyze?
c) Can such a patient consume fermented milk products? Describe the answer.

I5. In the human body there is a homopolysaccharide, which is mainly synthesized in the liver and skeletal muscle and stored in the cytoplasm of cells in the form of granules.
a) Name the homopolysaccharide.
b) Describe its structure and biological role.
c) Indicate the biological significance of low osmotic activity of this homopolysaccharide?

I6. Clinical examination of patient M. made it possible to establish a preliminary diagnosis gastric cancer. Lactic acid is found in gastric juice.

a) In what metabolic process is lactate formed?
b) Which enzyme is involved in the formation of lactate? What reaction is catalyzed by this enzyme?
c) What are the\nconsequences of the accumulation of lactate in tumor cells?

I7. During the biochemical study it was found that in the cytoplasm of hepatocytes decreases the activity of oxidative phosphorylation.
a) How does the ratio of ATP / ADP in hepatocytes change?
b) How does the activity of anaerobic glycolysis under these conditions? Describe the answer.
c) Specify the mechanism of regulation of the activity of glycolysis enzymes.

I8. In patients with persistent hypoglycemia blood test after the introduction of adrenaline did not change significantly. Doctor suggested liver disorders. About changing which liver function can we talk? And why?

I9. After the restoration of blood circulation in the damaged tissue, the accumulation of lactate stops and the rate of glucose consumption decreases.
a) How does the ATP / ADP ratio change?
b) Explain the reason for the decrease in lactate content under these conditions?
c) Indicate the name and biological significance of the metabolic effect that occurs in ischemic tissue after restoration of blood circulation.

20. In people after excessive alcohol consumption in the morning on an empty stomach there is hypoglycemia due to an increase in the ratio of NADH / NAD +.
a) Specify the reversible reaction of anaerobic glycolysis, the direction of which depends on this ratio.
b) In which direction is the equilibrium of the reaction shifted under these conditions?
c) How does the activity of gluconeogenesis change?

22. In order to transport protons from the cytoplasm to the mitochondria, shuttle systems are used for their oxidation.
a) Name the shuttle transport systems of hydrogen atoms
b) Which of them has the highest energy value and why?
c) Which of them is more universal and why?

24. Under aerobic conditions, the breakdown of glucose occurs only to pyruvate, while lactate is not formed
a) In what reaction is the conversion of pyruvate to lactate, name the enzyme, coenzyme.
b) Why under aerobic conditions pyruvate is not converted into lactate?
c) Calculate the energy balance of aerobic oxidation of glucose to pyruvate.

25. During prolonged starvation there is an increased breakdown of proteins into amino acids
a) What process will include amino acids under these conditions?
b) Which amino acid is most involved in this process?

c) What other substances can be included in this process?

26. The patient has hypoglycemia on an empty stomach, pyruvate carboxylase deficiency is detected in the punctate liver.
a) What reaction is catalyzed by pyruvate carboxylase? Name the coenzyme.
b) Decreased activity of which process is observed in the patient?
c) Is it advisable to prescribe aspartate to the patient?

27. In animals after administration of glutamate showed an increase in serum glucose.
a) The activity of which process increases under these conditions?
b) Indicate the reason for its activation.
c) Name the topical localization and biological significance of this process?

28. Child weak, apathetic. Convulsions often occur in the backpack on an empty stomach. Liver biopsy revealed a significant deficiency of glycogen.
a) Name the pathological condition of the child.
b) Deficiency of which enzyme occurs?
c) What is the cause of the court?

29. A child with a point gene mutation has been shown to lack glucose-6-phosphatase, hypoglycemia and hepatomegaly.
a) Name the pathological condition of the child
b) What reaction is catalyzed by this enzyme? In which cell organelle it passes
c) How does the activity of the pentose phosphate cycle change under these conditions?

30. The child has a delay in physical and mental development, profound disorders connective tissue of internal organs, in urine keratan sulfates were detected. Metabolism of which substances broken? Examples of this substances and them main function.

31. After switching to a mixed diet the newborn had dyspepsia with diarrhea, flatulence, developmental delay. Insufficiency of which components is the basis of this pathology?

32. In the endocrinology department with a diagnosis diabetes is treated by a 40-year-old woman with complaints thirst, increased appetite. What are pathological components detected in the laboratory examination of the patient's urine?

33. A patient with that diabetes that accompanied by fasting hyperglycemia over 7.2 mmol / l. The level of which blood protein allows retrospectively (for the previous 4-8 weeks before examination) to assess blood glucose levels?

34. A 62-year-old woman developed cataracts (cloudiness of the lens) on a background of sugar diabetes. Indicate what type of protein modification it has place in diabetic cataract?

35. The patient is 58 years old. The condition is serious, consciousness is darkened, skin is dry, eyes are inflamed, cyanosis, the smell of rotten apples with company. Test results: blood

glucose I5.I mm / l, c urine 3.5% glucose. What is the cause of this condition?

36. A 45-year-old woman has no symptoms of diabetes, however determined on an empty stomach high glucose in the blood (7.5 mmol / l). What next test is needed to do? And explain why?

37. A 46-year-old patient complains of dry mouth, thirst, increased urination, general weakness. At biochemical examination of blood revealed hyperglycemia, hyperketonemia. In the urine - glucose, ketone bodies. On the electrocardiogram diffuse changes in myocardium. What a disease?

38. In patients with severe diabetes and do not receive insulin, metabolic is observed acidosis. Increasing the concentration of which metabolites it is causes? And why?

39. It is known that synovial fluid reduces friction of joint surfaces. In rheumatism and arthritis, its viscosity decreases due to depolymerization of a substance.
a) Name this substance.
b) What class of carbohydrates does it belong to? What components is it made of?
c) What other biological functions does it perform?

40. Monosaccharide, which is a structural component of sucrose and is chemically ketohexose. It enters the human body as part of the fruit.
a) Name the monosaccharide.
b) What disaccharide is it part of? Describe the structure of this disaccharide.
c) Indicate the value of this monosaccharide.

41. A 7-year-old girl has obvious signs of hemolytic anemia. Laboratory deficiency of pyruvate kinase in erythrocytes.
a) Violation of which metabolic process in erythrocytes is observed in this case?
b) What reaction is catalyzed by pyruvate kinase in erythrocytes, indicate its value?
c) What are the reasons for the development of hemolysis of erythrocytes under these conditions?

42. Alcohol fermentation reactions take place in the cells of yeast and other microorganisms due to the presence of the enzyme pyruvate decarboxylase. At the same time, humans do not have this enzyme, and the reserves of endogenous ethanol in the blood are replenished by the intestinal microflora synthesized.
a) What reaction is catalyzed by pyruvate decarboxylase?
b) What is the difference between the processes of alcoholic fermentation and anaerobic glycolysis?
c) What is the importance of endogenous ethanol in the human body?

43. In order to prevent malaria, an anthropologist who was going on an expedition to South Africa was prescribed an antimalarial drug, acridine. Against the background of his admission, the patient developed hemolytic jaundice.

a) What is the cause of hemolysis of erythrocytes when taking an antimalarial drug?
b) Violation of which biochemical process and synthesis of which reducing agent is observed under these conditions?
c) What is the mechanism of anemia?

44. In tissues with intensive lipid metabolism, the path of glucose catabolism is of great importance, which supplies the reduced cofactor (source of hydrogen atoms) for the synthesis of fatty acids.
a) Name this pathway of glucose metabolism
b) What reduced cofactor does it supply for the synthesis of fatty acids?
c) For the synthesis of which other lipids is this reducing agent used?

45. In rapidly dividing cells, the pathway of glucose catabolism, which supplies the monosaccharide for nucleotide synthesis, is intensive.
a) Name this pathway of glucose metabolism
b) What monosaccharide does it supply for nucleotide synthesis?
c) How does the activity of this change in vitamin BI deficiency?

46. An 8-month-old child has vomiting and diarrhea after drinking fruit juices. Fructose loading leads to hypoglycemia.
a) Name the pathological condition of the child
b) Deficiency of which enzyme is observed under these conditions?
c) Indicate the reason for the development of hypoglycemia after loading with fructose.

47. A 2-year-old boy has an increase in the size of the liver and spleen, cataracts. In the blood increased sugar concentration, however, the test glucose tolerance is normal. Specify hereditary metabolic disorders are the cause of this state? And why it`s happened?

48. The childs blood has a high content of galactose, glucose concentration is reduced. There is cataract, mental retardation, developing fatty degeneration of the liver.
a) Name the pathological condition of the child.
b) Deficiency of which enzyme is observed under these conditions?
c) What reaction is catalyzed by this enzyme?

49. To determine the cause of hypoglycemia in a newborn, a glucagon test was performed, which did not cause an increase in blood glucose levels.
a) How does glucagon increase blood glucose levels?
b) Name the possible reasons for the lack of hyperglycemic effect of glucagon.
c) What biochemical tests will diagnose the child?

50. In the patients blood the fasting glucose content is 6.4 mmol / l, and 2 hours after a carbohydrate breakfast - 12.6 mmol / l.
a) Indicate the normative indicators of fasting glucose and 2 hours after a carbohydrate breakfast.
b) Analyze the results of the glucose tolerance test in the patient and draw conclusions?

c) Is it possible to develop glucosuria in this patient?

51. In the patient's blood fasting glucose - 5.8 mmol / l, and 2 hours after a carbohydrate breakfast - 8.4 mmol / l.
a) Analyze the data of glucose tolerance test in this patient and draw conclusions?
b) The risk of developing which diseases increases in this patient?
c) Name the biochemical index of long-term glycemia, indicate its normative indicators and diagnostic value.

52. A sick child has a mental delay development, enlarged liver, impaired vision. Your doctor associates these symptoms with a deficiency in the body child galactose-I-phosphaturidyltransferase. What pathological process takes place? And explain why?

53. The child's blood has a high content of galactose, glucose concentration is reduced. Observed cataract, mental retardation, developing fatty liver degeneration. What disease occurs? And what the enzyme can regulate it?

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60. During the biochemical study it was found that in the cytoplasm of hepatocytes decreases the activity of oxidative phosphorylation.
a) How does the ratio of ATP / ADP in hepatocytes change?
b) How does the activity of anaerobic glycolysis under these conditions? Describe the answer.
c) Specify the mechanism of regulation of the activity of glycolysis enzymes.

61. Alcohol fermentation reactions take place in the cells of yeast and other microorganisms due to the presence of the enzyme pyruvate decarboxylase. At the same time, humans do not have this enzyme, and the reserves of endogenous ethanol in the blood are replenished by the intestinal microflora synthesized.
a) What reaction is catalyzed by pyruvate decarboxylase?
b) What is the difference between the processes of alcoholic fermentation and anaerobic glycolysis?
c) What is the importance of endogenous ethanol in the human body?

62. In order to prevent malaria, an anthropologist who was going on an expedition to South Africa was prescribed an antimalarial drug, acridine. Against the background of his admission, the patient developed hemolytic jaundice.
a) What is the cause of hemolysis of erythrocytes when taking an antimalarial drug?
b) Violation of which biochemical process and synthesis of which reducing agent is observed under these conditions?
c) What is the mechanism of anemia?

63. After the restoration of blood circulation in the damaged tissue, the accumulation of lactate stops and the rate of glucose consumption decreases.
a) How does the ATP / ADP ratio change?
b) Explain the reason for the decrease in lactate content under these conditions?
c) Indicate the name and biological significance of the metabolic effect that occurs in ischemic tissue after restoration of blood circulation.

64. In tissues with intensive lipid metabolism, the path of glucose catabolism is of great importance, which supplies the reduced cofactor (source of hydrogen atoms) for the synthesis of fatty acids
a) Name this pathway of glucose metabolism

b) What reduced cofactor does it supply for the synthesis of fatty acids?
c) For the synthesis of which other lipids is this reducing agent used?

65. In people after excessive alcohol consumption in the morning on an empty stomach there is hypoglycemia due to an increase in the ratio of NADH / NAD +.
a) Specify the reversible reaction of anaerobic glycolysis, the direction of which depends on this ratio.
b) In which direction is the equilibrium of the reaction shifted under these conditions?
c) How does the activity of gluconeogenesis change?

66. In rapidly dividing cells, the pathway of glucose catabolism, which supplies the monosaccharide for nucleotide synthesis, is intensive.
a) Name this pathway of glucose metabolism
b) What monosaccharide does it supply for nucleotide synthesis?
c) How does the activity of this change in vitamin B I deficiency?

67. In order to transport protons from the cytoplasm to the mitochondria, shuttle systems are used for their oxidation.
a) Name the shuttle transport systems of hydrogen atoms
b) Which of them has the highest energy value and why?
c) Which of them is more universal and why?

68. Under aerobic conditions, the breakdown of glucose occurs only to pyruvate, while lactate is not formed.
a) In what reaction is the conversion of pyruvate to lactate, name the enzyme, coenzyme.
b) Why under aerobic conditions pyruvate is not converted into lactate?
c) Calculate the energy balance of aerobic oxidation of glucose to pyruvate.

69. During prolonged starvation there is an increased breakdown of proteins into amino acids.
a) What process will include amino acids under these conditions?
b) Which amino acid is most involved in this process?
c) What other substances can be included in this process?

70. The patient has hypoglycemia on an empty stomach, pyruvate carboxylase deficiency is detected in the punctate liver.
a) What reaction is catalyzed by pyruvate carboxylase? Name the coenzyme.
b) Decreased activity of which process is observed in the patient?
c) Is it advisable to prescribe aspartate to the patient?

7I. In animals after administration of glutamate showed an increase in serum glucose.
a) The activity of which process increases under these conditions?
b) Indicate the reason for its activation.
c) Name the topical localization and biological significance of this process?

72. An 8-month-old child has vomiting and diarrhea after drinking fruit juices. Fructose loading leads to hypoglycemia.
a) Name the pathological condition of the child
b) Deficiency of which enzyme is observed under these conditions?
c) Indicate the reason for the development of hypoglycemia after loading with fructose.

73. The child's blood has a high content of galactose, glucose concentration is reduced. There is cataract, mental retardation, developing fatty degeneration of the liver.
a) Name the pathological condition of the child.
b) Deficiency of which enzyme is observed under these conditions?
c) What reaction is catalyzed by this enzyme?

74. Child weak, apathetic. Convulsions often occur in the backpack on an empty stomach. Liver biopsy revealed a significant deficiency of glycogen.
a) Name the pathological condition of the child.
b) Deficiency of which enzyme occurs?
c) What is the cause of the court?

75. A child with a point gene mutation has been shown to lack glucose-6-phosphatase, hypoglycemia and hepatomegaly.
a) Name the pathological condition of the child
b) What reaction is catalyzed by this enzyme? In which cell organelle it passes
c) How does the activity of the pentose phosphate cycle change under these conditions?

76. To determine the cause of hypoglycemia in a newborn, a glucagon test was performed, which did not cause an increase in blood glucose levels.
a) How does glucagon increase blood glucose levels?
b) Name the possible reasons for the lack of hyperglycemic effect of glucagon.
c) What biochemical tests will diagnose the child?

77. In the patient's blood the fasting glucose content is 6.4 mmol / l, and 2 hours after a carbohydrate breakfast - 12.6 mmol / l.
a) Indicate the normative indicators of fasting glucose and 2 hours after a carbohydrate breakfast.
b) Analyze the results of the glucose tolerance test in the patient and draw conclusions?
c) Is it possible to develop glucosuria in this patient?

78. In the patient's blood fasting glucose - 5.8 mmol / l, and 2 hours after a carbohydrate breakfast - 8.4 mmol / l.
a) Analyze the data of glucose tolerance test in this patient and draw conclusions?
b) The risk of developing which diseases increases in this patient?
c) Name the biochemical index of long-term glycemia, indicate its normative indicators and diagnostic value

Chapter II. Lipid metabolism and its regulation.

List of the exam questions:

I. Lipids – definition and classification. List the functions of lipids. Structure and biological role of simple and complex lipids. Basics of biomembrane structure.
2. The digestion and absorption of lipids. Role of bile acids. Steatorrhea.
3. Catabolism of fats and phospholipids (lipolysis) and its regulation. The oxidation of glycerol. Energy balance.
4. Oxidation of fatty acids (saturated, unsaturated and odd-numbered), its energy balance and regulation. Biological role of carnitine.
5. Eicosanoids: classification, basics of metabolism, biological role. Non-steroid anti-inflammatory drugs.
6. Synthesis of fatty acids and its regulation.
7. The synthesis of fats and phospholipids in liver, adipose tissue and intestinal wall, its specific and regulation.
8. Metabolism of ketone bodies, their biological role. Ketosis.
9. Metabolism of cholesterol. Blood plasma lipoproteins. Hyperlipoproteinemias. Atherosclerosis. Liver steatosis.
I0. Sphingomyelins and glycolipids, their biological role. Sphingolipidoses.

Multiple Choice Questions:

1. Stool test detects in the patients feces a large amount of undigested fats.This patient is the most likely to have disturbed secretion of the following enzymes:
A. Pancreatic lipases
B. Pancreatic amylase
C. Pancreatic proteases
D. Bile lipase
E. Gastric protease

2. 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. Triacylglycerol lipase
B. Protein kinase
C. Adenylate kinase
D. Diacylglycerol lipase
E. Pancreatic lipase

3. Blood of the patients with diabetes mellitus shows increased content of free fatty acids. Name the most likely cause of this:
A. Increased activity of adipose triglyceride lipase
B. Accumulation of palmitoyl-CoA in cytosol
C. Activation of ketone bodies utilization
D. Activation of apo-A1, apo-A2, and apo-A4 apolipoprotein synthesis
E. Decreased activity of plasma phosphatidylcholine-cholesterolacyltransferase

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

5. 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. Sphingomyelinase deficiency
B. Glucose-6-phosphatase deficiency
C. Amylo-1,6-glucosidase deficiency
D. Acid lipase deficiency
E. Xanthine oxidase deficiency

6. 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. Sphingomyelinase
B. Glycosyltransferase
C. Sphingosine
D. Ceramides
E. Gangliosides

7. 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. Glucocerebrosidase
A. Hexosaminidase
B. Sphingomyelinase
C. в-Galactosidase
D. Hyaluronidase

8. A diet must include fats. Fats perform plastic function in an organism due to their inclusion in:
A. Cell membranes
B. Cell ion channel
C. Cell ion pumps
D. Cell end-organs
E. Glycocalyx

9. A patient with atherosclerosis has been prescribed Linaetholum containing essential fatty acids. Which of the following acids is an essential part of the preparation?
A. Linolenic
B. Palmitic
C. Crotonic
D. Stearic
E. Oleic

10. For cardiovascular disease prevention the patient was recommended to take vitamin F. What is the chemical nature of this vitamin?
A. Complex of polyunsaturated fatty acids
B. Cholesterol derivative
C. Polysaccharide complex
D. Amino acids complex
E. Carotin derivative

11. Roentgenologically confirmed obstruction of common bile duct resulted in preventing bile from inflowing to the duodenum. What process is likely to be disturbed? A. Fat emulgation
B. Protein absorption
C. Carbohydrate hydrolysis
D. Hydrochloric acid secretion in stomach
E. Salivation inhibition

12. A patient has a gallstone lodged in the common bile duct, which blocks bile supply to the intestine. What digestive process will be disturbed in this case?
A. Fat digestion
B. Protein absorption
C. Carbohydrate digestion
D. Carbohydrate absorption
E. Protein digestion

13. Inhibition of the synthesis of bile acids from cholesterol in liver of an experimental animals has caused maldigestion of lipids. What is the role of these acids in the enteral lipidic metabolism?
A. They emulsify dietary lipids
B. They keep balance of alkaline environment in the intestines
C. They participate in the synthesis of lipids
D. They are part of LDL
E. They activate the formation of chylomicrons

14. In snake venom there is a substance that causes erythrocyte hemolysis, when it is introduced into a human organism. Blood test revealed a large amount of lysolecithin (lysophosphatidylcholine). What enzyme leads to accumulation of lysolecithin in blood? A. Phospholipase A2
B. Phospholipase A1
C. Phospholipase C
D. Phospholipase D
E. Neuraminidase

15. After the consumption of animal food rich in fats, a patient feels 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. Bile acids
B. Fatty acids
C. Chylomicrons
D. Triacylglycerols
E. Phospholipids

16. Fabry's disease (one of sphingolipidoses) is an autosomal recessive disease. Major symptoms of this disease: skin rash, kidney failure, pain in lower extremities. It is caused by a deficiency of:
A. a-Galactosidase A
B. Hexosaminidase A and B
C. Gm1 gangliosidase
D. Galactocerebrosidase
E. Ceraminase

17. 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. Triacylglycerol lipase
B. Lipoprotein lipase
C. Phospholipase A

D. Phospholipase C
E. Cholesterol esterase

18. Essential fatty acids cant by synthesized because mammals do not possess the enzymes for their biosynthesis. Which of the following is an essential fatty acid?
A. Linoleic acid
B. Palmitic acid
C. Oleic acid
D. Steraric
E. Butyric

19. 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. Pancreatic lipase
B. Phospholipase
C. Entcrokinase
D. Amylase
E. Pepsin

20. A 44-year-old woman complains of common weakness, heart pain, considerable increase of body weigt. 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. Increased production of glucocorticoids
B. Decreased production of thyroidal hormones
C. Increased production of insulin
D. Decreased production of glucagon
E. Increased production of mineralocorticoids

21. What compound of lipid nature may contain a carbohydrate moiety and is presented in most cell membranes?
A. Ganglioside GM2
B. Sphingomyelin
C. Phosphatydylserine
D. Cholesterol
E. Leukotrienes

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

23. 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 that release during this process enter blood circulation and are transported by:
A. Serum albumins
B. Globulins
C. HDL
D. LDL
E. Chylomicrons

24. Chose from listed below a hormone, which stimulates the formation of glycogen and triacylglycerols:
A. Insulin
B. Norepinephrine
C. Glucagon
D. Epinephrine
E. Thyroxine

25. In digestion of dietary lipids there is a need of one of the digestive secretions. What secretion listed below takes part in lipids emulsification?
A. Bile
B. Intestinal juice
C. Pancreatic juice
D. Saliva
E. Gastric juice

26. Bile acids are necessary for fat digestion. They are produced in the liver from the next precursor:
A. Cholesterol
B. Protoporphyrin IX
C. Corticosterol
D. Lecithin
E. Arachidonic acid

27. Which one of the following enzymes is NOT involved in the degradation of dietary lipids during digestion?
A. Lipoprotein lipase
B. Pancreatic lipase
C. Gastric lipase
D. Phospholipase A2
E. Cholesterol ester hydrolase

28. Which one of the following substances is an intermediate in the synthesis of both glycerol-containing phospholipids and triacylglycerol?
A. Phosphatidic acid
B. Choline
C. Acetoacetyl CoA
D. CDP-Ethanolamine
E. 3-Hydroxyburyrate

29. In adipose tissue, glycerol-3-phosphate required for the synthesis of triglycerides comes mainly from:
A. Dihydroxyacetone phosphate formed in glycolysis

B. Hydrolysis of pre-existing triglycerides
C. Free glycerol
D. Hydrolysis of phospholipids
E. -

30. In patients suffering from diabetes mellitus an increase in a content of non esterified fatty acids in blood is observed. It may be caused by:
A. Increase in activity of triacylglycerol lipase
B. Stimulation of ketone bodies utilization
C. Activation of synthesis of apolipoproteins A1 , A2, A3
D. Decrease in activity of phosphatidylcholine-cholesterol-acyltransferase in blood plasma
E. Accumulation in cytosol of palmitoyl-CoA

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

32. After consumption of lipids in the body than begins their digestion and absorption in intestines. What products of lipid hydrolysis are absorbed in the intestine?
A. Monoacylglycerol, fatty acids
B. Amino acids
C. Polypeptides
D. Monosacharides
E. Lipoproteins

33. Lipids have a lot of important functions. What definition will the best describe triacylglycerols?
A. In the average individual, represent sufficient energy to sustain life for several weeks
B. Would be expected to be good emulsifying agents
C. Yield about the same amount of ATP on complete oxidation as would an equivalent weight of glycogen
D. Are stored as hydrated molecules
E. Are generally negatively charged molecules at physiological pH

34. Phospholipids are representatives of lipids. All of the following statements describe phosphoglycerides EXCEPT:
A. They are a major store of metabolic energy
B. They are both amphipathic and amphoteric
C. They arise from glycerol-3-phosphate
D. They are found in cell membranes
E. They contain two fatty acid moieties

35. Cell membrane is built of lipids, proteins and glycosides. Phospholipids are important cell membrane components because:
A. They have both polar and non polar portions
B. They have glycerol
C. They can form bilayers in water
D. They combine covalently with proteins
E. They consist of fatty acids

36. Fatty acids, waxes, sterols, fat-soluble vitamins, glycerids and phospholipids are classified as lipids. They have the following properties:
A. All of these
B. Insoluble in water and soluble in fat solvent
C. High energy content
D. Structural component of cell membrane
E. Precursors in biosynthesis of prostaglandins

37. Reserve fat is accumulated in adipose tissue. Indicate which from listed below disorders of lipid metabolism occur in fat tissue:
A. Obesity
B. Steatorrhea
C. Ketosis
D. Retention hyperlipemia
E. Fatty infiltration of liver

38. Some hormones regulate lipid metabolism. Hepatic lipogenesis is stimulated by:
A. Insulin
B. cAMP
C. Glucagon
D. Epinephrine
E. Cortisol

39. Lipids are digested in duodenum by pancreatic juice and bile. Pancreatic lipase converts triacylglycerols into:
A. 2-Monoacylglycerol
B. 2,3-Diacylglycerol
C. 1-Monoacylglycerol
D. 3-Monoacylglycerol
E. 1,3-Diacylglycerol

40. Human body accumulates fat in adipose tissue and liver. Lipids are stored mainly in the form of:
A. Triglycerides
B. Glycolipids
C. Phospholipids
D. Fatty acids
E. Steroids

41. Fatty acids, waxes, sterols, fat-soluble vitamins, glycerids and phospholipids are classified as lipids. Waxes contain higher alcohols named as:
A. Cetyl
B. Methyl
C. Ethyl
D. Phytyl
E. Propionyl

42. Synthesis and catabolism of lipids actively take place in adipose tissue, which lacks:
A. Glycerol kinase
B. Hormone-sensitive lipase
C. cAMP-dependent protein kinase
D. Glycerol-3-phosphate dehydrogenase
E. -

43. Lipids in adipose tissue are broken down to fatty acids and glycerol. Free fatty acids are transported in the blood:
A. Combined with albumin
B. Combined with fatty acid binding protein
C. Combined with в-lipoprotein
D. In unbound free salts
E. Combined with globulin

44. Lecithin has amphiphilic properties, which means both hydrophilic and lipophilic. The nitrogenous base in lecithin is:
A. Choline
B. Ethanolamine
C. Serine
D. Betaine
E. Alanine

45. Human body accumulates fat as a source of energy and thermoisolative substance. Lipid stores are mainly present in:
A. Adipose tissue
B. Liver
C. Brain
D. Muscles
E. Kidneys

46. Lipids are digested in duodenum by pancreatic juice and bile. Co-lipase is also necessary and is a:
A. Protein
B. Vitamin
C. Bile salt
D. Phospholipid
E. Amino acid

47. Hexosaminidase A is an enzyme involved in the hydrolysis of terminal N-acetyl-D- hexosamine residues in N-acetyl-e-D-hexosaminides and is deficient in:
A. Tay-Sachs disease
B. Gaucher's disease
C. Niemann-Pick disease
D. Fabry's disease
E. Gierke disease

48. Glycerol released from adipose tissue by hydrolysis of triglycerides is mainly:
A. Taken up by liver
B. Taken up by extrahepatic tissues
C. Reutilised in adipose tissue
D. Excreted from the body
E. -

49. Sphingolipidoses are a class of lipid storage disorders relating to sphingolipid metabolism. Mental retardation occurs in:
A. All of these
B. Tay-Sachs disease
C. Gaucher's disease
D. Niemann-Pick disease
E. None of these

50. Free glycerol cannot be used for triglyceride synthesis, because it has to be phosphorylated first by glycerol kinase, which is absent in:
A. Adipose tissue
B. Liver
C. Kidney
D. Intestine

51. Physical examination of a 16-year-old boy, who came to the clinic for a routine visit, reveals small reddish-black papules on the abdomen and scrotum, intermittent paresthesias in the digits bilaterally and heat intolerance. These findings indicate Fabry disease - X-linked recessive lysosomal storage disease, caused by deficiency of *a-* galactosidase A. Which of the following substances is most likely to be elevated in this patient's vascular endothelium?
A. Ceramide trihexoside
B. Galactocerebroside
C. Glucocerebroside
D. Lactosyl cerebroside
E. Sphingomyelin

52. A 2-year-old girl brought to the clinic because she has recently developed muscle weakness and is having difficulty walking. A peripheral nerve biopsy reveals histologic evidence of demyelination and macrophages with prominent reddish-pink vacuoles in the cytoplasm after straining with toluidine blue (metachromasia). Metachromasia is caused by accumulation of sulfatides, mainly cerebroside sulfate. This patient has a deficiency of which of the following enzymes?

A. Arylsulfatase A
B. a-Galactosidase A
C. в-Hexosaminidase A
D. Galactocerebrosidase
E. Glucocerebrosidase
F. Iduronate sulfatase
G. Sphingomyelinase

53.'Drying oil', oxidized spontaneously by atmospheric oxygen at ordinary temperature and forms a hard water proof material is
A. Coconut oil
B. Peanut oil
C. Rape seed oil
D. Linseed oil

54.A complete absence of fecal urobilinogen is strongly suggestive of
A. Obstruction of bile duct
B. Hemolytic jaundice
C. Intrahepatic cholestasis
D. Malignant obstructive disease

55.A mixture of conjugated and unconjugat¬ed bilirubin is found in the circulation in
A. Hemolytic jaundice
B. Hepatic jaundice
C. Obstructive jaundice
D. Post hepatic jaundice

56.A test to evaluate detoxifying function of liver is
A. Serum albumin\: globulin ratio
B. Galactose tolerance test
C. Hippuric acid test
D. Prothrombin time

57.Absence of phenylalanine hydroxylase causes
A. Neonatal tyrosinemia
B. Phenylketonuria
C. Primary hyperoxaluria
D. Albinism

58.All of the following statements about generalized gangliosidosis are true except
A. It results from deficiency of GM1-[J>- Gangliosidase
B. Breakdown of GM1 ganglioside is impaired
C. GM2 ganglioside accumulates in liver and elsewhere
D. It leads to mental retardation

59.All the following statements about brown adipose tissue are true except
A. It is rich in cytochromes
B. It oxidizes glucose and fatty acids
C. Oxidation and phosphorylation are tightly coupled in it
D. Dinitrophenol has no effect on it

60.All the following statements about obstructive jaundice are true except
A. Conjugated bilirubin in serum is normal
B. Total bilirubin in serum is raised
C. Bile salts are present in urine
D. Serum alkaline phosphatase is raised

61.Amount of phenylacetic acid excreted in the urine in phenylketonuria is
A. 100-200 mg/dL
B. 200-280 mg/dL
C. 290-550 mg/dL
D. 600-750 mg/dL

62.An enzyme required for the synthesis of ketone bodies as well as cholesterol is
A. Acetyl CoA carboxylase
B. HMG CoA synthetase
C. HMG CoA reductase
D. HMG CoA lyase

63.An enzyme which is excreted in urine is
A. Lactase dehydrogenase
B. Amylase
C. Ornithine transcarbamoylase
D. None of these

64.An important feature of maple syrup urine disease is
A. Patient can not be treated by dietary regulation
B. Without treatment death, of patient may occur by the end of second year of life
C. Blood levels of leucine, isoleucine and serine are increased
D. Excessive brain damage

65.An important feature of Zellweger's syndrome is
A. Hypoglycemia
B. Accumulation of phytanic acid in tissues
C. Skin eruptions
D. Accumulation of C26-C38 polyenoic acid in brain tissues

66.An important finding in glycinuria is
A. Excess excretion of oxalate in the urine
B. Deficiency of enzyme glycinase
C. Significantly increased serum glycine level
D. Defect in renal tubular reabsorption of glycine

67.An important finding in Histidinemia is
A. Impairment of conversion of a-Glutamate to a-ketoglutarate
B. Speech defect
C. Decreased urinary histidine level
D. Patients can not be treated by diet

68.An important finding of Fabry's disease is
A. Skin rash
B. Exophthalmos

C. Hemolytic anemia
D. Mental retardation

69. As a result of each oxidation a long chain fatty acid is cleaved to give
A. An acid with 3-carbon less and propionyl CoA
B. An acid with 2-carbon less and acetyl CoA
C. An acid with 2-carbon less and acetyl CoA
D. An acid with 4-carbon and butyryl CoA

70. At normal levels of creatinine in the blood, this metabolite is
A. Filtered at the glomerulus but not secreted nor reabsorbed by the tubule
B. Secreted by the tubule
C. Reabsorbed by the tubule
D. Secreted and reabsorbed by tubule

71. Biological functions of lipids include
A. Source of energy
B. Insulating material
C. Maintenance of cellular integrity
D. All of these

72. C22 and C24, fatty acids required for the synthesis of sphingolipids in brain are formed by
A. De novo synthesis
B. Microsomal chain elongation
C. Mitochondrial chain elongation
D. All of these

73. Carnitine acylcarnitine translocase is present
A. In the inner mitochondrial membrane
B. In the mitochondrial matrix
C. On the outer surface of inner mitochondrial membrane
D. On the inner surface of inner mitochondrial membrane

74. Carnitine is required for the transport of
A. Triglycerides out of liver
B. Triglycerides into mitochondria
C. Short chain fatty acids into mitochondria
D. Long chain fatty acids into mitochondria

75. Carnitine is synthesized from
A. Lysine and methionine
B. Glycine and arginine
C. Aspartate and glutamate
D. Proline and hydroxyproline

76. Cephalin consists of
A. Glycerol, fatty acids, phosphoric acid and choline
B. Glycerol, fatty acids, phosphoric acid and ethanolamine
C. Glycerol, fatty acids, phosphoric acid and inositol
D. Glycerol, fatty acids, phosphoric acid and serine

77. Cerebonic acid is present in
A. Triglycerides
B. Cerebrosides
C. Esterified cholestrol
D. Sphingomyelin

78. Cerebronic acid is present in
A. Glycerophospholipids
B. Sphingophospholipids
C. Galactosyl ceramide
D. Gangliosides

79. Characteristic finding in Gaucher's disease is
A. Night blindness
B. Renal failure
C. Hepatosplenomegaly
D. Deafness

80. Cholesterol circulates in blood stream chiefly as
A. Free cholesterol
B. Ester cholesterol
C. Low density lipoproteins
D. Low density lipoproteins and high density lipoproteins

81. Current concepts concerning the intestinal absorption of triacylglycerols are that
A. They must be completely hydrolysed before the constituent fatty acids can be absorbed
B. They are hydrolysed partially and the material absorbed consists of free fatty acids, mono and diacyl glycerols and unchanged triacyl glycerols
C. Fatty acids with less than 10 carbon atoms are absorbed about equally via lymph and via portal blood
D. In the absence of bile the hydrolysis of triacyl glycerols is absorbed

82. Deterioration of food (rancidity) is due to presence of
A. Cholesterol
B. Vitamin E
C. Peroxidation of lipids
D. Phenolic compounds

83. Excretion of phenolsulphanpthalein (PSP) reflects
A. Glomerulonephritis
B. Maximaltabular excretory capacity
C. Filtration factor
D. Renal plasma flow

84. Fat depots are located in
A. Intermuscular connective tissue
B. Mesentary
C. Omentum
D. All of these

85. Fatty acids can not be converted into carbohydrates in the body, as the following reaction is not possible\:
A. Conversion of glucose-6-phosphate into glucose
B. Fructose 1, 6 diphosphate to fructose-6- phosphate
C. Transformation of acetyl CoA to pyruvate
D. Formation of acetyl CoA from fatty acids

86.Fecal urobilinogen is decreased in
A. Obstruction of biliary duct
B. Hemolytic jaundice
C. Excess fat intake
D. Low fat intake

87.Galactose intolerance can occur in
A. Haemolytic jaundice
B. Hepatocellular jaundice
C. Obstructive jaundice
D. None of these

88.Gaucher's disease is due to deficiency of the enzyme\:
A. Sphingomyelinase
B. Glucocerebrosidase
C. Galactocerbrosidase
D. в—Galactosidase

89.Glomerular filtration rate can be measured by
A. Endogenous creatinine clearance
B. Para-aminohippurate test
C. Addis test
D. Mosenthal test

90.Glycosphingolipids are a combination of
A. Ceramide with one or more sugar residues
B. Glycerol with galactose
C. Sphingosine with galactose

91.Hepatocellular jaundice as compared to pure obstructive type of jaundice is char¬acterized by
A. Increased serum alkaline phosphate, LDH and ALT
B. Decreased serum alkaline phosphatase, LDH and ALT
C. Increased serum alkaline phosphatase and decreased levels of LDH and ALT
D. Decreased serum alkaline phosphatase and increased serum LDH and ALT

92.Hexosaminidase A is deficient in
A. Tay-Sachs disease
B. Gaucher's disease
C. Niemann-Pick disease
D. Fabry's disease

93.Hippuric acid is formed from
A. Benzoic acid and alanine
B. Benzoic acid glycine
C. Glucuronic acid and alanine
D. Glucuronic acid and glycine

94.HMG CoA is formed in the metabolism of
A. Cholesterol, ketones and leucine
B. Cholesterol, fatty acid and Leucine
C. Lysine, Lecuine and Isoleucine
D. Ketones, Leucine and Lysine

95.Impaired galactose tolerance test suggests
A. Defect in glucose utilisation
B. Liver cell injury
C. Renal defect
D. Muscle injury

96.In mammals, the major fat in adipose tissues is
A. Phospholipid
B. Cholesterol
C. Sphingolipids
D. Triacylglycerol

97.In the extra mitochondrial synthesis of fatty acids, CO2 is utilized
A. To keep the system anaerobic and prevent regeneration of acetyl CoA
B. In the conversion of malonyl to CoA hydroxybutyryl CoA
C. In the conversion of acetyl CoA to malonyl CoA
D. In the formation of acetyl CoA from 1 carbon intermediates

98.Increased serum ornithine carabamoyl transferase activity is diagnostic of
A. Myocardial infarction
B. Hemolytic jaundice
C. Bone disease
D. Acute viral hepatitis

99.Increased urinary indole acetic acid is diagnostic of
A. Maple syrup urine disease
B. Hartnup disease
C. Homocystinuia
D. Phenylketonuria

100. Ketosis in partly ascribed to
A. Over production and Glucose
B. Under production of Glucose
C. Increased carbohydrate utilization
D. Increased fat utilization

101. Lecithins are composed of
A. Glycerol + Fatty acids + Phosphoric acid + Choline
B. Glycerol + Fatty acids + Phosphoric acid + Ethanolamine
C. Glycerol + Fatty acids + Phosphoric acid + Serine
D. Glycerol + Fatty acids + Phosphoric acid + Beaine

102. Lipids have the following properties\:
A. Insoluble in water and soluble in fat solvent
B. High energy content
C. Structural component of cell membrane
D. All of these

103. Lipoprotiens may be identified more accurately by means of
A. Electrophoresis
B. Ultra centrifugation
C. Centrifugation

D. Immunoelectrophoresis

104. Long chain fatty acids penetrate the inner mitochondrial membrane
A. Freely
B. As acyl-CoA derivative
C. As carnitine derivative
D. Requiring Na dependent carrier

105. Lovastatin and mevastatin lower
A. Serum triglycerides
B. Serum cholesterol
C. Serum phospholipids
D. All of these

106. Lovastatin is a
A. Competitive inhibitor of acetyl CoA carboxylase
B. Competitive inhibitor of HMG CoA synthetase
C. Non-competitive inhibitor of HMG CoA reductase
D. Competitive inhibitor of HMG CoA reductase

107. Mental retardation occurs in
A. Tay-Sachs disease
B. Gaucher's disease
C. Niemann-Pick disease
D. All of these

108. Mitochondrial thiokinase acts on
A. Short chain of fatty acids
B. Medium chain fatty acids
C. Long chain fatty acids
D. All of these

109. NADPH is produced when this enzyme acts
A. Pyruvate dehydrogenase
B. Malic enzyme
C. Succinate dehydrogenase
D. Malate dehydrogenase

110. Ochronosis is an important finding of
A. Tyrosinemia
B. Tyrosinosis
C. Alkaptonuria
D. Richner Hanhart syndrome

111. Oliguria can occur in
A. Diabetes mellitus
B. Diabetes insipidus
C. Acute glomerulonephritis
D. Chronic glomerulonephritis

112. Plasma tyrosine level in Richner-Hanhart syndrome is
A. 1-2 mg/dL
B. 2-3 mg/dL
C. 4-5 mg/dL
D. 8-10 mg/dL

113. Propionyl CoA is formed on oxidation of
A. Monounsaturated fatty acids
B. Polyunsaturated fatty acids
C. Fatty acids with odd number of carbon atoms
D. None of these

114. Prothrombin is synthesised in
A. Erythrocytes
B. Reticulo-endothelial cells
C. Liver
D. Kidneys

115. Prothrombin time remains prolonged even after parenterals administration of vitamin K in
A. Haemolytic jaundice
B. Liver damage
C. Biliary obstruction
D. Steatorrhoea

116. Richner-Hanhart syndrome is due to defect in
A. Tyrosinase
B. Phenylalanine hydroxylase
C. Hepatic tyrosine transaminase
D. Fumarylacetoacetate hydrolase

117. Saliva contains a lipase which acts on triglycerides having
A. Short chain fatty acids
B. Medium chain fatty acids
C. Long chain fatty acids
D. All of these

118. Salivary lipase converts dietary trigly¬cerides into
A. Diglycerides and fatty acids
B. Monoglycerides and fatty acids
C. Glycerol and fatty acids
D. All of these

119. Salivary lipase hydrolyses the ester bond at
A. Position 1 of triglycerides
B. Position 2 of triglycerides
C. Position 3 of triglycerides
D. All of these

120. Salivary lipase is secreted by
A. Parotid glands
B. Sub-maxillary glands
C. Dorsal surface of tongue
D. None of these

121. Saponification number is
A. mg of KOH required to saponify one gm of fat or oil
B. mg of KOH required to neutralize free fatty acids of one gms of fat
C. mg of KOH required to neutralize the acetic acid obtained by saponification of one gm of fat after it has been acetylated
D. None of these

122. Serum gamma glutamyl transpeptidase is raised in
A. Haemolytic jaundice
B. Myocardial infarction
C. Alcoholic hepatitis
D. Acute cholecystitis

123. Sphingomyelins are composed of fatty acids, phosphoric acid and
A. Sphingosine and choline
B. Glycerol and sphingosine
C. Glycerol and Serine
D. Glycerol and Choline

124. The ability of liver to remove a dye like BSP from the blood suggests a normal
A. Excretory function
B. Detoxification function
C. Metabolic function
D. Circulatory function

125. The best known and most frequently used test of the detoxicating functions of liver is
A. Hippuric acid test
B. Galactose tolerance test
C. Epinephrine tolerance test
D. Rose Bengal dye test

126. The enzymes of в-oxidation are found in
A. Mitochondria
B. Cytosol
C. Golgi apparatus
D. Nucleus

127. The filtration factor is decreased in
A. Glomerulonephritis
B. Early essential hypertension
C. Malignant phase of hypertension
D. Starvation

128. The filtration factor is increased in
A. Glomerulonephritis
B. Malignant phase of hypertension
C. Early essential hypertension
D. Acute nephritis

129. The free fatty acids in blood are
A. Stored in fat depots
B. Mainly bound to в-lipoproteins
C. Mainly bound to serum albumin
D. Metabolically most inactive

130. The major storage form of lipids is
A. Esterified cholesterol
B. Glycerophospholipids
C. Triglycerides
D. Sphingolipids

131. The number of ml of N/10 KOH required to neutralize the fatty acids in the distillate from 5 gm of fat is called
A. Reichert-Meissel number
B. Polenske number
C. Acetyl number
D. Non volatile fatty acid number

132. The polysaccharide insulin is
A. Filtered at the glomerulus but neither secreted nor reabsorbed by the tubule
B. Filtered at the glomerulus and secreted by the tubule
C. Filtered at the glomerulus and reabsorbed by the tubule
D. Filtered at the glomerulus, secreted and reabsorbed by the tubule

133. The presence of bilirubin in the urine without urobilinogen suggests
A. Obstructive jaundice
B. Hemolytic jaundice
C. Pernicious anemia
D. Damage to the hepatic parenchyma

134. This interferes with cholesterol absorption
A. Lipoprotein lipase
B. Creatinase
C. 7-dehydrocholesterol
D. в-sitosterol

135. Triglycerides are
A. Heavier than water
B. Major constituents of membranes
C. Non-polar
D. Hydrophilic

136. Tyrosinosis is due to defect in the enzyme\:
A. Fumarylacetoacetate hydrolase
B. p-Hydroxyphenylpyruvate hydroxylase
C. Tyrosine transaminase
D. Tyrosine hydroxylase

137. Urea clearance is lowered in
A. Acute nephritis
B. Pneumonia
C. Early stage of nephritic syndrome
D. Benign hypertension

138. Which of the following can be oxidized by в-oxidation pathway?
A. Saturated fatty acids
B. Monosaturated fatty acids
C. Polyunsaturated fatty acids
D. All of these

139. Which of the following lipid is absorbed actively from intestines?

A. Glycerol
B. Cholesterol
C. Monoacylglycerol
D. None of these

140. One of the factors that cause obesity is the inhibition of fatty acids oxidation due to: A. Low carnitine content
B. Impaired phospholipid synthesis
C. Excessive consumption of fatty foods
D. Choline deficiency
E. Lack of carbohydrates in the diet

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

142. A patient during fasting developed ketoacidosis as a result of increased fatty acids decomposition. This decomposition can be inhibited with:
A. Insulin
B. Glucagon
C. Adrenaline
D. Thyroxin
E. Cortisol

143. A patient with diabetes mellitus has been delivered to a hospital unconscious. BP is low, Kussmaul's respiration is observed, the smell of acetone can be detected from the patient's mouth. What mechanism is leading in the coma development in this case?
A. Accumulation of ketone bodies in blood
B. Accumulation of potassium ions
C. Accumulation of sodium ions
D. Accumulation of chlorine ions
E. Accumulation of urea

144. Fatty acids arrive into mitochondria, and there their oxidation occurs. Name the vitamin-like substance that takes part in transportation of fatty acids through mitochondrial membrane:
A. Carnitine
B. Choline
C. Biotin
D. Pantothenic acid
E. Folic acid

145. Hydrolysis reaction will NOT occur with:
A. Glycerol
B. Starch
C. Cellulose
D. Fat
E. Protein

146. Intracellular metabolism of glycerol starts with its activation. What compound is formed in the fi- rst reaction of its conversion?
A. a-Glycerolophosphate
B. Pyruvate
C. Lactate
D. Choline
E. Acetyl coenzyme A

147. Fatty acids synthesis occurs in human body. What compound is initial in this process?
A. Acetyl coenzyme A
B. Vitamin C
C. Glycine
D. Succinate
E. Cholesterol

148. Lipids are obvious energetic material for the body. What is the main pathway of fatty acids metabolism in mitochondria?
A. в—Oxidation
B. Decarboxylation
C. Reduction
D. a-Oxidation
E. Y—Oxidation

149. Appearance of sugar and ketone bodies is revealed in the patient's urine. Blood glucose concentration is 10,1 mM/l. What is a presumptive diagnosis of the patient?
A. Diabetes mellilus
B. Atherosclerosis
C. Toxic hepatitis
D. Pancreatitis
E. Myocardial infarction

150. 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 urine. Diffuse changes in myocardium are marked on the electrocardiogram. Make an assumptive diagnosis of the illness.
A. Diabetes mellitus
B. Alimentary hyperglycemia
C. Acute pancreatitis
D. Diabetes insipidus
E. Ischemic cardiomyopathy

151. In a 57-year-old patient, suffering from diabetes mellitus, ketoacidosis has been developed. Biochemical background of this status is decrease in utilization of acetyl- CoA due to a deficiency of:

A. Oxaloacetate
B. 2-Oxoglutarate
C. Glutamate
D. Aspartate
E. Succinate

152. A condition called «diabetic ketoacedosis» is caused by a lack of insulin leading to a build-up of ketoacids. Excessive ketone bodies are formed by the biochemical imbalance in uncontrolled or poorly managed diabetes. Which compounds are called ketone bodies?
A. Acetoacetate, в-hydroxybulyrate, and acetone
B. Aspartate, pyruvate
C. a-Ketoglutarate, malate, sussinate
D. Acyl-CoA, malonyl-CoA
E. Cholic and deoxycholic acid

153. 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. Glucose, ketone bodies
B. Protein, amino acid
C. Protein, creatine
D. Bilirubin, urobilin
E. E. Sodium, potassium

154. Under diabetes mellitus, the level of ketone bodies in blood dramatically rises, which results in the development of metabolic acidosis. What substance is the precursor of the ketone bodies synthesis?
A. Acetyl-CoA
B. Succinyl-CoA
C. Propionyl-CoA
D. Malonyl-CoA
E. Methylmalonyl-CoA

155. A patient manifests ketonuria. What disease is recognized by the augmented concentration of ketone bodies in his urine?
A. Diabetes mellitus
B. Acute glomerular inflammation
C. Urolithiasis
D. Tuberculosis of the kidney
E. Myocardial infarction

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

157. 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. Transport of fatty acids into mitochondria
B. Ketone bodies synthesis
C. Lipids synthesis
D. Tissue respiration
E. Steroid hormones synthesis

158. Lipids are the most valuable energetic material for an organism. What is the main pathway of fatty acids metabolism in cell mitochondria?
A. в-oxidation
B. Decarboxylation
C. Reduction
D. a-oxidation
E. Y-oxidation

159. The intermediates in fatty acid synthesis are linked to acyl carrier protein (ACP), a component of fatty acid synthase. The prosthetic group of ACP is:
A. Phosphopantetheine
B. Methionine
C. Thiamine
D. Biotin
E. Cobalamin

160. 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. Transport of fatty acids into mitochondria
B. Regulation of the level of Ca^{2+} in mitochondria
C. Substrate level of phosphorylation
D. Utilization of lactate
E. Synthesis of actin and myosin

161. 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. Transport of FFA (free fatty acids) from cytosol to the mitochondria
B. Transport of FFA from fat depots to the tissues
C. It takes part in one of reactions of FFA beta-oxidation
D. FFA activation
E. Activation of intracellular lipolysis

162. Patients who suffer from severe diabetes and don't receive insulin have metabolic acidosis. This is caused by increased concentration of the following metabolites:
A. Ketone bodies
B. Fatty acids

C. Unsaturated fatty acids
D. Triacylglycerols
E. Cholesterol

163. One functional subunit of multi-enzyme complex for de novo synthesis of fatty acids contains:
A. Two -SH groups
B. One -SH group
C. Three -SH groups
D. Four -SH groups
E. Five -SH groups

164. The enzyme acyl-CoA synthase catalyses the conversion of a fatty acid of an active fatty acid in the presence of:
A. ATP
B. ADP
C. AMP
D. GTP
E. UDP

165. Patients who suffer from severe diabetes and don't receive insulin have metabolic acidosis. This is caused by increased concentration of the following metabolites: A. Ketone bodies
B. Fatty acids
C. Unsaturated fatty acids
D. Triacylglycerols
E. Cholesterol

166. In diabetes mellitus and starvation there is an increase of ketone bodies content in blood, which are utilized as energetic material by tissues. Note the substance which is used in ketone bodies synthesis.
A. Acetyl-CoA
B. Citrate
C. Succinyl-CoA
D. a-Ketoglutarate
E. Malate

167. In a patient suffering from diabetes mellitus in blood was detected acetone. Note the process of its production in the body:
A. By condensation of two molecules of acetyl-CoA
B. In course of a-oxidation of fatty acids
C. In course of в-oxidation of fatty acids
D. In course of Y-oxidation of fatty acids
E. In tricarboxylic acid cycle.

168. During the prolonged starvation in blood of a person an increase in ketone bodies content occurs. It is caused by the next factors:
A. Production of acetyl-CoA
B. Decrease of free fatty acid level in blood plasma
C. Mobilization of high density lipoproteins
D. Enhancement of fatty acids biosynthesis in liver
E. Decrease of triacylglycerols in adipose tissue

169. What process of lipid metabolism requires a protein with covalently bound prosthetic group derived from pantothenic acid?
A. Fatty acid biosynthesis
B. в-Oxidation of fatty acids
C. Utilization of ketone bodies
D. Bile acid synthesis from cholesterol
E. Utilization of LDL

170. The removal of two-carbon units from a fatty acyl coenzyme A (fatty acyl-CoA) involves four sequential reactions. Which of the following best describes the reaction sequence?
A. Dehydrogenation, hydratation, dehydrogenation, cleavage
B. Oxidation, dehydration, oxidation, cleavage
C. Reduction, dehydration, reduction, cleavage
D. Hydrogenation, dehydration, hydrogenation, cleavage
E. Reduction, hydration, dehydrogenation, cleavage

171. Acetyl-CoA carboxylase regulates fatty acid synthesis by which of the following mechanism?
A. All of these
B. Covalent modification
C. Induction and repression
D. Allosteric regulation
E. None of these

172. Propionyl CoA formed from the oxidation of fatty acids having an odd number of carbon atoms is converted into:
A. *D*-Methylmalonyl CoA
B. Acetoacetyl CoA
C. Acetyl CoA
D. Butyryl CoA
E. Acety lCoA

173. What process of lipid metabolism requires a protein with covalently bound prosthetic group derived from pantothenic acid?
A. Fatty acid biosynthesis
B. в-Oxidation of fatty acids
C. Utilization of ketone bodies
D. Bile acid synthesis from cholesterol
E. Utilization of LDL

174. An experimental animal has been given excessive amount of carbon-labeled glucose for a week. What compound can the label be found in?
A. Palmitic acid
B. Methionine

C. Vitamin A
D. Choline
E. Arachidonic acid

175. Essential fatty acids cant by synthesized because mammals do not possess the enzymes for their biosynthesis. Which of the following is an essential fatty acid:
A. Linoleic acid
B. Palmitic acid
C. Oleic acid
D. Steraric
E. Butyric

176. Which of the following is required as a reductant in fatty acid synthesis?
A. NADPH2
B. NADH2
C. FADH2
D. FMNH2
E. FAD

177. Carnitine is a vitaminoid, which takes part in lipids metabolism. It is required for the transport of:
A. Long chain fatty acids into mitochondria
B. Triglycerides into mitochondria
C. Short chain fatty acids into mitochondria
D. Triglycerides out of liver
E. Glycerol into cytosol

178. в-Oxidation of fatty acids provides organism with energy. The enzymes of в- oxidation are found in:
A. Mitochondria
B. Cytosol
C. Golgi apparatus
D. Nucleus
E. Microsomes

179. в-Oxidation of fatty acidsis a cyclic process. During each cycle of в-oxidation:
A. Two carbon atoms are removed from the carboxyl end of the fatty acid
B. One carbon atom is removed from the methyl end of the fatty acid
C. One carbon atom is removed from the carboxyl end of the fatty acid
D. Two carbon atoms are removed from the methyl end of the fatty acid
E. Three carbon atom is removed from the methyl end of the fatty acid

180. NADPH2 is required for fatty acid synthesis and can come from:
A. Hexose monophosphate shunt
B. Oxidative decarboxylation of malate
C. Extramitochondrial oxidation of isocitrate
D. Citric acid cycle
E. All of these

181. Citrate stimulates fatty acid synthesis by all of the following EXCEPT:
A. Participating in the production of ATP
B. Allosterically activating acetyl-CoA carboxylase
C. Providing a mechanism to transport acetyl CoA from the mitochondria to the cytosol
D. Participating in a pathway that ultimately produces CO2 and NADPH in the cytosol
E. E. -

182. *De novo* synthesis and oxidation of fatty acids differ in the following respect:
A. Synthesis occurs in cytosol and oxidation in mitochondria
B. Synthesis is decreased and oxidation increased by insulin
C. NADH is required in synthesis and FAD in oxidation
D. Malonyl CoA is formed during oxidation but not during synthesis
E. -

183. *De novo* synthesis of fatty acids requires all of the following substances EXCEPT:
A. NADH
B. NADPH
C. Panthothenic acid
D. ATP
E. Biotin

184. Carnitine is a vitaminoid, which transports fatty acids into mitochondria and is synthesized from:
A. Lysine and methionine
B. Glycine and arginine
C. Aspartate and glutamate
D. Proline and hydroxyproline
E. Lysine and arginine

185. в-Oxidation of fatty acids provides organism with ATP and requires all the following coenzymes EXCEPT:
A. NADP
B. FAD
C. NAD
D. CoA
E. -

186. Carboxylation of acetyl-CoA to malonyl-CoA takes place in the presence of a special coenzyme of carboxylases, which is:
A. Biotin
B. FAD
C. NAD^+
D. $NADP^+$
E. GTP

187. Malonyl-CoA provides 2-carbon units to fatty acids and reacts with the next group of acyl carrier protein:
A. -SH group
B. -NH2 group
C. -COOH group
D. -CH2OH group
E. -OH group

188. Propionyl CoA consists of 3 carbon atoms and is formed on oxidation of:
A. Fatty acids with odd number of carbon atoms
B. Polyunsaturated fatty acids
C. Monounsaturated fatty acids
D. Fatty acids with even number of carbon atoms
E. None of these

189. Carnitine takes part in lipids metabolism. What process cannot occur in the absence of carnitine?
A. в-Oxidation of fatty acids
B. Cleavage of triacylglycerol
C. Utilization of ketone bodies
D. Fatty acid biosynthesis
E. Biosynthesis of prostaglandins

190. A 4-year-old child is brought to the physician because of delayed growth. The mother also states that the child is unsteady on his feet and cannot properly use eating utensils. Physical exam reveals the boy demonstrates signs of muscle hypotonia. The physician diagnoses a deficiency in acetyl-CoA carboxylase. Which of the following is likely to be deficient in this patient?
A. Malonyl-coenzyme A
B. Glycerol-3-phosphate
C. Ketone bodies
D. NADPH2
E. S-adenosylmethionine

191. A 10-year-old boy presents with progressive neurologic and dermatologic symptoms. His mother says he has a progressively worsening staggering gait, he has thick, dry and scaly skin. The patient also reports that he has been having difficulty with his sense of smell. During a thorough physical examination, visual acuity testing reveals bilateral deficits; a sensorineural hearing loss is also identified. A nerve conduction study shows delayed action potential propagation. Diagnostic testing reveals an accumulation of phytanic acid within multiple tissues, including the epidermal layer of skin. These findings suggest Refsum disease - disease caused by deficiency of special enzymes, which are shortening very-long-chain fatty acids into long-chain fatty acids, which will be metabolized via в-oxidation later. A disorder in which of the following organelles is most likely causing this patient's symptoms?
A. Peroxisomes
B. Endoplasmic reticulum
C. Endosomes
D. Mitochondria
E. Cytoskeleton
F. Ribosomes

192. Increased HDL levels decrease the risk of atherosclerosis. What is the mechanism of HDL anti-atherogenic action?
A. They remove cholesterol from tissues
B. They supply tissues with cholesterol
C. They are involved in the breakdown of cholesterol
D. They activate the conversion of cholesterol to bile acids
E. They promote absorption of cholesterol in the intestine

193. 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. Low-density lipoproteins
B. Chylomicrons
C. Very low-density lipoproteins
D. High-density lipoproteins
E. Intermediate-density lipoproteins

194. 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. Low-density lipoproteins
B. High-density lipoproteins
C. Chylomicrons
D. Very low-density lipoproteins
E. Middle-density lipoproteins

195. A 67-year-old man 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 IIa
B. Hyperlipoproteinemia type I
C. Hyperlipoproteinemia type IIb
D. Hyperlipoproteinemia type IV
E. Cholesterol, hyperlipoproteinemia

196. A dry-cleaner's worker has been found to have hepatic steatosis. This pathology can be caused by disruption of synthesis of the following substance:
A. Phosphatidylcholine
B. Tristearin
C. Urea
D. Phosphatidic acid

E. Cholic acid

197. 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. Methionine
B. Ascorbic acid
C. Glucose
D. Glycerol
E. Citrate

198. 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. Triacylglycerol lipase
B. Protein kinase
C. Adenylate kinase
D. Diacylglycerol lipase
E. Monoacylglycerol lipase

199. During metabolic process active forms of the oxygen including superoxide anion radical are formed in the human body. With help of what enzyme is this anion activated? A. Superoxide dismutase
B. Catalase
C. Peroxidase
D. Glutathione peroxidase
E. Glutathione reductase

200. A 67-year-old patient has atherosclerosis of cardiac and cerebral vessels. Examination revealed hyperlipidemia. What class of blood plasma lipoproteids is most important in atherosclerosis pathogenesis?
A. Low-density lipoproteids
B. Chylomicrons
C. a-lipoproteids
D. High-density lipoproteids
E. -

201. Blood serum of the patient has milky appearance. Biochemical analysis revealed high content of triacylglycerols and chylomicrons. This condition is caused by hereditary defect of the following enzyme:
A. Lipoprotein lipase
B. Phospholipase
C. Pancreatic lipase
D. Adipose tissue hormone-sensitive lipase
E. Phosphodiesterase

202. Preventative examination of a 55-year-old patient revealed type II diabetes mellitus. An endocrinologist detected an increase in body weight and liver enlargement. The man is a non-smoker and does not abuse alcohol but likes to have a "hearty meal". Histological examination by means of diagnostic liver puncture revealed that the hepatocytes were enlarged mostly on the lobule periphery, their cytoplasm had transparent vacuoles that reacted positively with sudan III. What liver pathology was revealed?
A. Fatty hepatosis
B. Acute viral hepatitis
C. Chronic viral hepatitis
D. Alcohol hepatitis
E. Portal liver cirrhosis

203. The patient, who for a long time has been keeping to an unbalanced lowprotein diet, developed fatty liver infiltration. Name the substance, absence of which in the diet can lead to this condition:
A. Methionine
B. Alanine
C. Cholesterol
D. Arachidonic acid
E. Biotin

204. In the process of metabolism human body produces active oxygen forms, including superoxide anion radical O2\ This anion is inactivated by the following enzyme:
A. Superoxide dismutase
B. Catalase
C. Peroxidase
D. Glutathione peroxidase
E. Glutathione reductase

205. Periodontitis induces development of lipid peroxidation in the periodontal tissues, as well as increase in malondialdehyde and hydrogen peroxide concentration in the oral cavity. Which of the following enzymes provides antioxidant protection?
A. Catalase
B. Amylase
C. Maltase
D. Lactase
E. Invertase

206. A woman, who had undergone mastectomy due to breast cancer, was prescribed a course of radiation therapy. What vitamin preparation has marked antiradiation effect due to its antioxidant activity?
A. Tocopherol acetate
B. Ergocalciferol
C. Riboflavin
D. Cyanocobalamin
E. Folic acid

207. There are various diseases that cause sharp increase of active oxygen, thus leading to cell membranes destruction. Antioxidants are used to prevent it from happening. The most potent natural antioxidant is:
A. a-tocopherol

B. Glucose
C. Vitamin D
D. Fatty acids
E. Glycerol

208. Hyperlipemia can be observed in 2-3 hours after eating fatty food. 9 hours later lipid content normalizes again. How can this condition be characterized?
A. Alimentary hyperlipemia
B. Transport hyperlipemia
C. Hyperplastic obesity
D. Retention hyperlipemia
E. Hypertrophic obesity

209. A 70-year-old patient presents with cardiac and cerebral atherosclerosis. Examination revealed changes of blood lipid spectre. Increase of the following lipoproteins plays a significant role in atherosclerosis pathogenesis:
A. Low-density lipoproteins
B. Very low-density lipoproteins
C. Intermediate density lipoproteins
D. High-density lipoproteins
E. Chylomicrons

210. A patient demonstrates milkywhite color of blood plasma due to high content of chylomicrons. Disintegration of triacylglycerol is disrupted. Deficiency of the following enzyme activity is observed:
A. Lipoprotein lipase
B. Amylase
C. Tripsin
D. Cholesterol esterase
E. Lactase

211. Natural peptides can carry out various functions. What bioactive peptide is a major antioxidant and functions as a coenzyme?
A. Glutathione
B. Bradykinin
C. Oxytocin
D. Liberin
E. Anserine

212. Increased concentration of active oxygen forms is a mechanism of pathogenesis in a number of diseases. To prevent this process, antioxidants are prescribed. Select an antioxidant from the list below:
A. a-Tocopherol
B. Glucose
C. Calciferol
D. Cobalamine
E. Glycerol

213. A man 67 years old suffers from brain vessels atherosclerosis. After investigation hyperlipidemia was detected. What class of lipoproteins in blood plasma will be increased the most of all in biochemical investigation?
A. LDL
B. HDL
C. Non esterified fatty acids in complex with albumin
D. Chylomicrons
E. VLDL

214. 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. VLDL
B. Chylomicrons
C. LDL
D. HDL
E. Complexes with albumin

215. After the consumption of a diet rich in fats, a patient complains of languor and nausea. Later signs of steatorrea appear. The level of blood cholesterol makes 9,2 mM/1. The shortage of what substances causes this state of the patient?
A. Bile acids
B. Triacylglycerols
C. Fatty acids
D. Phospholipids
E. Chylomicrons

216. What products are produced from superoxide anion under the action of superoxide dismutase?
A. Free oxygen
B. Hydroxyl radical
C. Protons
D. NAD
E. FMN reduced

217. What enzyme can decompose hydrogen peroxide without involvement of organic compounds as donors of hydrogen?
A. Catalase
B. Peroxidase
C. Monooxygenase
D. Cytochrome P450
E. Lipoxygenase

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

219. Profuse foam appeared when dentist put hydrogen

peroxide on the mucous of the oral cavity. What enzyme caused such activity?
A. Catalase
B. Cholinesterase
C. Acetyltransferase
D. Glucose-6-phosphate-dehydrogenase
E. Methemoglobinreductase

220. Hydrogen peroxide is harmful and extremely toxic to living cells. Chose an enzyme which is used by cells for neutralization of hydrogen peroxide:
A. Glutathion peroxidase
B. Cytochrome oxidase
C. NADPH2-oxidase
D. Cyclooxygenase
E. Monoamine oxidase

221. In diseases which are accompanied by hypoxia an incomplete reduction of oxygen molecule in respiratory chain and accumulation of hydrogen peroxide occurs. Note an enzyme which provides neutralization of hydrogen peroxide:
A. Glutathion peroxidase
B. Cytochrome oxidase
C. Succinate dehydrogenase
D. Glutathion reductase
E. Oxidase of reduced NADP

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

223. Bile acids are necessary for fat digestion. They are produced in the liver from the next precursor:
A. Cholesterol
B. Protoporphyrin IX
C. Corticosterol
D. Lecithin
E. Arachidonic acid

224. In a patient after investigation it was detected an increased content of low density lipoproteins in blood serum. What disease can be expected in this patient?
A. Atherosclerosis
B. Pneumonia
C. Gastritis
D. Acute pancreatitis
E. Kidney disease

225. In cases of complete or partial restriction of lipotropic factors in humans develops a fat degeneration of liver. What substances can be considered as lipotropic?
A. Choline
B. Pyridoxine
C. Fatty acids
D. Cholesterol
E. Triacylglycerols

226. Obesity generally reflects excess intake of energy and is often associated with the development of:
A. Non-insulin dependent diabetes mellitus
B. Nervousness
C. Hepatitis
D. Colon cancer
E. -

227. The complaints and objective data permit to suppose an inflammatory process in gall bladder, disorder of colloidal properties of bile, probability of bile stones formation. What compound can cause their formation?
A. Cholesterol
B. Oxalates
C. Chlorides
D. Phosphates
E. Urates

228. In a worker of chemical cleaning the fatty liver dystrophy was recognized. What substance biosynthesis disorder can lead to this pathology?
A. Phosphatidyl choline
B. Tristearylglycerol
C. Phosphatidic acid
D. Urea
E. Folic acid

229. A patient with high blood cholesterol levels was treated with lovastatin. This drug lowers blood cholesterol levels because it inhibits:
A. HMG CoA reductase in liver and peripheral tissues
B. Lipoprotein lipase in adipose tissue
C. Citrate lyase in liver
D. VLDL excretion by the liver
E. Absorption of dietary cholesterol

230. Chose from listed below compounds the final product of cholesterol metabolism in human body:
A. Chenodeoxycholic acid
B. Cortisol
C. Prostaglandine E2
D. Cholecalciferol
E. Ergrosterol

231. 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:
A. Chylomicrons
B. HDL
C. LDL
D. Cholesterol
E. Phospholipids

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

233. In cases of complete or partial restriction of lipotropic factors providement in humans develops a fat degeneration of liver. What substances can be considered as lipotropic? A. Choline
B. Fatty acids
C. Triacylglycerols
D. Cholesterol
E. Pyridoxine

234. An experimantal animal that was kept on protein-free diet developed fatty liver infiltration, in particular as a result of deficiency of methylating agents. This is caused by disturbed generation of the following metabolite:
A. Choline
B. DOPA
C. Cholesterol
D. Acetoacetate
E. Linoleic acid

235. Note an intermediate metabolite which is on the cholesterol synthesis pathway and is of multifunctional significance:
A. в-Hydroxy в-methyl glutaryl-CoA (HMG-CoA)
B. Succinyl-CoA
C. Acetoacetate
D. Palmitoyl-CoA
E. 2-Oxoglutaryl-CoA

236. A person with a low-density lipoprotein (LDL) receptor deficiency was treated with lovastatin. As a consequence of the action of this drug, the person should have:
A. Lower blood cholesterol levels
B. Increased de novo cholesterol synthesis
C. Increased ACAT activity
D. Fewer LDL receptors in cell membranes
E. Higher blood triacylglycerol levels

237. In metabolic transformations in human body appear active oxygen intermediates, including hydrogen peroxide. This substance is reduced by substrates as donor of hydrogen with the aid of the next enzyme:
A. Catalase
B. Cytochrome P-450
C. Glutathion peroxidase
D. Glutathion redsuctase
E. Superoxide dysmutase

238. In a patient after the action of ionizing radiation an increased level of malonic dialdehyde was detected in blood, indicating the activation of peroxide oxidation of lipids. This may lead to injury of biological membranes due to:
A. Degradation of phospholipids
B. Oxidation of cholesterol
C. Changes in structure of transfer proteins
D. Breakdown of carbohydrate constituents
E. Activation of Na, K-ATPase

239. All the following correctly describe the intermediate 3-OH-3-methyl glutaryl CoA except:
A. It is generated enzymatically in the mitochondrial matrix
B. It is formed in the cytoplasm
C. It is involved in the synthesis of cholesterlol
D. It inhibits the first step in cholesterol synthesis
E. It is involved in the synthesis of ketone bodies

240. A man 67 years old suffers from brain vessels atherosclerosis. After investigation hyperlipidemia was detected. What class of lipoproteins in blood plasma will be increased most of all in biochemical investigation?
A. LDL
B. HDL
C. Non esterified fatty acids in complex with albumin
D. Chylomicrons
E. VLDL

241. Chylomicron, intermediate density lipoproteins (IDL), low density lipoproteins (LDL) and very low density lipoproteins (VLDL) all are serum lipoproteins. What is the correct ordering of these particles from the lowest to the greatest density?
A. Chylomicron, VLDL, IDL, LDL
B. LDL, IDL, VLDL, Chylomicron
C. VLDL, IDL, LDL, Chylomicron
D. Chylomicron, IDL, VLDL, LDL
E. IDL, VLDL, LDL, Chylomicron

242. A 25-year-old woman presents to her family physician for a routine check-up. Physical examination reveals mildly overweight woman with a smooth, firm

but mobile, skin-colored nodule over the Achilles tendon. A fasting lipid panel shows markedly elevated total cholesterol, LDL cholesterol and triglyceride levels and decreased HDL cholesterol levels. The physician starts her on a medication to manage her condition and counsels her on lifestyle modifications. Which of the following describes the mechanism of action of the medication this patient takes to treat her hypercholesterolemia?

A. Inhibition of 3-hydroxy-3-methylglutaryl coenzyme A reductase
B. Activates peroxisome proliferator-activated receptor a
C. Inhibition of bile acid reuptake in the intestine
D. Inhibition of cholesterol uptake by the intestinal brush border
E. Reduced transfer of cholesteryl ester from HDL to LDL and delayed HDL clearance

243. A 30-year-old man comes for evaluation because of acute epigastric pain that radiates to his back and worsens after meals. Serum lipase concentration is increased, blood is drawn in the clinic and plasma is found to be milky-white in color. The preliminary diagnosis is type I dyslipidemia (familial hyperchylomicronemia). Which of the following most likely explains the pathophysiology of this patient's underlying condition?

A. Lipoprotein lipase deficiency
B. Defect in processing LDL receptors
C. Increase in apolipoprotein CII levels
D. Mutation in apolipoprotein E

244. VLDL cholesterol clearance deficiency 53. A 25-year-old man comes to his primary care physician for a physical examination before starting a new job. His family history is significant for a father and grandmother with “cholesterol issues”. Physical examination reveals a well-developed, well- nourished adult man with well-demarcated white plaques on his upper eyelids. Laboratory studies show: total cholesterol level - 300 mg/dL, LDL level - 200 mg/dL, triglyceride level - 130 m/dL, HDL level - 60 mg/dL. The preliminary diagnosis is familial hypercholesterolemia. A mutation in which of the following proteins is most likely responsible for this patient's condition?

A. Apolipoprotein B-100
B. Apolipoprotein A-II
C. Apolipoprotein C-II
D. Apolipoprotein E
E. Lipoprotein lipase deficiency

245. A 22-year-old man visits his primary care physician after recently being discharged from the hospital. Before hospitalization, the patient presented with 1 day of nausea, vomiting and abdominal pain radiating to his back. Relevant labs from the hospital: triglycerides - >1000 mg/dL, lipase - 714 U/L. Repeated labs today: LDL - 124 mg/dL, HDL - 48 mg/dL, triglycerides - 644 mg/dL. What is the mechanism of action of the first-line pharmaceutical intervention indicated for this patient?

A. Increases activity of lipoprotein lipase
B. Inhibition of 3-hydroxy-3-methylglutaryl coenzyme A reductase
C. Inhibits intestinal absorption of cholesterol
D. Inhibits lipolysis by hormone-sensitive lipase
E. Sequestration of charged bile acids

246. A 3-day-old infant remains in the neonatal intensive care after being born at 27 weeks' gestation. Although the pregnancy was uncomplicated, the infant developed significant respiratory distress after delivery due to surfactant deficiency. Which of the following amino acids is essential for *de novo* synthesis surfactant, taking into account that its main component is phosphatidylcholine?

A. Methionine
B. Glycine
C. Serine
D. Threonine
E. Valine

Situational Tasks:

1. Prolonged negative emotional stress that accompanied by the release of catecholamines, may cause noticeable weight loss. What is it connected with? Which process is stimulated?

2. A 42-year-old man suffers from rheumatoid arthritis.To the complex of medical treatments assigned to him drugs included aspirin - a synthesis inhibitor prostaglandins. From which acids are formed prostaglandins?

3. To stimulate childbirth, the doctor prescribed prostaglandin E2. From what substance is it synthesized?

4. Prolonged use of large doses of aspirin causes inhibition of prostaglandin synthesis as a result decrease in activity of which enzyme it occurs?

5. For the prevention of atherosclerosis, coronary heart disease heart and cerebrovascular disorders man should receive 2-6 g of irreplaceable per day polyunsaturated fatty acids. What do these acids need for synthesis?

6. The man is 35 years old with pheochromocytoma. 1n the blood there is an increased level of adrenaline and norepinephrine, the concentration of free fatty acids increases 11 times. Specify which activation enzyme under the influence of adrenaline increases lipolysis.

7. After eating fatty foods, the patient feels discomfort, and in the stool undigested drops of fat. The reaction of urine to bile acids is positive. Lack of what is the cause of this condition?

8. Examination of the patient revealed bile stasis liver and gallstones in the gallbladder. Specify the main component of gallstones that formed in this state.

9. A 40-year-old man ran 10 km in 60 minutes. How will change energy metabolism in muscle tissue?

10. The patient is fasting for 48 hours. What substances used by muscle tissue as sources energy in these conditions?

11. The heart muscle is characterized by aerobic the nature of the oxidation of substrates. What is the main one? And why?

12. Athletes need to raise sports results. To do this, he is recommended to use a drug that contains carnitine. What process in most activated by this compound?

13. A 42-year-old man suffers from rheumatoid arthritis. The complex of drugs prescribed to him includes the anti-inflammatory drug aspirin, which is a prostaglandin synthase inhibitor.
a) Name the substrate on which the enzyme prostaglandin synthase acts
b) List the eicosanoids that are formed with the participation of this enzyme
c) Specify the biological role of these eicosanoids

14. A patient with bronchial asthma was prescribed the drug zileuton - a lipoxygenase inhibitor.
a) Name the substrate on which the enzyme lipoxygenase acts.
b) List the eicosanoids that are formed with the participation of this enzyme.
c) Specify the biological role of these eicosanoids.

15. The composition of cellular biomembranes includes glycerophospholipids, which form a lipid bilayer.
a) Name the representatives of phospholipids.

b) What is the peculiarity of the structure of phospholipids determines their ability to form a lipid bilayer?
c) 1ndicate the asymmetry of the membranes relative to the location of glycerophospholipids.

16. At the patient at probing of a duodenum the delay of outflow of bile from a gall bladder is revealed.
a) Digestion and absorption of which components of food will be disturbed?
b) What components of bile are involved in this process? From what substance are they synthesized?
c) What is the biological role of these components

17. A patient with gallstone disease after eating fatty foods feels nausea, lethargy, over time, there are signs of steatorrhea.
a) Explain the term steatorrhea
b) Name the causes of steatorrhea in a patient
c) 1s it advisable to prescribe the patient chenodeoxycholic acid?

18. 1n a patient with diphtheria there is a decrease in the content of carnitine in the heart muscle.
a) 1ndicate the class of compounds that are the main source of energy for cardiomyocytes
b) How does their oxidation change under these conditions? Describe the answer.
c) What process is activated in this case?

19. With prolonged stress, diabetes mellitus there is a decrease in fat content in fat depots and an increase in the content of non-esterified (free) fatty acids (FFA) in serum.
a) Which process is activated? Specify the regulatory enzyme of this process
b) Describe the mechanism of activation of the process under prolonged stress?
c) Explain the reasons for the increased activity of the process in diabetes.

20. Beta-oxidation of palmitic acid plays an important role in meeting the energy needs of the heart, kidneys and liver.
a) How many cycles of in-oxidation are needed for its complete decay? How much ATP is formed due to this?
b) How many molecules of acetyl-CoA are synthesized in this case? How much ATP is formed by acetyl-CoA?
c) Calculate the energy balance of its oxidation.

21. Lipolysis of neutral fat trioleinateglycerol is the main source of glycerol and oleic acid in the cell, the oxidation of which is accompanied by the release of significant amounts of energy.
a) Describe the energy balance of glycerol oxidation.
b) Calculate the energy balance of complete oxidation of oleic acid.
c) Determine the energy balance of complete oxidation of trioleate glycerol.

22. A 40-year-old woman diagnosed with gallstone disease was prescribed chenodeoxycholic acid.
a) What are the main causes of cholesterol crystallization?
b) For what purpose the patient is prescribed chenodeoxycholic acid.
c) Why does gallstone disease occur more often in women?

23. A 58-year-old man has signs of atherosclerotic lesions of the cardiovascular system. Magnification which of the indicators of biochemical analysis of blood most characteristic of this condition?

24. In a 45-year-old patient, the content of total cholesterol in the blood plasma is 4.5 mmol / l, the level of LDL is 4.0 mmol / l, HDL is 1.2 mmol / l.
a) Comment on the results of the analysis.
b) High risk of which pathology in the patient?
c) How will the risk of developing this pathology change if the serum HDL content is 0.7 mmol / l?

25. In diabetes due to the activation of processes oxidation of fatty acids occurs ketosis. To which acid-base imbalance can lead to excessive accumulation of ketone bodies in blood?

26. A patient with diabetes was found to be elevated the content of ketone bodies in the blood. Indicate from which compound ketone bodies are synthesized.

27. The dry cleaner was diagnosed with fatty degeneration liver. Disruption of the synthesis of any substance in the liver can lead to this pathology?

28. In case of non-receipt or insufficient formation in human body lipotropic factors in it develops fatty degeneration of the liver. Which of of these substances can be attributed to lipotropic?

29. Laboratory tests showed that in the brain, liver and spleen increased ganglioside levels glycometide. What is a hereditary disease in a child?

30. Which of the hormones slows down lipolysis in adipose tissue? And explain how it happens.

31. In the blood of patients with diabetes is elevated the content of free fatty acids (FFA). What could be the reason?

32. Excessive consumption of carbohydrates (600 g per day) that exceeds the energy needs of a person 28 years old will be accompanied by activation of the process. What process? And what disease?

33. Among the antiatherosclerotic drugs that used for prevention and treatment atherosclerosis, there is levostatin. How does it work?

34. The patient has a hereditary deficiency of lipoprotein lipase.
a) What reaction is catalyzed by lipoprotein lipase?
b) Which lipoprotein content will be increased in the blood under these conditions?
c) Indicate the features of the structure and biological role of these lipoproteins.

35. The patient has an enlarged liver and spleen (hepatosplenomegaly), xanthoma on the skin (fat deposition in the skin). The blood has a high content of triglycerides, blood serum has the form of milk, with its prolonged standing a creamy layer is formed.
a) An increase in which lipoproteins is most likely in a patient?
b) Indicate the features of the structure, properties and biological role of these lipoproteins
c) Deficiency of which enzyme is the cause of this condition?

36. Excessive consumption of carbohydrates in excess of energy expenditure is accompanied by increased lipogenesis in the liver and adipose tissue.
a) What products of carbohydrate catabolism are metabolic precursors of fat biosynthesis?
b) What is the difference between fat biosynthesis in the liver and adipose tissue?
c) What hormones regulate lipogenesis in adipose tissue?

37. A dry cleaner who has worked with organic solvents for a long time has been diagnosed with fatty liver disease. Lipotropic substances were used for treatment.
a) Indicate the mechanism of development of fatty degeneration of the liver under these conditions.
b) Explain the term "lipotropic substances".
c) Explain the mechanism of lipotropic action of carnitine and choline.

38. The patient suffers from hypertension, atherosclerotic vascular lesions. The use of which lipid to him should be reduced in the daily diet. And why?

39. A patient with diabetes has a high content of fatty inclusions in the liver biopsy.
a) Name the pathological process in the patient.
b) Indicate the mechanism of development of this pathological process.
c) Explain the expediency of enriching a woman's diet with vitamins B6, B9, B12 and B15?

40. A patient with a liver biopsy showed a decrease in the activity of the enzyme acetyl-CoA-carboxylase.
a) Violation of which process is detected under these conditions?
b) What reaction does this enzyme catalyze?
c) Which vitamin should be prescribed to the patient?

41. The synthesis of fatty acidstakes place in the absorbent period in the cytoplasm of cells from acetyl-CoA, synthesized in mitochondria during the oxidative decarboxylation of pyruvate.
a) Indicate the substance that is the main source of pyruvate for the synthesis of fatty acids
b) Why under these conditions increases the use of acetyl-CoA for the synthesis of fatty

acids and inhibits its oxidation in the citric acid cycle?
c) How is acetyl-CoA transported to the cytoplasm?

42. A patient with diabetes has developed ketoacidosis.
a) Name the compounds whose accumulation causes the development of ketoacidosis.
b) From what substance and in what organ are ketone bodies synthesized?
c) Indicate the reasons for the development of ketoacidosis in diabetes.

43. A patient with atherosclerosis after long-term use of statins (drugs that inhibit cholesterol synthesis) developed ketoacidosis.
a) Indicate the common steps in the synthesis of ketone bodies and cholesterol.
b) Explain the reasons for the activation of ketogenesis under these conditions?
c) Indicate the normal content of ketone bodies in the blood.

44. The child has anorexia, vomiting, irritability, enlarged liver, spleen and lymph nodes, decreased visual acuity. There is a stoppage of general development, loss of motor skills. The child was diagnosed with Neiman-Pick disease.
a) To which group of diseases does this pathology belong? What are the causes and consequences of these diseases?
b) Deficiency of which enzyme is observed in this child? What reaction does this enzyme catalyze?
c) The accumulation of which substance is observed under these conditions?

45. On the 4th day of fasting, the brain begins to use ketone bodies as a source of energy.
a) Which organ does not use ketone bodies as an alternative source of energy?
b) Which ketone body does not oxidize to acetyl-CoA and therefore does not serve as a source of energy?
c) Specify the synthetic role of ketone bodies.

46. A patient with atherosclerotic vascular lesions is prescribed a drug from the group of statins.
a) Name the regulatory enzyme for the synthesis of cholesterol, which blocks this drug.
b) The biosynthesis of which intermediate metabolite of cholesterol synthesis is disrupted?
c) Specify the biological role of cholesterol.

47. A dispensary examination of a 40-year-old patient revealed a thickening of the carotid artery wall, serum total cholesterol was 7.2 mmol / l, and HDL cholesterol was 0.8 mmol / l.
a) Comment on the results of biochemical analysis.
b) What pathology is characterized by such changes?
c) Name the lipoproteins that transport cholesterol and indicate their biological role.
48. In a 45-year-old patient, the content of total cholesterol in the blood plasma is 4.5 mmol / l, the level of LDL is 4.0 mmol / l, HDL is 1.2 mmol / l.
a) Comment on the results of the analysis.
b) High risk of which pathology in the patient?
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mmol / l?

49. A 42-year-old man suffers from rheumatoid arthritis. The complex of drugs prescribed to him includes the anti-inflammatory drug aspirin, which is a prostaglandin synthase inhibitor.
a) Name the substrate on which the enzyme prostaglandin synthase acts
b) List the eicosanoids that are formed with the participation of this enzyme
c) Specify the biological role of these eicosanoids

50. In a patient who was in the area of radiation damage,the content of reactive oxygen species and malonic dialdehyde in the blood increased.
a) Name the main reactive oxygen species
b) Specify the enzymes that ensure their inactivation
c) What does the increase in the content of malonic dialdehyde in the blood indicate?

51. A patient with bronchial asthma was prescribed the drug zileuton - a lipoxygenase inhibitor.
a) Name the substrate on which the enzyme lipoxygenase acts.
b) List the eicosanoids that are formed with the participation of this enzyme.
c) Specify the biological role of these eicosanoids.

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a) Digestion and absorption of which components of food will be disturbed?
b) What components of bile are involved in this process? From what substance are they synthesized?
c) What is the biological role of these components of bile?

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a) Explain the term "steatorrhea"
b) Name the causes of steatorrhea in a patient
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b) Indicate the features of the structure, properties and biological role of these lipoproteins
c) Deficiency of which enzyme is the cause of this condition?

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a) Indicate the class of compounds that are the main source of energy for cardiomyocytes
b) How does their oxidation change under these conditions? Describe the answer.
c) What process is activated in this case?

58. With prolonged stress, diabetes mellitus there is a decrease in fat content in fat depots and an increase in the content of non-esterified (free) fatty acids (FFA) in serum.
a) Which process is activated? Specify the regulatory enzyme of this process
b) Describe the mechanism of activation of the process under prolonged stress?
c) Explain the reasons for the increased activity of the process in diabetes.

59. Beta-oxidation of palmitic acid plays an important role in meeting the energy needs of the heart, kidneys and liver.
a) How many cycles of in-oxidation are needed for its complete decay? How much ATP is formed due to this?
b) How many molecules of acetyl-CoA are synthesized in this case? How much ATP is formed by acetyl-CoA?
c) Calculate the energy balance of its oxidation.

60. Lipolysis of neutral fat trioleinateglycerol is the main source of glycerol and oleic acid in the cell, the oxidation of which is accompanied by the release of significant amounts of energy.
a) Describe the energy balance of glycerol oxidation.
b) Calculate the energy balance of complete oxidation of oleic acid.
c) Determine the energy balance of complete oxidation of trioleate glycerol.

6I. Excessive consumption of carbohydrates in excess of energy expenditure is accompanied by increased lipogenesis in the liver and adipose tissue.
a) What products of carbohydrate catabolism are metabolic precursors of fat biosynthesis?
b) What is the difference between fat biosynthesis in the liver and adipose tissue?
c) What hormones regulate lipogenesis in adipose tissue?

62. A dry cleaner who has worked with organic solvents for a long time has been diagnosed with fatty liver disease. Lipotropic substances were used for treatment.
a) Indicate the mechanism of development of fatty degeneration of the liver under these conditions.

b) Explain the term "lipotropic substances".
c) Explain the mechanism of lipotropic action of carnitine and choline.

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a) Name the pathological process in the patient.
b) Indicate the mechanism of development of this pathological process.
c) Explain the expediency of enriching a woman's diet with vitamins B6, B9, B12 and B15?

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a) Violation of which process is detected under these conditions?
b) What reaction does this enzyme catalyze?
c) Which vitamin should be prescribed to the patient?

65. The synthesis of fatty acids takes place in the absorbent period in the cytoplasm of cells from acetyl-CoA, synthesized in mitochondria during the oxidative decarboxylation of pyruvate.
a) Indicate the substance that is the main source of pyruvate for the synthesis of fatty acids
b) Why under these conditions increases the use of acetyl-CoA for the synthesis of fatty acids and inhibits its oxidation in the CAC?
c) How is acetyl-CoA transported to the cytoplasm?

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a) Name the compounds whose accumulation causes the development of ketoacidosis.
b) From what substance and in what organ are ketone bodies synthesized?
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b) Explain the reasons for the activation of ketogenesis under these conditions?
c) Indicate the normal content of ketone bodies in the blood.

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a) To which group of diseases does this pathology belong? What are the causes and consequences of these diseases?
b) Deficiency of which enzyme is observed in this child? What reaction does this enzyme catalyze?
c) The accumulation of which substance is observed under these conditions?

69. On the 4th day of fasting, the brain begins to use ketone bodies as a source of energy.
a) Which organ does not use ketone bodies as an alternative source of energy?
b) Which ketone body does not oxidize to acetyl-CoA and therefore does not serve as a

source of energy?
c) Specify the synthetic role of ketone bodies.

70. A patient with atherosclerotic vascular lesions is prescribed a drug from the group of statins.
a) Name the regulatory enzyme for the synthesis of cholesterol, which blocks this drug.
b) The biosynthesis of which intermediate metabolite of cholesterol synthesis is disrupted?
c) Specify the biological role of cholesterol.

7I. A dispensary examination of a 40-year-old patient revealed a thickening of the carotid artery wall, serum total cholesterol was 7.2 mmol / l, and HDL cholesterol was 0.8 mmol / l.
a) Comment on the results of biochemical analysis.
b) What pathology is characterized by such changes?
c) Name the lipoproteins that transport cholesterol and indicate their biological role.

72. A 40-year-old woman diagnosed with gallstone disease was prescribed chenodeoxycholic acid.
a) What are the main causes of cholesterol crystallization?
b) For what purpose the patient is prescribed chenodeoxycholic acid.
c) Why does gallstone disease occur more often in women?

Chapter III. Amino acid metabolism and its regulation.

List of the exam questions:

I. Digestion and absorption of proteins and amino acids.
2. Conversion of amino acids by microbe enzymes.
3. Tissue proteolysis. Cathepsins.
4. Nitrogen balance and its biological role. Kwashiorkor. Marasmus.
5. Decarboxylation of amino acids. Biogenic amines (dopamine, histamine, gamma-aminobutyric acid, serotonin and other), their biological role. Detoxification of biogenic amines.
6. Deamination of amino acids. Types of deamination. Glutamate dehydrogenase reaction and its biological role.
7. Transamination of amino acids. Diagnostic importance of transaminases.
8. Ammonia detoxification. Urea synthesis. Uremia. Hyperammonemia. Congenital defects in urea cycle.
9. Metabolism of amino acid side chain (branched-chain, sulfur-containing, aromatic and other amino acids). Gluco- and ketogenic amino acids.
I0. Conversion of amino acids to specialized products: synthesis of polyamines, creatine metabolism, nitrogen monooxide, taurine, methylation reactions and other.
I I. Metabolic disorders of amino acid catabolism: maple syrup urine disease, isovaleric acidemia, cystinuria, cystinosis, homocystinuria, albinism, phenylketonuria, alkaptonuria, tyrosinosis, glycinuria, primary hyperoxaluria, creatinuria etc.

Multiple Choice Questions:

1. 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. Aminotransferase activity (AST, ALT)
B. Unconjugated and conjugated bilirubin content
C. Erythrocytes sedimentation rate (ESR)
D. Cholesterol content
E. Protein fraction content

2. 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 the first two days?
A. Aspartate aminotransferase
B. Alanine aminotransferase
C. Alanine aminopeptidase
D. LDH4
E. LDH5

3. Depression and emotional disturbances result 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. Monoamine oxidase
B. Diamine oxidase
C. *L*-amino acids oxidase
D. *D*-amino acid oxidase
E. Phenylalanine-4-monooxygenase

4. 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. Acetylcholine
B. Noradrenaline
C. Adrenaline
D. Dopamine
E. Serotonin

5. It is known that in catecholamine metabolism a special role belongs to monoamine oxidase (MAO). This enzyme inactivates mediators (noadrenaline, adrenaline, dopamine) by:
A. Oxidative deamination
B. Adjoining amino groups
C. Removing methyl groups

D. Carboxylation
E. Hydrolysis

6. 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. GABA
B. Dopamine
C. Serotonin
D. Adenosine
E. Acetylcholine

7. 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. Decarboxylation
B. Hydroxylation
C. Dehydration
D. Deamination
E. Reduction

8. 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. Decarboxylation
B. Methylation
C. Phosphorilation
D. Isomerization
E. Deamination

9. 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. Histamine
B. Hageman's factor
C. Lysosomal enzymes
D. Noradrenaline
E. Adrenaline

10. 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 flood enzyme proves to be a diagnostic test for the disease?
A. Creatine kinase
B. Lactate dehydrogenase
C. Pyruvate dehydrogenase
D. Glutamate dehydrogenase
E. Adenylate kinase

11. A patient is diagnosed with cardiac infarction. Blood test for cardiospecific enzymes activity was performed. Which of the enzymes has three isoforms?
A. Creatine kinase
B. Lactate dehydrogenase
C. Aspartate transaminase
D. Alanine transaminase
E. Pyruvate kinase

12. A patient has been prescribed pyridoxal phosphate. What processes are corrected with this drug?
A. Transamination and decarboxylation of amino acids
B. Oxidative decarboxylation of keto acids
C. Deaminization of amino acids
D. Synthesis of purine and pyrimidine bases
E. Protein synthesis

13. There is increased activity of AST, LDH1, LDH2, and CPK in the patient's blood. Pathological process most likely occurs in the:
A. Heart
B. Skeletal muscles
C. Kidneys
D. Liver
E. Adrenal glands

14. A 60-year-old man consulted a doctor about an onset of chest pain. In blood serum analysis showed a significant increase in the activity of the following enzymes: creatine kinase and its MB isoform, aspartate aminotransferase. These changes indicate the development of the pathological process in the following tissues:
A. Cardiac muscle
B. Lungs
C. Skeletal muscles
D. Liver
E. Smooth muscles

15. Significant amount of biogenic amines in body tissues can be subject to oxidative deamination due to the action of the following enzyme:
A. Monoamine oxidase
B. Transaminase
C. *D*-amino acid oxidase
D. Isomerase
E. *L*-amino acid dehydrogenase

16. Biogenic amines, such as histamine, serotonin, dopamine and others, are highly active substances affecting various physiological functions. What transformation process of amino acids results in biogenic amines being produced in somatic tissues? A. Decarboxylation
B. Deamination

C. Transamination
D. Oxidation
E. Reductive amination

17. A patient presents with dysfunction of the cerebral cortex accompanied by epileptic seizures. He has been administered a biogenic amine synthetized from glutamate and responsible for central inhibition. What substance is it?
A. Y-Aminobutyric acid
B. Serotonin
C. Dopamine
D. Acetylcholine
E. Histamine

18. A 24-year-old patient has been administered glutamic acid to treat epilepsy. Medicinal effect in this case occurs not due to glutamate itself, but due to the product of its decarboxylation:
A. Y-Aminobutyric acid
B. Histamine 4-monooxygenase
C. Serotonin
D. Dopamine
E. Taurine

19. A 9-month-old infant is on bottle feeding. Formula used in feeding has insufficient content of vitamin B6. The infant has seizures possibly caused by disruption in production of the following substance in the body:
A. Y-Aminobutyric acid (GABA)
B. Serotonin
C. Histamine
D. Dopamine
E. в-Alanine

20. 30 minutes after dental treatment the patient developed red itching spots on the face and oral mucosa. The patient was diagnosed with urticaria. What bioactive substance with vasodilating and pruriginous effect is produced during this type of allergic reaction?
A. Histamine
B. Prostaglandin E2
C. Leukotriene B4
D. Interleukin-1
E. Bradykinin

21. A woman has scalded her hand with boiling water. The affected area of her skin became red, swollen and painful. This effect is caused by accumulation of the following substance:
A. Histamine
B. Lysine
C. Thiamine
D. Glutamine
E. Asparagine

22. What factor results in maximal dilation of the gemomicrocirculatory pahtway vessels and their increased permeability?
A. Histamine
B. Endothelin
C. Vasopressin
D. Noradrenaline
E. Serotonin

23. Dopamine precursor - dioxyphenylalanine (DOPA) - is used in treatment of Parkinson's disease. This active substance is produced from the following amino acid: A. Tyrosine
B. Alanine
C. Cysteine
D. Histidine
E. Tryptophan

24. An 84-year-old patient suffers from parkinsonism. One of the pathogenetic development elements of this disease is deficiency of a certain mediator in some of the brain structures. Name this mediator:
A. Dopamine
B. Adrenaline
C. Noradrenaline
D. Histamine
E. Acetylcholine

25. For biochemical diagnostics of cardiac infarction it is necessary to determine activity of a number of enzymes and their izoenzymes in the blood. What enzyme assay is considered to be optimal for confirming or ruling out cardiac infarction at the early stage, after the patient develops thoracic pain?
A. Creatine kinase MB isoenzyme
B. Creatine kinase MM isoenzyme
C. LDH1 isoenzyme
D. LDH5 isoenzyme
E. Cytoplasmic isoenzyme of aspartate aminotransferase

26. A patient has myocardial infarction. The first several hours of such medical condition will be characterized by signifi- cant increase of activity of the following enzyme in his blood serum:
A. Creatine phosphokinase
B. Lactate dehydrogenase 4
C. Aspartate aminotransferase
D. Lactate dehydrogenase 5
E. Alanine-aminotransferase

27. Protein structure includes proteinogenic amino acids. What is the position of the amino group in the structure of these amino acids?
A. a-position

B. в-position
C. Y—position
D. 6-position
E. є-position

28. A patient has a mental disorder due to the insufficient synthesis of gammaaminobutyric acid in the brain. Such pathological changes might be caused by the deficiency of the following vitamin:
A. Pyridoxine
B. Tocopherol
C. Cyanocobalamin
D. Folic acid
E. Riboflavin

29. A 46-year-old patient presents with hyperactivity of creatine kinase in his blood serum. What pathology can be suspected?
A. Myocardial infarction
B. Acute pancreatitis
C. Chronic hepatitis
D. Hemolytic anemia
E. Renal failure

30. In response to the administration of protein drugs, a patient developed an allergic reaction. The development of the allergic reaction is caused by the increased synthesis of the following compound:
A. Histamine
B. Choline
C. Adrenaline
D. Histidine
E. Serotonin

31. Patients with severe depression demonstrate decreased serotonin levels in brain and cerebrospinal fluid. What aminoacid is a serotonin precursor?
A. Tryptophan
B. Threonine
C. Tyrosine
D. Glutamic acid
E. Aspartic acid

32. Natural peptides can carry out various functions. What bioactive peptide is a major antioxidant and functions as a coenzyme?
A. Glutathione
B. Bradykinin
C. Oxytocin
D. Liberin
E. Anserine

33. An important reaction for the synthesis of amino acid from carbohydrate intermediates is transamination, which requires the cofactor:
A. Pyridoxal phosphate
B. Riboflavin
C. Niacin
D. Thiamin
E. Folic acid

34. Which of the following enzymes catalyses reactions in the biosynthesis of both catecholamines and indoleamines (serotonin)?
A. Aromatic amino acid decarboxylase
B. Dopamine в-hydroxylase
C. Phenylethanolamine N-methyltransferase
D. Tryptophan hydroxylase
E. Tyrosine hydroxylase

35. In recognition of hepatitis the determination of the following enzymes activity in blood has diagnostic significance:
A. Aminotransferases
B. Amylase
C. Lactate dehydrogenase
D. Aldolase
E. Creatin kinase

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

37. Examination of a patient suffering from cancer of urinary bladder revealed high rate of serotonin and hydroxyanthranilic acid. It is caused by excess of the following amino acid in the organism:
A. Tryptophan
B. Alanine
C. Histidine
D. Methionine
E. Tyrosine

38. Glutamate decarboxylation results in formation of inhibitory transmitter in CNS. Name it:
A. GABA
B. Glutathione
C. Histamine
D. Serotonin
E. Asparagine

39. Biochemical function of glutathion in an organism is connected with reduction and detoxification of organic peroxides. During an interaction of glutathion with hydroperoxides harmless organic alcohols are formed

with subsequent further oxidation. Indicate an amino acid composing glutathion:
A. Glutamate
B. Valine
C. Lysine
D. Isoleucine
E. Tryptophan

40. A child manifests epileptic seizures caused by vitamin B6 deficiency. This is conditioned by the decrease of the 7-aminobutyrate level in the nervous tissue which acts as an inhibiting neurotransmitter. The activity of which enzyme is decreased in this case?
A. Glutamate decarboxylase
B. Pyridoxal kinase
C. Glutamate dehydrogenase
D. Alanine aminotransferase
E. Glutamate synthetase

41. 12 hours after an accute attack of retrosternal pain a patient presented an increase of aspartate aminotransferase activity in blood serum. What pathology is this deviation typical for?
A. Myocardium infarction
B. Viral hepatitis
C. Collagenosis
D. Diabetes mellitus
E. Diabetes insipidus

42. In diagnostics of an acute viral hepatitis estimation of the next enzymatic activity in blood serum is the most valuable:
A. Alanine aminotransferase
B. Glutathion peroxidase
C. Creatine kinase
D. Amylase
E. Alkaline phosphatase

43. A patient diagnosed with carcinoid of bowels was admitted to the hospital. Analysis revealed high production of serotonin. It is known that this substance is formed of tryptophan amino acid. What biochemical mechanism underlies this process?
A. Decarboxylation
B. Desamination
C. Microsomal oxydation
D. Transamination
E. Formation of paired compounds

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

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

46. In course of histidine catabolism a biogenic amine is formed that has powerful vasodilatating effect. Name it:
A. Histamine
B. Serotonin
C. Dioxyphenylalanine
D. Noradrenalin
E. Dopamine

47. Production of some toxic substances in large intestines occurs due to decarboxylation of some amino acids. Indicate, what substance is produced from ornithine?
A. Putrescine
B. Skatole
C. Indole
D. Cadaverine
E. Phenol

48. In case of skin combustion the injured area of skin gets red and painful, the swelling of tissue also develops. What substance is responsible for these effects?
A. Histamine
B. Glutamine
C. Lysine
D. Thiamine
E. Asparaginate

49. 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. B6
B. B12
C. B3
D. B8
E. B5

50. According to the clinical signs, pyridoxal phosphate was prescribed to a patient. For the correction of what biochemical processes is this drug recommended?
A. Transamination and decarboxylation of amino acids
B. Oxidative decarboxylation of ketoacids

C. Deamination of amino acids
D. Synthesis of purines and pyrimidines
E. Protein synthesis

51. Patient presents all signs of the hepatic coma: loss of consciousness, absence of reflexes, cramps, convulsions, disorder of heart activity, recurrent (periodical) respiration. What is the cerebrotoxical substance which accumulate in blood under hepar insufficiency?
A. Ammonia
B. Interleukin-1
C. Autoantibody
D. Necrosogenic substances
E. Ketone bodies

52. 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. Ammonia
B. Urea
C. Glutamine
D. Bilirubin
E. Histamine

53. During intensive muscle work there is a large amount of 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. Alanine
B. Arginine
C. Lysine
D. Ornithine
E. Aspartate

54. 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. Disorder of ammonia neutralization in ornithinic cycle
B. Activated processes of aminoacids decarboxylation
C. Disorder of biogenic amines neutralization
D. Increased purtefaction of proteins in intestines
E. Inhibited activity of transamination enzymes

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

56. 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. Carbamoyl phosphate synthetase
B. Aspartate aminotransferase
C. Urease
D. Amylase
E. Pepsin

57. 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. Carbamoyl phosphate synthetase
B. Aspartate aminotransferase
C. Urease
D. Amylase
E. Pepsin

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

59. A 2-year-old child with mental and physical retardation has been delivered to a hospital. He presents with frequent vomiting after having meals. There is phenylpyruvic acid in urine. Which metabolism abnormality is the reason for this pathology?
A. Amino acid metabolism
B. Lipidic metabolism
C. Carbohydrate metabolism
D. Water-salt metabolism
E. Phosphoric calcium metabolism

60. 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 are typical for the following pathology of the amino acid metabolism: A. Phenylketonuria
B. Alkaptonuria

C. Tyrosinosis
D. Albinism
E. Xanthinuria

61. 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. Phenylketonuria
B. Albinism
C. Tyrosinosis
D. Alkaptonuria
E. Gout

62. 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. Tyrosine
B. Galactose
C. Methionine
D. Cholesterol
E. Tryptophan

63. 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. Tyrosine
B. Phenylalanine
C. Alanine
D. Methionine
E. Asparagine

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

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

66. Albinos can't stand sun impact - they don't aquire sun-tan but get sunburns. Disturbed metabolism of what amino acid underlies this phenomenon?
A. Phenylalanine
B. Methionine
C. Tryptophan
D. Glutamic acid
E. Histidine

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

68. Laboratory examination of a child revealed increased concentration of leucine, valine, isoleucine and their ketoderivatives in blood and urine. Urine smells of maple syrup. This disease is characterized by the deficit of the following enzyme:
A. Dehydrogenase of branched amino acids
B. Aminotransferase
C. Glucose-6-phosphatase
D. Phosphofructokinase
E. Phosphofructomutase

69. A 50-year-old man, who has been suffering for a long time from viral hepatitis, developed mental impairments, impairments of consciousness, and motor disturbances (tremor, ataxia, etc.). What is the mechanism of such condition?
A. Decreased detoxification function of the liver
B. Insufficient phagocytic function of stellate macrophages
C. Decreased synthesis of albumins and globulins in the liver
D. Disturbed lipid exchange in the liver
E. Alterations in the lipid composition of blood

70. A 2-year-old child presents with mental development retardation, intolerance of proteins, severe hyperammonemia against the background of low blood urea content. This condition is caused by the congenital deficiency of the following mitochondrial enzyme:
A. Carbamoyl phosphate synthetase
B. Citrate synthase
C. Succinate dehydrogenase
D. Malate dehydrogenase
E. Monoamine oxidase

71. An oncological patient had been administered methotrexate. With time target cells of the tumour lost sensitivity to this drug. At the same time the change in gene expression of the following enzyme is observed:
A. Dihydrofolate reductase

B. Thiaminase
C. Deaminase
D. Folate oxidase
E. Folate decarboxylase

72. Continuous treatment of cancer patients with methotrexate over time reduces the target cell's sensitivity to the drug. In this case gene amplification of the following enzyme is observed:
A. Dihydrofolate reductase
B. Thiaminase
C. Deaminase
D. Thioredoxin reductase
E. -

73. Dopamine precursor - dioxyphenylalanine (DOPA) - is used in treatment of Parkinson's disease. This active substance is produced from the following amino acid:
A. Tyrosine
B. Alanine
C. Cysteine
D. Histidine
E. Tryptophan

74. Mother had noticed her 5-year-old child's urine to become dark in colour. Bile pigments in urine were not detected. The diagnosis of alkaptonuria was made. What pigment is deficient?
A. Homogentisic acid oxidase
B. Phenylalanine hydroxylase
C. Tyrosinase
D. Oxyphenylpyruvate oxidase
E. Phenylpyruvate decarboxylase

75. A 20-year-old woman came to the doctor with complaints of general weight loss, loss of appetite, weakness, skin discoloration resembling bronze tan. In addtition to hyperpigmentation, examination in the hospital revealed bilateral adrenal tuberculosis. What substance leads to skin hyperpigmentation, when accumulated excessively?
A. Melanin
B. Bilirubin
C. Hemozoin
D. Lipofuscin
E. Adrenochrome

76. Many organic compounds break up in the cell into simple products. What compounds break up into ammonia, carbon dioxide, and water in the human body?
A. Amino acids
B. Monosaccharides
C. Monohydric alcohols
D. Fatty acids
E. Keto acids

77. Disintegration of adenosine nucleotides results in release of ammonia. What enzyme plays the key role in ammonia synthesis from these compounds?
A. Adenosine deaminase
B. Alcohol dehydrogenase
C. Lactate dehydrogenase
D. Alanine transaminase
E. Amylase

78. Main process of ammonia neutralization occurs in the liver. Arginine decomposition reaction that produces urea as a result is catalyzed with arginase. What group of enzymes does arginase belong to?
A. Hydrolases
B. Synthetases
C. Oxidoreductases
D. Transferases
E. Isomerases

79. A man presents with signs of albinism: blonde hair, extreme photosensitivity, impaired vision. What amino acid metabolism is disrupted in the patient?
A. Tyrosine
B. Methionine
C. Proline
D. Histidine
E. Valine

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

81. In a child in urine were detected phenylpyruvate and phenylacetate. What enzyme insufficiency causes this phenomenon?
A. Phenylalanine-4-monooxygenase
B. Thyrosine-3-monooxygenase
C. Fumarylacetoacetate hydrolase
D. Cystathionyl-e-synthase
E. DOPA-decarboxylase

82. The principal end product of protein metabolism, which is excreted in the greatest quantity in human urine, is:
A. Urea
B. Glutamine
C. Ammonium and its salts
D. Uric acid
E. Allantoin

83. What chemical component in urine indicates on a

hereditary metabolic disease - alkaptonuria?
A. Homogentisic acid
B. Phenylalanine
C. Phenylpyruvic acid
D. Pyruvic acid
E. Tyrosine

84. An inborn error - maple syrup urine disease - is due to the deficiency of the enzyme:
A. Isovaleryl-CoA-hydrogenase
B. Phenylalnine hydroxylase
C. Adenosyl transferase
D. a-Ketoacid decarboxylase
E. -

85. In albinism there is negative reaction to direct insolation, as a result solar burns may appear. Metabolic disorders of what amino acid cause these effects?
A. Tyrosine
B. Tryptophan
C. Methionine
D. Glutamic acid
E. Histidine

86. Transfer of the carbamoyl moiety of carbamoyl phosphate to ornithine is catalysed by a liver mitochondrial enzyme:
A. Ornithine transcarbamoylase
B. Carbamoyl phosphate synthetase I
C. N-acetyl glutamate synthetase
D. N-acetyl glutamate hydrolase
E. Carbamoyl phosphate synthetase II

87. In humann body is degraded approximately 70 g of amino acids daily. The main end product of nitrogen metabolism in human is:
A. Urea
B. Ammonia
C. Uric acid
D. Glutamine
E. Creatinine

88. What is the principal final nitrogen containing product of protein catabolism in human body?
A. Urea
B. Glutamine
C. Ammonia and ammonium ion
D. Creatinin
E. Uric acid

89. Indicate amino acid, which is a precursor of the thyroid hormones thyroxine and triiodothyronine:
A. Tyrosine
B. Histidine
C. Tryptophan
D. Glycine
E. Glutamate

90. In human body are synthesized 10 amino acids only from 20 ones needed for protein biosynthesis. What amino acid from listed below is produced in human body?
A. Tyrosine
B. Histidine
C. Lysine
D. Methionine
E. Phenylalanine

91. Under alcaptonuria, 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. Homogentisate oxidase
B. Alanine aminotransferase
C. Tyrosinase
D. Phenylalanine-4-monooxygenase
E. Tyrosine aminotransferase

92. 13 years old patient complains of general weakness, dizziness, fatigue. Besides this mental underdevelopement is observed. Laboratory investigations revealed high content of valine, isoleucine and leucine in urine, which has a characteristic odor. What is the most probable cause of this condition?
A. Maple syrup syndrome
B. Cystinosis
C. Phenylketonuria
D. Porphyria
E. Hyperuricemia (gout)

93. In a young child besides other clinical symptoms the sharp darkening of urine after standing in open air was revealed. Blood and urine examination detected the presence of homogentisic acid. What is the most probable cause of disease?
A. Alkaptonuria
B. Porphyria
C. Albinism
D. Cystinuria
E. Hemolytic anemia

94. An infant shows the darkening of scleras, mucous membranes. The excreted urine darkens in tin air, homogentistic acid is determined both in the blood and urine. What is the diagnosis?
A. Alkaptonuria
B. Albinism
C. Cystinuria
D. Porphyria
E. Hemolytic anemia

95. In two years old boy suffering from alkaptonuria urine became black after standing. This disease is hereditary disorder of:
A. Tyrosine metabolism
B. Alanine metabolism
C. Urea synthesis
D. Uric acid synthesis
E. Cysteine metabolism

96. Laboratory analysis of the urine of a 6-day infant displayed excessive concentration of phenylpyruvate and phenylacetate. Metabolism of what amino acid is disturbed in the body of this child?
A. Phenylalanine
B. Tryptophan
C. Methionine
D. Histidine
E. Arginine

97. 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. Phenylalanine-4-monooxygenase
B. Homogentisate oxidase
C. Glutamine transaminase
D. Aspartate aminotransferase
E. Glutamate decarboxylase

98. In a patient suffering from liver cirrhosis a decrease in urea concentration in blood serum was detected. This may be caused by:
A. Disorder of urea synthesis in liver
B. Absense of alanine aminotransferase activity in hepatocytes
C. Deficiency of ammonia for urea synthesis
D. Deficiency of CO2 for urea synthesis
E. Excess of ammonia blocking enzymes of urea synthesis

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

100. 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. Activation of tyrosinase
B. Inhibition of tyrosinase
C. Activation of homogentisate oxidase
D. Inhibition of homogentisate oxidase
E. Inhibition of phenylalanine hydroxylase

101. A 2-week-old infant is brought to his pediatrician for a check-up. His mother is concerned because he has not been feeding well and appears to have lost weight. His blood is found to contain excess of leucine, isoleucine and valine. This infant is most likely to exhibit which of the following additional symptoms?
A. Dystonia
B. Fair skin
C. Hyperglycemia
D. Recurrent urinary tract infection
E. Red urine with no measurable RBCs
F. Renal stones

102. 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. Methionine
B. Ascorbic acid
C. Glucose
D. Glycerol
E. Citrate

103. Urine analysis of a 12-year-old boy reveals high concentration of all aliphatic amino acids with the highest excretion of cystine and cysteine. US of kidneys revealed kidney concrements. What is the most likely pathology?
A. Cystinuria
B. Alkaptonuria
C. Cystitis
D. Phenylketonuria
E. Hartnup disease

104. 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. Vitamin B12
B. Vitamin C
C. Vitamin B1
D. Vitamin B2
E. Vitamin PP

105. 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. Nitrogen oxide

B. Histamine
C. Bradykinin
D. Acetylcholine
E. Adrenaline

106. Examination of a patient suffering from cancer of urinary bladder revealed high rate of serotonin and hydroxyanthranilic acid. It is caused by excess of the following amino acid in the organism:
A. Tryptophan
B. Alanine
C. Histidine
D. Methionine
E. Tyrosine

107. A male patient has been diagnosed with acute radiation disease. Laboratory examination revealed a considerable reduction of platelet serotonin level. The likely cause of platelet serotonin reduction is the disturbed metabolism of the following substance:
A. 5-Oxytryptophan
B. Tyrosine
C. Histidine
D. Phenylalanine
E. Serine

108. A mother consulted a doctor about her 5-year-old child who develops erythemas, vesicular rash and skin itch under the influence of sun. Laboratory studies revealed decreased iron concentration in the blood serum, increased uroporphyrinogen I excretion with the urine. What is the most likely inherited pathology in this child?
A. Erythropoietic porphyria
B. Methemoglobinemia
C. Hepatic porphyria
D. Coproporphyria
E. Intermittent porphyria

109. 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. Uroporphyrinogen III cosynthase
B. Uroporphyrinogen I synthase
C. б-Aminolevulinate synthase
D. Uroporphyrinogen decarboxylase
E. Ferrochelatase

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

111. The patient, who for a long time has been keeping to an unbalanced lowprotein diet, developed fatty liver infiltration. Name the substance, absence of which in the diet can lead to this condition:
A. Methionine
B. Alanine
C. Cholesterol
D. Arachidonic acid
E. Biotin

112. Patients with severe depression demonstrate decreased serotonin levels in brain and cerebrospinal fluid. What aminoacid is a serotonin precursor?
A. Tryptophan
B. Threonine
C. Tyrosine
D. Glutamic acid
E. Aspartic acid

113. Pharmaceuticals, containing mercury, arsen or other heavy metals, are inhibiting enzymes, posessing sulfhydril groups. What amino acid is used for reactivation of these enzymes?
A. Cysteine
B. Histidine
C. Isoleucine
D. Aspartic acid
E. Glycine

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

115. A polypeptide is shown to have a high pI value (approx. at pH 8,9). What from listed below amino acids is responsible for this property?
A. Arginine
B. Valine
C. Serine
D. Tyrosine
E. Cysteine

116. Glutathion is a tripeptide possessing reducing properties. What amino acid residue is responsible for reductive properties of glutathion?
A. Cysteine
B. Glutamic acid
C. Glycine
D. Valine

E. Aspartic acid

117. As a result of tryptophan hydroxylation in presence of tryptophan-5-monoaxygenase is produced:
A. Serotonin
B. Histamine
C. Dopamine
D. Melanin
E. Adrenaline

118. Examination of a patient suffering from cancer of urinary bladder revealed high rate of serotonin and hydroxyanthranilic acid. It is caused by excess of the following amino acid in the organism:
A. Tryptophan
B. Alanine
C. Histidine
D. Methionine
E. Tyrosine

119. High levels of serotonin and 3-oxianthranilate are revealed in the blood of a patient suffering from urinary bladder cancer. By the disturbance of the metabolism of what amino acid is it caused?
A. Tryptophan
B. Alanine
C. Histidine
D. Methionine
E. Tyrosine

120. In experimental animals hold prolonged time on protein free diet, a fat degeneration of liver has been developed. The possible cause may be insufficiency of methylating agents. Indicate an amino acid, donor of methyl groups:
A. Methionine
B. Phenylalanine
C. Lysine
D. Cysteine
E. Arginine

121. The product of oxidase reactions is hydrogen peroxide, a very toxic substance for cells. An important role in its reduction plays glutathion. Indicate an amino acid present in glutathion structure:
A. Cysteine
B. Serine
C. Alanine
D. Aspartate
E. Thyrosine

122. A patient diagnosed with carcinoid of bowels was admitted to the hospital. Analysis revealed high production of serotonin. It is known that this substance is formed of tryptophan amino acid. What biochemical mechanism underlies this process?
A. Decarboxylation
B. Desamination
C. Microsomal oxydation
D. Transamination
E. Formation of paired compounds

123. Biosynthesis of creatine, synthesis of choline from ethanolamine, adrenaline from noradrenaline, are taking part in a presense of:
A. S-Adenosylmethionine
B. NADH2
C. ATP
D. NADPH2
E. THFA

124. High levels of serotonin and 3-oxianthranilate are revealed in the blood of a patient suffering from urinary bladder cancer. By the disturbance of the metabolism of what amino acid is it caused?
A. Tryptophan
B. Alanine
C. Histidine
D. Methionine
E. Tyrosine

125. Methylene blue promotes oxidation of hemoglobin. Give the name of the obtained compound:
A. Methemoglobin
B. Hematin
C. Hemine
D. Carboxyhemoglobin
E. Carbhemoglobin

126. As a complex protein, hemoglobin consists of protein and non-protein moieties. Indicate the components of hemoglobin.
A. 4 Heme groups, 2 a- and 2 в-polypeptide chains
B. Heme, 1 a- and 3 в-polypeptide chains
C. 4 Heme groups and 4 в-polypeptide chains
D. 4 Heme groups and 4 a-polypeptide chains
E. Heme, 2 a- and 2 в-polypeptide chains

127. The content of vitamin PP is very low in milk and eggs, never the less these products have antipellagric action. It is caused by high content of precursor of this vitamin in mentioned products, namely:
A. Tryptophan
B. Riboflavin
C. Thiamine
D. Adenine
E. GDP

128. During the patronage a doctor revealed that a child had symmetric roughness of skin on his cheeks, diarrhea, disturbance of nervous activity. The deficiency of what

food factors caused the appearance of such symptoms?
A. Nicotinic acid, tryptophan
B. Lysine, ascorbic acid
C. Threonine, panthothenic acid
D. Methionine, lipoic acid
E. Phenylalanine, pangamic acid

129. To obese patient with risk of liver fat degeneration is recommended diet enriched with lipotropic factors. What nutritional component is the most important in diet?
A. Methionine
B. Cholesterol
C. Vitamin C
D. Glycine
E. Glucose

130. Reactions of methylation take place in biosynthesis of catecholamines, creatine, lecithin, as well as in detoxification of some xenobiotics. As donor of methyl groups serves the next substance:
A. Methionine
B. Leucine
C. Glutathion
D. Choline
E. Adenosine

131. Which of the following enzymes catalyses reactions in the biosynthesis of both catecholamines and indoleamines (serotonin)?
A. Aromatic amino acid decarboxylase
B. Dopamine в-hydroxylase
C. Phenylethanolamine N-methyltransferase
D. Tryptophan hydroxylase
E. Tyrosine hydroxylase

132. A patient, 64 years old, worked as pilot in past, has been working with ethanol gas in recent years. From that time, he began to notice pigmentation of hands and scars. Periodically, bubbles appear on the open parts of the body and extremities. The liver is enlarged by 10 cm. The violation of the liver's protein-synthetic function has been detected. Total protein of blood - 100 g/l, albumin - 40 g/l, globulin - 60 g/l. The content of iron in the blood is reduced by 50%. Urine of pink color, with increased content of coproporphyrins in it. What is the possible reason?
A. Porphyria
B. Hemolytic jaundice
C. Albinism
D. Gout
E. Phenylketonuria

133. A patient, 51 years old, complains of constant dull pain in the epigastric region, weakness, weight loss, poor sleep, rashes on the surface of the skin of the face, neck, hands in the form of bubbles. In the history - alcohol abuse. For the first time noticed such a rash a year ago. Aggravation arose in the spring and summer. During examination on the skin of the hands, neck, face, old scars, pigmented spots, and liver enlarged by 5 cm were found. Glucose, bilirubin, and cholesterol are normal. What is the possible reason for this condition?
A. Porphyrinuria
B. Gierke disease
C. Cystic fibrosis
D. Pellagra
E. They-Saks disease

134. A woman 43 years old, a worker of paint and varnish enterprise, complains of general weakness, weight loss, apathy, drowsiness. Chronic lead intoxication is laboratory confirmed: hypochromic anemia has been detected. In blood, elevated levels of protoporphyrin and reduced levels of б-aminolevulinic acid, indicating a violation of the synthesis:
A. Heme
B. Protein
C. RNA
D. Mevalonic acid
E. DNA

135. During examination it was found bubble rash and increased pigmentation of skin under the influence of ultraviolet radiation. Patient's urine is red coloured. Identification of which component in urine will give the possibility to verify Gunter's disease?
A. Uroporphirinogen I
B. Acetone
C. Hemoglobin
D. Creatine
E. Bilirubin

136. There are 20 *L*-amino acids, which can be used for protein synthesis. The sulphur containing amino acid is:
A. Methionine
B. Serine
C. Homoserine
D. Valine
E. Tyrosine

137. Disulphide bridges are providing secondary and tertiary structures of protein molecules. They are formed between the next amino acids:
A. Cysteine-cysteine
B. Lysine-aspartic acid
C. Tyrosine-histidine
D. Proline-tryptophan
E. Histidine-arginine

138. Disulphide bridges are providing secondary and tertiary structures of protein molecules and can be formed between:

A. Two cysteine residues
B. Two methionine residues
C. A methionine and a cysteine residue
D. Two serine residues
E. Two valine residues

139. Creatine is a precursor of creatine phosphate - a macroergic compound. The amino acids involved in the synthesis of creatine are:
A. Arginine, glycine, active methionine
B. Arginine, alanine, glycine
C. Glycine, lysine, methionine
D. Arginine, lysine, methionine
E. Glycine, lysine, alanine

140. Creatine is a precursor of creatine phosphate - a macroergic compound. Note amino acids, which are participants of creatine biosynthesis:
A. Arginine
B. Lysine
C. Methionine
D. Tryptophan
E. Phenylalanine

141. Lipotropic factors are used to prevent fatty liver disease. Which amino acid is a lipotropic factor?
A. Methionine
B. Lecuine
C. Tryptophan
D. Lysine
E. Tyrosine

142. Biogenic amine serotonin is an important neurotransmitter and produced by decarboxylation of the next amino acid:
A. Tryptophan
B. Lysine
C. Histidine
D. Arginine
E. Tyrosine

143. Heme is an iron-containing component of hemoglobin, which provides gas transport function of blood. What amino acid from listed below participates in biosynthesis of heme?
A. Glycine
B. Aspartic acid
C. Methionine
D. Histidine
E. Phenylalanine

144. Which of denoted symptoms are characteristic to cystinosis?
A. The increase of exertion of all amino acids except cyclic; the most prominent is exretion of cystine and cystein
B. Normal blood cystine level
C. Absence of cystine stones in kidneys
D. Hypoaminoaciduria
E. Presence of phenylpyruvic acid in blood

145. Amino acids metabolism can be disturbed in patients with some hereditary diseases. Increased urinary indole acetic acid is diagnostic of:
A. Hartnup disease
B. Maple syrup urine disease
C. Homocystinuia
D. Phenylketonuria
E. Alcaptonuria

146. Tryptophan is an essential amino acid and could be considered as a precursor of: A. Melatonin
B. Thyroid hormones
C. Melanin
D. Epinephrine
E. Insuline

147. Cystinuria is characterized by cystine stones in kidneys and results from inability to:
A. Reabsorb cystine in renal tubules
B. Convert cystine into cysteine
C. Incorporate cysteine into proteins
D. Metabolise cysteine
E. Convert cysteine into methionine

148. Hemoglobin is an oxygen and carbon dioxide transporting molecule, present in erythrocytes and belongs to:
A. Chromoproteins
B. Nukleoproteins
C. Phosphoproteins
D. Lipoprotein
E. Glycoproteins

149. Hemoglobin is an oxygen and carbon dioxide transporting molecule, present in erythrocytes. The structure of heme in hemoglobin is:
A. Protoporphyrin IX, attached to the Fe^{2+}
B. Four pyrrol rings, attached to Fe^{3+}
C. Four pyrrol rings, attached to Fe^{2+}
D. Porphyrin coupled with Fe
E. Protoporphyrin X, attached to and Fe^{3+}

150. Protoporphyrin IX contains the porphine core - a tetrapyrrole macrocycle and belongs to one of the following:
A. Hemoglobins
B. Transferrins
C. Ceruloplasmins
D. Properdins

E. Cryoglobulines

151. Niacin is a water-soluble vitamin and is synthesized in the body from:
A. Tryptophan
B. Tyrosine
C. Glutamate
D. Aspartate
E. Valine

152. A 7-year-old boy is brought to the emergency department by his parents because of severe right-sided lower back and pelvic pain. His creatine level is 1,7 mg/dL and a urine analysis is positive for blood. The pain eventually ceases and the patient is advised to urinate into a strainer. A stone is retrieved and analyzed microscopically. The pathologist states the microscopic crystals appear hexagonal in shape. A defect in which process is likely to be the cause of this patient's recurrent symptoms?
A. Amino acid reabsorption in the proximal tubule
B. Calcium sensor in the parathyroid glands
C. Parathyroid hormone receptor
D. Vitamin D receptor
E. Xanthine oxidase

Situational Tasks:

I. The patient is on a tryptophan-free diet for a long time (all other amino acids are presented in sufficient quantities).
a) To which amino acid group is the amino acid substitutable, polarity and ability to synthesize glucose and ketone bodies?
b) How does protein synthesis change under these conditions?
c) Specify the type of nitrogen balance in the patient.

2. The patient is on an alanine-free diet (all other amino acids are in sufficient quantities).
a) To which amino acid group, by amino acid substitution, polarity, and ability to synthesize glucose and ketone bodies, does this amino acid belong?
b) How does protein synthesis change under these conditions?
c) Specify the type of nitrogen balance in the patient.

3. In a protein-free diet, 25-28 g of protein decays per day. On this basis, the indicators are justified - protein minimum (35 g / day) and protein optimum (80-100 g / day).
a) Give the name of the factor on the basis of which the protein minimum and protein optimum are set.
b) Explain why the protein minimum is greater than the coefficient of 25-28 g / day?
c) Specify physiological processes that provide protein minimum and protein optimum?

4. In a patient with chronic gastritis, there is bloating, iron deficiency anemia, pH of gastric acid is 4.5.
a) What is the pathological condition of the patient? Specify gastric acid pH standards?
b) Explain the cause of iron deficiency anemia.
c) Justify the mechanism of abdominal distention under these conditions.

5. In a 43-year-old patient operated on for obstruction of the colon, the urine turned brown. The doctor suspected an increase in the processes of protein rot in the gut.
a) What pathological component of urine is a marker of protein rot?
b) From which amino acid is it formed?
c) Name the products of decay of phenylalanine and tyrosine in the gut.

6. Epileptiform convulsions caused by vitamin B6 deficiency are observed in infants. The doctor believes that this is caused by a defection of synthesis in the nerve tissue of the mediator.
a) Name this mediator.
b) From which amino acid is it formed?
c) Name the enzyme and coenzyme of this reaction.

7. The patient complains of itching, swelling and redness of the skin.
a) Synthesis of which mediator increases in tissues under these conditions?
b) From which amino acid is it formed?
c) Name the enzyme and coenzyme of this reaction.

8. One of the neurotransmitters formed by sequential hydroxylation and decarboxylation reactions is serotonin.
a) From which amino acid is it formed?
b) Describe the sequential steps of serotonin formation. Name the enzymes and coenzymes.
c) Specify the biological value of serotonin.

9. An important biogenic amine is formed in the decarboxylation process of the ornithine amino acid.
a) What is a biogenic amine?
b) Name the enzyme and coenzyme involved in its formation.
c) Specify the biological value of this biogenic amine.

I0. Increase in activity of alanine aminotransferase enzyme is noted in the patient in serum.
a) What reaction catalyzes this enzyme? Specify the coenzyme.
b) Which organ pathology is most likely? Describe the answer.
c) What is the coefficient de Ritis? How it changes with this pathology?

I I. The 2 years child has the mental retardation, neurological disorders that are exacerbated after eating protein. The content of ammonia in the blood plasma is I50 μmol / l, the high content of citrulline in the blood, in the urine - an increased concentration of ammonium salts.
a) What biochemical process is impaired in a child?
b) Which enzyme deficiency is noted under these conditions?
c) Why eating protein exacerbates neurological disorders?

I2. In a patient of 52 years with liver cirrhosis - headache, nausea, vomiting, inhibition. The content of ammonia in the blood plasma is I00 μmol / l, urea - 2.2 mmol / l; there is a large amount of ammonium salts in the urine.
a) Describe the results of analysis.
b) What biochemical process is impaired in the patient?
c) Describe the feasibility of using a low protein diet in a patient?

13. The patient has neurological disorders, serum ammonia content is 120 μmol / l, blood pH is 7.50.
a) Describe the results of analysis.
b) What the possible causes of this pathological condition?
c) Explain the mechanism of development of neurological disorders under these conditions.

14. The formation of large quantities of ammonia is observed in the gut under the influence of microorganisms.
a) Name the process in which ammonia is formed in the intestine.
b) Name the transport form of intestinal ammonia. How is it formed?
c) Name the products of permanent disposal of ammonia in the liver and kidneys.

15. Ammonia is a highly toxic substance, especially for brain cells.
a) Name the process during which ammonia is formed in the brain.
b) How is the temporary destruction of ammonia in brain cells?
c) How does the activity of the Krebs cycle change during the accumulation of ammonia in brain cells?

16. A combination of the ornithine cycle and the tricarboxylic acid cycle, the Krebs two-wheeled bicycle, is essential in eukaryotic cells, which is important for the functioning of each.
a) At the level of which common metabolite is the combination of these two metabolic processes?
b) Explain the biological significance of the ornithine cycle.
c) What is the significance of the Krebs cycle in the functioning of the ornithine cycle?

17. Hyperoxalaturia and deposition of calcium oxide crystals in the kidneys were found in a 2-year-old child with kidney failure. This is due to a disruption of the metabolism of amino acids, which decomposes to form oxalate.
a) What is an amino acid?
b) What metabolism is closely linked to which amino acid?
c) What coenzyme is involved in this process?

18. A certain amino acid is used for the synthesis of the glutathione tripeptide and the CNS inhibitory mediator u-amino butyric acid (GABA).
a) What is an amino acid?
b) To which amino acid group, by the substitution, polarity, and ability to synthesize glucose and ketone bodies, does this amino acid belong?
c) What other amino acids are included in glutathione?

19. Some of amino acid is used for the synthesis of homocysteine and cysteine, and is a donor of methyl groups of a certain.
a) What is an amino acid?
b) To which amino acid group, by the substitution, polarity and ability to synthesize glucose and ketone bodies, does this amino acid belong?
c) Justify the importance of methylation processes.

20. Nuclear proteins of protamines, histones, and collagen connective tissue protein in large quantities contain a certain amino acid.
a) What is an amino acid?
b) To which amino acid group, by the substitution, polarity and ability to synthesize glucose and ketone bodies, does this amino acid belong?
c) Specify the role of this amino acid in the maturation of collagen. Name the enzymes and coenzymes involved in this.

21. Some of amino acid is used in the primary first cycle and used for the synthesis of nitrogen monoxide of a particular amino acid.
a) What is an amino acid?
b) 1s it use amino acid groups as a substitute, or is it use synthesize glucose and ketone individuals related to that amino acid?
c) Specify the biological value of the nitrogen monoxide.

22. A 10-month-old baby whose parents are brunette have fair hair, very light skin and blue eyes. At birth, she had a normal appearance, but during the last 3 months there were disturbances of cerebral circulation, mental retardation, seizures. Catecholamines are lowered in the blood. When a few drops of 5% trichloctic iron are added to fresh urine, a purple color appears.
a) Which pathology of amino acid metabolism is characterized by such changes? Deficiency of which enzyme is noted under these conditions.
b) What urine metabolite gives purple color in the presence of ferric ions?
c) What explains the light color of the hair and eyes of the child under the specified conditions?

23. Parents of a 3 years child have noticed the darkening of the urine of the child while standing. The body temperature of the baby is normal, the skin is pink, clean, the liver is not enlarged. Bile pigments were not detected in the urine.
a) Which pathology of amino acid metabolism is characterized by such changes?
b) Which enzyme deficiency occurs?
c) Which metabolite causes darkening of urine?

24. The baby refuses to breastfeed, is agitated, irregular breathing, urine has the specific smell of "brewer's leaven" or "refined sugar".
a) Which pathology of amino acid metabolism is characterized by such changes?
b) Which enzyme deficiency occurs?
c) Which amino acid metabolism is destroyed?

25. 1n deficiency in the diet of this amino acid is broken synthesis in the body of vitamin PP.
a) What is an amino acid?
b) Specify the biological value of this amino acid.
c) Name the products of decay of amino acids in the gut.

Chapter IV. Nucleotide metabolism and its regulation.

List of the exam questions:

1. Digestion and absorption of nucleoproteins and nucleotides.
2. Biosynthesis of purine nucleotides.
3. Degradation of purine nucleotides. Hyperuricemia. Lesch-Nyhan syndrome. Gout.
4. Biosynthesis of pyrimidine nucleotides.
5. Catabolism of pyrimidine nucleotides. Orotic aciduria.
6. Biosynthesis of deoxyribonucleotides.

Multiple Choice Questions:

1. A patient suffering from gout was prescribed allopurinol. What pharmacological property of allopurinol provides therapeutic effect in this case?

A. Competitive inhibition of xanthine oxidase
B. Acceleration of nitrogen-containing substances excretion
C. Acceleration of pyrimidine nucleotides catabolism
D. Deceleration of pyrimidine nucleotides salvage
E. Acceleration of nucleic acids synthesis

2. A physician 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 color. What substances can cause such changes in urine?

A. Uric acid salt
B. Chlorides
C. Ammonium salts
D. Calcium phosphate
E. Magnesium sulfate

3. 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. Uric acid
B. Cholesterol
C. Bilirubin
D. Urea
E. Cystine

4. A 49-year-old man complains of pain in his metatarsophalangeal joints and joint deformation. In blood hyperuricemia 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. Gout
B. Pyrophosphate arthropathy
C. Rheumatoid arthritis
D. Hyperparathyroidism
E. Urolithiasis

5. 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. Purines
B. Carbohydrates
C. Lipids
D. Pyrimidines
E. Amino acids

6. 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. Dihydrofolate reductase
B. Thiaminase
C. Deaminase
D. Thioredoxinreductase
E. -

7. 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 transfer of monocarbon groups, thus suppressing the synthesis of the following polymer:

A. DNA
B. Protein

C. Homopolysaccharides
D. Gangliosides
E. Glycosaminoglycans

8. 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. Xanthine oxidase
B. Adenosine deaminase
C. Adenine phosphoribosyl transferase
D. Hypoxanthine guanine phosphoribosyl transferase
E. Guanine deaminase

9. 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. Hypoxanthine guanine phosphoribosyl transferase
B. Xanthine oxidase
C. Dihydrofolate reductase
D. Thymidylate synthase
E. Carbamoyl phosphate synthetase

10. A 46-year-old patient consulted a doctor complaining about joint pain that becomes stronger the day before the weather changes. Blood examination revealed an increased concentration of uric acid. The most probable cause of the disease is the intensified disintegration of the following substance:
A. Adenosine monophosphate
B. Cytidine monophosphate
C. Uridine triphosphate
D. Uridine monophosphate
E. Thymidine monophosphate

11. In a child a physical and mental underdevelopment is observed. In urine is excreted large quantity of orotic acid. This hereditary disease is a result of the next metabolic disorder:
A. Pyrimidine nucleotides synthesis
B. Pyrimidine nucleotides breakdown
C. Purine nucleotides synthesis
D. Purine nucleotides breakdown
E. Ornithine cycle of urea production

12. A 48-year-old patient complained about intense pain, slight swelling and reddening of skin over the joints, temperature rise up to 38°C. Blood analysis revealed high concentration of urates. This condition might be caused by disturbed metabolism of:
A. Purines
B. Collagen
C. Cholesterol
D. Pyrimidines
E. Carbohydrates

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

14. A 65 year old man suffering from gout complains of kidney pain. Ultrasound examination revealed renal calculi. The most probable cause of calculi formation is the strengthened concentration of the following substance:
A. Uric acid
B. Cholesterol
C. Bilirubin
D. Urea
E. Cystine

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

16. In one-month-old child an enhanced content of orotic acid in urine is detected, a child has diminished weight gain. What treatment must be undertaken in order to correct metabolic disorders?
A. Injections of uridine
B. Injections of adenosine
C. Injections of guanosine
D. Injections of thymidine
E. Injections of histidine

17. An oncological patient had been administered methotrexate. With time target cells of the tumor lost sensitivity to this drug. At the same time the change in gene expression of the following enzyme is observed:
A. Dehydropholate reductase
B. Thiaminase
C. Deaminase
D. Pholateoxidase

E. Pholate decarboxylase

18. A 1,7-year-old child with a developmental delay and manifestations of self-agression has the concentration of uric acid in blood at the rate of 1,96 millimole/l. What metabolic disoder is this typical for?

A. Lesch-Nyhan syndrome
B. Gout
C. Acquired immunodeficiency syndrome
D. Gierke'sdisease
E. Cushing's basophilism

19. A patient has increased content of uric acid in his blood that is clinically presented by pain syndrome as a result of urate deposition in the joints. What process does this acid result from?

A. Breackdown of purine nucleotides
B. Lysis of pyrimidine nucleotides
C. Heme catabolism
D. Proteolysis
E. Reutilization of purine bases

20. 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. Hyperuricemy
B. Argininosuccinic aciduria
C. Hyperazotemia
D. Hyperaminoacidemia
E. Citrullinuria

21. Purine ring biosynthesis occurs in ribose-5-phosphate through gradual accumulation of nitrogen and carbon atoms and closing of the rings. The source of ribose phosphate is the process of:

A. Pentose phosphate cycle
B. Glycolysis
C. Glyconeogenesis
D. Gluconeogenesis
E. Glycogenolysis

22. An oncological patient was prescribed fluorouracil that is a competitive inhibitor of thymidine synthase. It inhibits the process of:

A. Pyrimidine nucleotides synthesis
B. Carbohydrate disintegration
C. Purine nucleotides synthesis
D. Purine nucleotides disintegration
E. Lipids synthesis

23. Gout develops when purine nucleotide metabolism is disturbed. A doctor prescribed the patient allopurinol that is a competitive inhibitor of:

A. Xanthine oxidase
B. Succinate dehydrogenase
C. Alcohol dehydrogenase
D. Lactate dehydrogenase
E. Hexokinase

24. A 72-year-old woman complains on pains in joints, restriction of movement in joints. The joints are swollen, looking as an enlarged knots. In blood and urine an increased concentration of uric acid is detected. What disease is characterized by these symptoms?

A. Gout
B. Alkaptonuria
C. Pellagra
D. Hepatitis
E. Liver cirrhosis

25. A physician prescribed allopurinol to a patient suffering from gout. What pharmacological property of allopurinol provide a therapeutic effect in this case?

A. Competitive inhibition of xanthine oxydase
B. Acceleration of pyrimidine nucleotides catabolism.
C. Increace of nitrogen-containing substances excretion.
D. Decrease of pyrimidine nucleotides reutilization.
E. Acceleration of nucleic acids biosynthesis

26. The decrease of uric acid concentration and the accumulation of xanthine and hvpoxanthine were found in the blood of a 12-year-old boy. The genetic defect of the synthesis of what enzyme does it testifies to?

A. Xanthine oxydase
B. Arginase
C. Ornithine carbamoyl transferase
D. Urease
E. Glycerol kinase

27. A 50-year-old patient is diagnosed with gout and there is hyperuricemia in his blood. The metabolism of what substances is disturbed?

A. Purines
B. Fats
C. Amino acids
D. Carbohydrates
E. Pyrimidines

28. An 8-year-old boy suffers from Lesch-Nyhan's disease. The increased concentration of uric acid was determined in this blood. Which biochemical process disorder is the cause of this inherited disease?

A. Salvage of purine nucleotides
B. Synthesis of deoxtribonucleotides
C. Synthesis of purine nucleotides
D. Synthesis of pyrimidine nucleotides

E. Degradation of pyrimidine nucleotides

29. Hereditary Lesch-Nyhan syndrome is characterized by combination of symptoms of gout and mental underdevelopment. This disease is caused by hereditary defect in the next metabolic pathway:

A. Hypoxanthine and guanine reutilisation
B. Urea cycle
C. Pyrimidine nucleotides synthesis
D. Pyrimidine nucleotides breakdown
E. Purine nucleotides synthesis de novo

30. In a child a physical and mental underdevelopement is observed. In urine is excreted large quantity of orotic acid. This hereditary disease is a result of the next metabolic disorder:

A. Pyrimidine nucleotides synthesis
B. Purine nucleotides breakdown
C. Ornithine cycle of urea production
D. Purine nucleotides synthesis
E. Pyrimidine nucleotides breakdown

31. A patient with a suspicion of gout was brought to a clinic. What biochemical analysis is it necessary to perform to confirm the diagnosis?

A. Determination of uric acid level in the blood and urine.
B. Determination of concentration of urea in the blood and urine.
C. Determination of amino acids level in the blood.
D. Determination of creatine level in the blood.
E. Measurement of urease activity in the blood.

32. A patient complains of pain in the small joints. High concentration of uric acid is detected in his blood plasma. What pathology causes such changes?

A. Gout
B. Diabetes mellitus
C. Phenylketonuria
D. Lesch-Nyhan syndrome
E. Diabetes insipidus

33. 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. AMP
B. UTP
C. CMP
D. UMP
E. TMP

34. 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. Uric acid
B. Cholesterol
C. Bilirubin
D. Urea
E. Cystine

35. 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-fluoro-deoxyuridine, which is a thymidylate synthase inhibitor. The synthesis of what biomolecule is blocked under the action of this medicine in the first place?

A. DNA
B. Protein
C. mRNA
D. rRNA
E. tRNA

36. 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 pathology is the disorder of metabolism of:

A. Purines
B. Ammo acids
C. Carbohydrates
D. Lipids
E. Pyrimidines

37. In a 60-year-old man a surgical treatment of prostate cancer was performed, after which a course of chemotherapy with 5-fluorouracil was conducted. Biosynthesis of what vital important substances is blocked with this drug?

A. DNA
B. mRNA
C. rRNA
D. tRNA
E. Protein

38. 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 competitive inhibitor of?

A. Xanthine oxidase
B. Urease
C. Arginase
D. Dihydrouracyl dehydrogenase

E. Carbamoyl synthase

39. A physician evaluates a 42-year-old patient for fatigue. The patient is found to have an elevated white blood cell count and an enlarged spleen. A referral to an oncologist results in a diagnosis of chronic myelogenous leukemia. Treatment with hydroxyurea, a ribonucleotide reductase inhibitor, is begun. The normal function of ribonucleotide reductase is to catalyse which one of the following reactions?

A. Convert ADP to dADP
B. Form PRPP from adenosine diphosphate (ADP) and ribose
C. Convert xanthine to uric acid
D. Form carbamoylphosphate from glutamine, CO2, and two ATP molecules
E. Convert guanosine to guanine and ribose 1-phosphate

40. Formation of thymidine nucleotides, which are used for the biosynthesis of DNA, begins from dUDP, which on the first stage is hydrolised to dUMP, and thereafter methylated. What compound serves as the donor of methyl groups?

A. Methylenetetrahydrofolate
B. Lecithin
C. Choline
D. Methionine
E. Carnitine

41. In reaction of transformation of ribose to deoxyribose in course of deoxyribonucleotide production for DNA biosynthesis participates a low molecular weight protein thioredoxine. It contains two SH groups, which in course of reaction are oxidized. What coenzyme is used in restoration of reduced form of thioredoxine?

A. NADP H2
B. Coenzyme Q
C. Glutathion
D. NAD H2
E. AMP

42. A 7-year-old boy suffers from mental retardation and self-mutilation (e.g., biting through lip) and has an increased susceptibility to gout. These symptoms are characteristic of Lesch-Nyhan syndrome, which is due to a mutation in which of the following pathways?

A. Salvage pathway for purines
B. Salvage pathway for pyrimidines
C. Pathway of uric acid synthesis
D. De novo biosynthesis of purines
E. De novo biosynthesis of pyrimidines

43. A 58-year-old man is awakened by a throbbing ache in his great toe. He has suffered these symptoms before, usually after indulging in a rich meal. On examination, he is noted to have a greatly inflamed great toe; also of note are several small nodules on the antihelix of his ear. Inhibition of which of the following proteins might prevent further occurrences of this man's ailments?

A. Xanthine oxidase
B. Carbamoyl phosphate synthetase
C. HGPRT
D. Orotate phosphoribosyl transferase
E. PRPP synthetase

44. Nitrosamines are considered as deaminating mutagenic agents. What nitrogeneous base is transformed to uracil after deamination with these mutagens?

A. Cytosine
B. Adenine
C. Guanine
D. Thymine
E. Methyluracil

45. A 56-year-old diabetic patient with end-stage renal disease receives a kidney transplant from hiss on. His nephrologist is concerned about the possibility of transplant rejection and puts the patient on mycophenolic acid, which inhibits which important enzyme in the synthesis of nucleotides?

A. IMP dehydrogenase
B. PRPP synthetase
C. Adenylosuccinate synthetase
D. Ribonucleotide reductase
E. Adenylosuccinate lyase

46. Xanthine oxidase is a metalloenzyme and contains the following metal ion as cofactor:

A. Molybdenum
B. Copper
C. Iron
D. Zinc
E. Mangan

47. In urine of monthly child was detected the enchanced quantity of orotic acid. A child gains body mass badly. What substances should be used for correction of metabolism?

A. Uridine
B. Adenosine
C. Guanosine
D. Thymine
E. Histidine

48. The products of xanthine oxidase reaction include one of the following compound: A. Hydrogen peroxide
B. Urea
C. Allantoin
D. CO2

E. Superoxide anion

49. A 13-year-old boy with intellectual disability is brought to the doctor because of strong pain in joints. During the examination, his doctor notices that the boy makes uncontrollable self-injury. His blood analysis reveals increased concentration of uric acid. Which of the following is the most likely cause of these findings?

A. Absence of hypoxantine guanine phosphoribosyl transferase
B. Deficiency of xanthine oxidase
C. Absence of dihydrofolate reductase
D. Increased activity of thymidylate synthase
E. Absence of carbamoyl phosphates

Situational Tasks:

1. Methotrexate is a structural analogue of folic acid used as an antitumor agent (cytostatic).
a) Which enzyme activity is inhibited by methotrexate?
b) What type of inhibitors does it belong to?
c) The synthesis of which coenzyme and which compounds is disturbed?

2. 1n the synthesis of nucleotides and DNA, an important role is played by a vitamin coenzyme that carries single-carbon fragments. When it is deficient, hematopoiesis is disrupted and macrocytic anemia occurs.
a) Name this coenzyme.
b) From which vitamin and with which enzyme is it formed?
c) What single-carbon fragments does it carry?

3. After surgical removal of a part of a stomach at patients there is a malignant macrocytic anemia of Addison-Birmer that is connected with the broken absorption of vitamin B12.
a) Which coenzyme group 2 is formed from vitamin B12?
b) What enzymes is it part of and in what reactions is it involved?
c) Disruption of the synthesis of which substances causes Addison-Birmer anemia?

4. A 19-month-old baby has developmental delay, spasticity, impulsive behavior, and self-aggression (self-inflicted injury). The content of uric acid in the blood is 1.96 mmol / l.
a) What is the name of this disease?
b) What enzyme deficiency does the baby have?
c) What reaction catalyzes this enzyme and what is its significance?

5. Megaloblastic anemia has developed in the child. Treatment with iron-containing drugs and vitamin B12 did not produce the expected results. Orotic acid was found in the urine.
a) What is the name of this disease?
b) What process disorder causes the pathology?
c) Which metabolite can improve the child's condition?

6. 1n a patient of 50 years, the content of uric acid in the blood is 1.7 mmol / l.
a) Comment on the result of the analysis
b) What pathological processes can develop in the patient?
c) Which drug should be prescribed? Give the mechanism of its action.

Chapter V. Fundamentals of molecular biology and genetics.

List of the exam questions:

1. Types of genetic information transfer. Central dogma of molecular genetics.
2. Molecular fundamentals of DNA synthesis (replication).
3. Molecular mechanisms of mutations. DNA repair.
4. Molecular fundamentals of RNA synthesis (transcription).
5. Post-transcriptional alterations in RNA.
6. Reverse transcription. Antiviral drugs.
7. Genetic code and its characterization.
8. Molecular principles of protein synthesis (translation).
9. Post-translational modifications of proteins, protein folding.
10. Regulation of protein biosynthesis (gene expression). The operon theory.
11. Preparations affecting protein biosynthesis: antibiotics and antitumor drugs.
12. Principles of genetic engineering.

Multiple Choice Questions:

1. 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. DNA based on the viral RNA 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. Informational RNA based on the viral protein matrix

2. 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. Translocation
B. Deletion
C. Inversion
D. Deficiency
E. Duplication

3. Cells of a person working in the Chornobyl Exclusion Z one he 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. Repair
B. Replication
C. Transcription
D. Reverse transcription
E. Translation

4. During cell division DNA replication occurs after a signal is received from the cytoplasm, then a certain portion of the DNA helix unwinds and splits into two individual strains. What enzyme facilitates this process?

A. Helicase
B. RNA polymerase
C. Ligase
D. Restrictase
E. DNA polymerase

5. 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. Endonuclease
B. RNA ligase
C. Primase
D. DNA polymerase
E. DNA gyrase

6. It was found out that some compounds, for instance fungi toxins and some antibiotics can inhibit activity of RNA-polymerase. What process will be disturbed in a cell in case of inhibition of this enzyme?

A. Transcription
B. Processing
C. Replication
D. Translation
E. Reparation

7. 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. Transcription
B. Translation
C. Replication
D. Processing
E. Repression

8. It was proved that a molecule of immature mRNA (precursor mRNA) contained more triplets than amino acids found in the synthesized protein. The reason for that is that translation is normally preceded by:
A. Processing
B. Initiation
C. Reparation
D. Mutation
E. Replication

9. It was revealed that T-lymphocytes were affected by HIV. Virus enzyme reverse transcriptase (RNA-dependent DNA polymerase) - catalyzes the synthesis of:
A. DNA on the matrix of virus mRNA
B. Virus informational RNA on the matrix of DNA
C. DNA on virus ribosomal RNA
D. Viral DNA on DNA matrix
E. mRNA on the matrix of virus protein

10. RNA-polymerase B(II) is blocked due to amanitine poisoning (poison of deathcup). It disturbs:
A. Synthesis of m-RNA
B. Synthesis of t-RNA
C. Reversetranscription
D. Primerssynthesis
E. Maturation of m-RNA

11. Into human body were incorporated mercury ions. This led to the increase in rate of transcription of the gene, responsible for detoxification of heavy metals. What protein gene amplification is in the background of this process?
A. Metallothioneine
B. Ceruloplasmin
C. Interferone
D. Transferrin
E. Ferritin

12. In the course of evolution there developed molecular mechanisms for correction of damaged DNA molecules. This process is called:
A. Reparation
B. Transcription
C. C. Translation
D. D. Replication
E. E. Processing

13. Under the influence of physical factors there can develop defects in a DNA molecule. Ultraviolet irradiation, for instance, can cause development of dimers. Dimers are two adjacent pyrimidine bases joined together. Name these bases:
A. Thymine and cytosine
B. Adenine and thymine
C. Guanine and cytosine
D. Adenine and guanine
E . Guanine and thymine

14. Patients suffering from xeroderma pigmentosum have extremely photosensitive skin due to disrupted excision repair. Specify the process that is affected in such patients:
A. Repair of DNA molecule
B. Synthesis of iRNA
C. Maturation of iRNA
D. Synthesis of protein primary structure
E. Intron extraction and exon connection

15. As a result of treatment of viral RNA with nitrous acid, UCA triplet mutated to UGA triplet. What kind of mutation occurred?
A. Transition
B. Nucleotide deletion
C. Missense
D. Nucleotide insertion
E. Inversion

16. Prokaryotic cell division is different from that of eukaryotic, but there is one molecular process that is the basis of both types of division. Name this process.
A. DNA replication
B. Transcription
C. Reparation
D. Translation
E. Gene amplification

17. In some areas of South Africa many people have sickle cell disease characterized by red blood cells that assume an abnormal sickle shape due to the substitution of glutamic acid for valine in the hemoglobin molecule. What is the cause of this disease?
A. Gene mutation
B. Disturbances of the mechanisms of genetic information transmission
C. Crossing-over
D. Genomic mutation
E. Transduction

18. During reproduction of some RNA-containing viruses that cause tumors in animals, genetic information can be transmitted in the opposite direction from the RNA to the DNA via a specific enzyme. The enzyme of reverse transcription is called:
A. Reverse transcriptase
B. DNA polymerase
C. Ligase
D. Primase
E. Topoisomerase

19. DNA replication occurs during the cell division when a signal is received from the cytoplasm, and a certain portion of the DNA helix is unwound and divided into two chains. The helix is unwound by the following enzyme:
A. Helicase
B. Restrictase

C. DNA polymerase
D. RNA polymerase
E. Ligase

20. Skin of patients with pigment xeroderma is very sensitive to the sun radiation, there is a risk of skin cancer development. The reason for this is hereditary deficiency of UF endonuclease. As a result of this defect the following process is disturbed:
A. DNA reparation
B. Transcription
C. DNA replication
D. Translation
E. Initiation

21. Inside a human cell the informational RNA containing both exons and introns was delivered to the granular endoplasmic reticulum to the ribosomes. What process does NOT take place?
A. Processing
B. Replication
C. Transcription
D. Translation
E. Prolongation

22. Blood of a child and putative father was referred to forensic medical examination for affiliation. What chemical components should be identified in the blood under study?
A. DNA
B. Transfer RNA
C. Ribosomal RNA
D. MessengerRNA
E. SnRNA

23. A group of researchers set an experiment and obtained a nucleate mutant cells. In the first place they will have disturbed synthesis of the following compounds:
A. Ribosomal RNA
B. Transfer RNA
C. Lipids
D. Monosaccharides
E. Polysaccharides

24. In a genetical laboratory in course of work with DNA molecules of white rats of Wistar's line a nucleotide was substituted for another one. At that only one amino acid was substituted in the peptide. This result is caused by the following mutation:
A. Transversion
B. Deletion
C. Duplication
D. Displacement of reading frame
E. Translocation

25. General structure of eukaryotic genes is as follows: exon-intron-exon. Such functional structure of a gene leads to certain specifics of the transcription process. What sequence will correspond with precursor mRNA (immature)?
A. Exon-intron-exon
B. Exon-exon-intron
C. Exon-exon
D. Intron-exon
E. Exon-intron

26. 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. Deletion
B. Inversion
C. Duplication
D. Translocation
E. Nullisomy

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. Reverse transcription
B. Replication
C. Transcription
D. Repair
E. Translation

28. RNA of AIDS virus invaded leukocyte and caused production of viral DNA in a cell with the aid of the enzyme revertase. This is based on the next process:
A. Reversed transcription
B. Operone activation
C. Operone repression
D. Convariant replication
E. Reversed translation

29. In oncology patients prolong application of antitumor drugs induce appearance of resistance of target cells to this drugs. What process is responsible for this effect?
A. Gene amplification
B. Gene recombination
C. Gene modification
D. Gene expression
E. Gene mutation

30. Oncology patient was administered an antitumor drug - metothrexate. After some period tumor cells lost sensitivity to this drug. What gene amplification caused this effect?
A. Dihydrofolate reductase
B. Glutathion reductase
C. Thioredoxine reductase
D. Ribonucleitide reductase
E. Methemoglobin reductase

31. Molecular analysis of patient's hemoglobin suffering from anemia revealed change of amino acid Glu 6 for Val-6 in B-chain. What is the molecular mechanism of this pathology?
A. Gene mutation
B. Gene transduction
C. Chromosomal mutation
D. Genome mutation

E. Gene amplification

32. For the treatement of urogenital infections are used quinolons - inhibitors of the enzyme DNA-gyraze. What process is damaged under the influence of quinolons first of all?

A. Replication
B. Gene amplification
C. Reversed transcription
D. Reparation
E. Gene recombination

33. In a patient a disease "xeroderma pigmentosum" was recognized. His skin is extremely sensitive to direct sunlight. Hereditary disorder in biosynthesis of what specific enzyme causes this disease?

A. Endonuclease
B. Exonuclease
C. RNA Polymerase I
D. Glycosidase
E. DNA-ligase

34. Ability to divide is characteristic of procariotic and eukaryotic cells. Procariotic cell division is different from that of eukaryotic, but there is one molecular process that is the basis of both types of division. Name this process.

A. DNA replication
B. Transcription
C. Reparation
D. Translation
E. Gene amplification

35. A 23-year-old man presents to his family physician with a painless swelling of his testicles. An ultrasound is suspicious for a neoplasm, and a biopsy confirms the presence of cancer. He is referred to an oncologist, who begins treatment with the topoisomerase inhibitor etoposide. The normal function of this enzyme is to do which of the following?

A. Break and rejoin the DNA helix during replication
B. Synthesize RNA primers for DNA polymerase
C. Prevent the single strands of DNA from reannealing during replication
D. Repair nuclear DNA in the event of DNA damage
E. Unwind the DNA helix during replication

36. A 37-year-old immigrant from Thailand develops fevers, night sweats, weight loss, and a blood-tinged cough. He present to the emergency room, where an infectious disease doctor is consulted and immediately prescribes a multidrug regimen that includes rifampin. Rifampin inhibits which one of the following types of enzymes?

A. DNA-dependent RNA polymerase
B. DNA-dependent DNA polymerase
C. RNA-dependent DNA polymerase
D. RNA-dependent RNA polymerase
E. Reverse transcriptase

37. Two couples present to the emergency room with severe nausea, vomiting, and diarrhea. One of the patients admits hat she had a dinner party and served a salad containing mushrooms she had picked during haikai the forest earlier that day. Inhibition of which enzyme or process explains the clinical manifestations of a-amanitin poisoning seen in these patients

A. RNA polymerase II
B. RNA splicing
C. RNA polymerase I
D. RNA polyadenylation
E. RNA polymerase III

38. A 4-year-old child, on a well-child check-up, is found to have a large flank mass. Computed tomography demonstrates a large mass arising from the kidney, and a subsequent biopsy reveals a diagnosis of Wilms tumor. A pediatric oncologist starts chemotherapy including the transcription inhibitor actinomycin D. Which of the following statements is correct regarding transcription regulation in bacteria?

A. The TATA box contains a consensus sequence for the binding of RNA polymerase.
B. All mRNAs are monocistronic
C. The RNA chain grows in the30 to50 direction
D. RNA polymerase requires a primer
E. Rho factor is critical for initiation of RNA synthesis

39. A 20-year-old anemic man is found to have an abnormal form of в-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. UAA ^ CAA
B. UAA ^ UAG
C. CGA ^ UGA
D. GAU ^ GAC
E. GCA ^ GAA.

40. Scientists were running the gene experiments on *Esherichia colli*. For the of these experiments, they inserted a segment of human DNA into the circular genome of bacteria. To accomplish this, they used a restriction enzyme, which is known for its ability to cut DNA at palindromic sequences. Which of the following is a palindromic sequence of DNA?

A. GTGTACAC
B. CGCAGAGC
C. CGTCGC
D. ATTAGGAT
E. TATAAG

41. A 34-year-old woman fond mushrooms in the forest near her home. A few hours after eating cooked mushrooms, she experienced colicky abdominal pain, vomiting, diarrhea, and nausea. She has driven herself to the emergency department with these mushrooms. The mushrooms were identified as *Amanita phalloides*. Which

of the following enzymes did the toxin present in these mushrooms inhibit?

A. RNA polymerase II
B. Helicases
C. RNA polymerase II
D. Topoisomerase
E. RNA primase

42. Scientists are investigating the antineoplastic properties of an existing medications. In an in vitro experiments, cancer cells are exposed to this drug and observed over time. Cells exposed to the drug are found to be uniformly arrested in metaphase with intact mitotic spindles. Which of the following drugs most likely used in this experiment?

A. Paclitaxel
B. 5-Fluoruracil
C. Vincristine
D. Bleomycin
E. Cyclophosphamide

43. Scientists are investigating the genetic causes of в-thalassemia in 50 patients. In one of these patients molecular tests showed a single nucleotide substitution in a large noncoding intervening sequence. This patient в-globin gene was cloned and further purified by electrophoresis, which shows a significantly shortened в-globin protein. The mutation responsible for this patient's в-thalassemia most likely leads to defect during which of the following processes?

A. Posttranscriptional modification
B. Transcription
C. Meiosis
D. Posttranslational modification
E. Replication

44. Infectious diseases are treated with antibiotics (streptomycin, erythromycin, chloramphenicol). They inhibit the following stage of protein synthesis:

A. Translation
B. Transcription
C. Replication
D. Processing
E. Splicing

45. 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. mRNA codons
B. tRNA nucleotides
C. tRNA anticodons
D. rRNA anticodons
E. rRNA nucleotides

46. A patient's organism has decreased concentration of magnesium ions that are necessary for attachment of ribosomes to the granular endoplasmic reticulum. It is known that this causes protein biosynthesis disturbance. What stage of protein biosynthesis will be disturbed?

A. Translation
B. Transcription
C. Amino acid activation
D. Replication
E. Termination

47. In diphtheria infection an inhibition of translation process in ribosomes is observed due to inactivation of eEF-2 and blocking the translocation of polypeptide from A site to P-site of ribosome. What enzyme cause inactivation of eEF-2?

A. ADP-ribosyl transferase
B. EEF-2 -protein kinase
C. Peptidyl transferase
D. Peptidyl translocase
E. Hypoxanthine, guanin-phosphoribosyl transferase

48. What enzyme is used for synthesis of genes from template RNA or DNA in gene engineering? (This enzyme was discovered in some RNA containing viruses).

A. Revertase
B. Exonuclease
C. Endonuclease
D. Topoisomerase I
E. Helicase

49. In a patient was recognized endemic goiter. What type of post-translational modification of thyroglobuline is damaged in a patient?

A. Iodination
B. Phosphorylation
C. Methylation
D. Acetylation
E. Glycosylation

50. Genetic information is stored in DNA, which does not participate directly in protein synthesis in the cell. What process provides the transformation of genetic information into amino acid sequence of polypeptide chain?

A. Translation
B. Translocation
C. Transcription
D. Replication
E. Splicing

51. The inherited information is saved in DNA, though directly in the synthesis of protein in a cell it does not participate. What process provides the realization of the inherited information in a polypeptide chain?

A. Translation
B. Transcription
C. Translocation
D. Replication

E. Transformation

52. Redundancy (degeneracy) of the genetic code means that:

A. A given base triplet can code for more then one amino acid

B. There is no punctuation in the code sequences

C. The third base in codon is not important in coding

D. A given amino acid can be coded for by more than one base triplet

E. Codons are not ambiguous

53. A human genome contains about 30000 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. Recombination of genes

B. Amplification of genes

C. Replication of DNA

D. Reparation of DNA

E. Formation of Okazaki fragments

54. During cell analysis, their cytoplasm was determined to have high content of aminoacyl tRNA synthetase. This enzyme ensures the following process:

A. Amino acid activation

B. Repair

C. Elongation

D. Transcription

E. Replication

55. One of the protein synthesis stages is recognition. The first iRNA triplet starts with UAU triplet. What complementary triplet is found in tRNA?

A. AUA

B. AAA

C. GUG

D. UGU

E. CUC

56. A patient has decreased concentration of magnesium ions that are required for ribosomes connection to granular endoplasmic reticulum. This condition is known to disturb the process of protein biosynthesis. Disturbance occurs at the following stage:

A. Translation

B. Transcription

C. Replication

D. Amino acids activation

E. Processing

57. 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. Translation initiation in procaryotes

B. Translation initiation in eucaryotes

C. Transcription initiation in procaryotes

D. Transcription initiation in eucaryotes

E. Replication initiation in procaryotes

58. 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. Gene amplification

B. Nucleotide deletion

C. Genetic recombination

D. Missense mutation

E. Transduction

59. Amino acids join to each other in ribosomes of granular endoplasmic reticulum. Knowing the sequence of amino acids and applying genetic code, it is possible to determine the sequence of nucleoids in:

A. mRNA

B. Introns

C. Proteins

D. Carbohydrates

E. rRNA

60. Genetic information is stored in DNA but does not participate directly in protein synthesis within DNA cells. What process ensures transfer of genetic information into polypeptide chain?

A. Translation

B. Formation of rRNA

C. Formation of tRNA

D. Formation of iRNA

E. Replication

61. A cell of granular endoplasmatic reticulum is at the stage of translation, when mRNA advances to the ribosomes. Amino acids get bound by peptide bonds in a certain sequence thus causing polypeptide biosynthesis. The sequence of amino acids in a polypeptide corresponds with the sequence of:

A. mRNA codons

B. tRNA nucleotides

C. tRNA anticodons

D. rRNA nucleotides

E. rRNA anticodons

62. It is known that information about sequence of amino acids in a protein molecule is encoded as a sequence of four types of nucleotides in a DNA molecule, and different amino acids are encoded by different number of triplets - from one to six. Such peculiarity of the genetic code is called:

A. Degeneracy

B. Universality

C. Nonoverlapping

D. Triplety

E. Specificity

63. A 27-year-old man is seen by his physician fora week-long cough, sore throat, and difficulty swallowing. He is diagnosed with diphtheria, which has reactivated because of waning immunity. One way in which

diphtheria toxin leads to cell death is through the inhibition of eEF-2. Which statement best explains the function ofeEF-2?

A. It is required for the translocation of peptidyl-tRNA during translation

B. It is required for the initiation of protein synthesis

C. It is the agent that binds to, and is inactivated by, chloramphenicol

D. It functions as a peptidyl transferase

E. It is analogous to the prokaryotic factor eIF-1

64. A PCR assay needs to be developed to determine the HIV status of a newborn in the pediatric intensive care unit whose mother is HIV positive. Which set of primers should be used for the assay?

A. The primers should be designed with identical sequences to those in the HIV genome and must bind to DNA in a complementary, antiparallel manner

B. The primers should consist of antiparallel complements of two parts of a noninfected human genome

C. The primers should be synthesized so that, after annealing with potential in fective DNA, the 50 end of both primers ''face'' each other.

D. The primers should be designed to be synthesized with dideoxynucleotides to allows equencing of the mutation.

E. The primers should be designed so that, after annealing with potential infective DNA, the50 end of primer1would ''face'' the 30 end of primer 2.

65. An 8-year old boy is treated with Ciprofloxacin for some respiratory infection. Which of the following enzyme activity is most directly affected by this drug?

A. Topoisomerase

B. DNA polymerase

C. Reverse transctiptase

D. RNA polymerase

E. DNA-ligase

66. In order to study or detect individual genes or specific DNA regions or mutations of interest, it is often necessary to obtain a large quantity of nucleic acid for study. Which of the following techniques is primarily undertaken to amplify DNA?

A. PCR

B. Nothern Blotting

C. Western Blotting

D. Southern Blotting

E. ELISA

67. The same codons are used to code for the same amino acids in all the living organisms. This feature of genetic code is known as:

A. Universality

B. Specificity

C. Non-overlapping

D. Degenerate

E. Commaless

68. The genetic code is the set of rules by which information encoded in genetic material is translated into proteins by living cells. A particular codon always codes for the same amino acid. This feature of genetic code is known as:

A. Specificity

B. Universality

C. Non-overlapping

D. Degenerate

E. Polarity

69. Translation is a complex process and it has become a favorite target for inhibition by antibiotics. Majority of the antibiotics interfere with the bacterial protein synthesis and are harmless to higher organisms. Explain the mechanism of action of tetracycline.

A. It inhibits the binding of aminoacyl tRNA to the ribosomal complex

B. It causes misreading of mRNA and interferes with the normal pairing between codons and anticodons.

C. It enters the A site of ribosome and gets incorporated into the growing peptide chain and causes its release

D. It acts as a competitive inhibitor of the enzyme peptidyl transferase

E. It inhibits translocation by binding with 50S subunit of bacterial ribosome

70. Post-translational modification refers to the covalent and generally enzymatic modification of proteins following protein biosynthesis. In post-translation modification of nascent protein chain are involved the following proteins:

A. Chaperons 60 K

B. Cathepsins

C. Caspases

D. Cytochrome c

E. Ubiquitin

71. Genetic code refers to the relationship between the sequence of nitrogenous bases (UCAG) in mRNA and the sequence of amino acids in a polypeptide chain. What amino acid is coded by the triplet of bases AUG?

A. Methionine

B. Serine

C. Tyrosine

D. Cysteine

E. Valine

72. Which of the following toxins inhibits eukaryotic protein synthesis through the inactivation elongation factor eEF2?

A. Diphtheria toxin

B. Ricin

C. Sarcin

D. Puromycin

E. Cycloheximide

73. O-linked glycosylation is one of the types of post-translational modification of proteins. It is the attachment of a sugar molecule to the oxygen atom of serine (Ser) or threonine (Thr) amino acids in a protein destined for secretion from the cell. Glycosylation proceeds in which of the following cell compartment:

A. Golgi vesicles
B. Mitochondria
C. Lysosomes
D. Proteasomes
E. Ribosomes

74. Restrictases are enzymes of bacterial origin, which are used in recombinant DNA technology. They belong to the next class of enzymes:

A. Hydrolases
B. Oxido-reductases
C. Transferases
D. Liases
E. Isomerases

75. Gene amplification is an increase in the number of copies of a gene without a proportional increase in other genes. This can result from duplication of a region of DNA that contains a gene through errors in DNA replication and repair machinery as well as through fortuitous capture by selfish genetic elements. Which of the following techniques is used for the amplification of genes?

A. Polymerase chain reaction (PCR)
B. DNA fingerprint analysis
C. Southern blot analysis
D. Northern blot analysis
E. Restriction fragment length polymorphism (RFLP) analysis

76. 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 AUGUUUUUUUAG, the only product formed is the dipeptide fMet-Phe. What step in protein synthesis is most likely inhibited by the antibiotic?

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

77. 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. Methionine.
B. Serine.
C. Alanine.
D. Leucine.
E. Lysine.

78. A tRNA molecule that is supposed to carry cysteine (tRNAcys) is mischarged, so that it actually carries alanine (ala-tRNAcys). Assuming no correction occurs, what will be the fate of this alanine residue during protein synthesis?

A. It will be incorporated into a protein in response
B. It will be incorporated into a protein in response
C. It will remain attached to the tRNA, as it cannot
D. It will be incorporated randomly at any codon
E. It will be chemically converted to cysteine by cellular enzymes.

79. Translation is a complex process and it has become a favorite target for inhibition by antibiotics. Majority of the antibiotics interfere with the bacterial protein synthesis and are harmless to higher organisms. Explain the mechanism of action of puromycin.

A. It enters the A site of ribosome and gets incorporated into the growing peptide chain and causes its release
B. It causes misreading of mRNA and interferes with the normal pairing between codons and anticodons.
C. It inhibits the binding of aminoacyl tRNA to the ribosomal complex
D. It acts as a competitive inhibitor of the enzyme peptidyl transferase
E. It inhibits translocation by binding with 50S subunit of bacterial ribosome

80. Protein synthesis rates in procaryotes are limited by the rate of mRNA synthesis. If RNA synthesis occurs at the rate of 50 nucleotides/sec, then rate of protein occurs at:

A. 17 amino acids/sec
B. 10 amino acids/sec
C. 25 amino acids/sec
D. 50 amino acids/sec
E. 100 amino acids/sec

81. What enzyme allows for synthesis of various genes from template-RNA to DNA in genetic engineering (this enzyme catalyzes the process discovered in RNA-viruses)?

A. Reverse transcriptase
B. Exonuclease
C. DNA-ligase
D. Helicase
E. Endonuclease

82. Interferon was named for its ability to interfere with viral proliferation. The various forms of interferon are the body's most rapidly produced and important defense against viruses. Interferons can also combat bacterial and parasitic infections, inhibit cell division, and promote or impede the differentiation of cells. What is the mechanism of interferon action?

A. Protein synthesis depression
B. Protein synthesis increase

C. Replication activation
D. Transcription activation
E. Repair activation

83. In a patient with cystic fibrosis caused by the AF508 mutation, 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 is degraded by the proteasome
B. It performs its normal function, as the ubiquitin largely corrects for the effect of the mutation
C. It is secreted from the cell
D. It is placed into storage vesicles
E. It is repaired by cellular enzymes

84. A 21-years-old man presents to the hospital with a 1-week history of headaches, fever, chills, and nonproductive cough. Vital signs are: temperature 38.2°C, blood pressure 102/76 mm Hg, heart rate 96, respiratory rate 20, and oxygen saturation 92% on room air. Rales and diffuse wheezes are auscultated bilaterally on lung examination. A chest x-ray reveals a fluffy bilateral infiltrates. An antibiotic is prescribed. Which of the following is the mechanism of action of the antibiotic used to treat this patient's infection?

A. Inhibiting protein synthesis by blocking the translocation of the peptide chain
B. Forming free radical toxic metabolites that damage bacterial cell DNA
C. Blocking the transpeptidase cross-linkage of cell walls
D. Inhibiting mycolic acid synthesis
E. Inhibiting DNA-dependent RNA polymerase

True or False:

Indicate whether each of the following statements about eukaryotic cells is true (T) or false (F).

o They have three distinct RNA polymerases.
o Their mRNAs are generally synthesized by RNA polymerase 1.
o RNA polymerase 111 synthesizes only rRNAs.
o The 5S rRNA is synthesized by RNA polymerase 1.
o Their RNA polymerases initiate transcription at\nspecific promoter sites on the DNA.

Indicate whether each of the following statements is true (T) or false (F).

o Assembly of a complete ribosome onto an mRNA requires ATP hydrolysis.
o Aminoacylation or "charging" of tRNA requires the formation of an aminoacyl-AMP intermediate.
o Aminoacyl-tRNA binding to the A site of the ribosome requires the accessory factor EF-G and GTP hydrolysis.
o Translocation of a growing polypeptide from the A to the P site on the ribosome requires EF-G and GTP hydrolysis.
o Termination of translation requires release factors, but no NTP hydrolysis.
o Bacterial mRNA is broken down within a few minutes of its formation in E. coli.
o Bacterial mRNA consists only of the bases that code for amino acids.
o Polysomes do not necessarily contain mRNA.
o Bacterial mRNA normally occurs as a double-stranded structure, with one strand containing codons, the other containing anticodons.
o Bacterial mRNA can be translated while it is still being synthesized.
o A ribosome is the complex within which protein synthesis occurs.
o Ribosomes contain many separate proteins.
o The three ribosomal RNAs in a bacterial ribosome are distributed in three separate, large, ribosomal subunits.
o There are four binding sites for aminoacyl-tRNAs on a ribosome.

• **Regarding translation in eukaryotes versus that in prokaryotes (bacteria), indicate whether each of the following statements is true (T) or false (F).**

○ In eukaryotes the 3' end of the mRNA is associated with the 5' end during initiation whereas in prokaryotes it is not.

○ In prokaryotes it is initiated at an AUG near a Shine-Dalgarno sequence in the mRNA whereas in eukaryotes it is initiated at an AUG near the 3' end of the mRNA.

○ In prokaryotes it is initiated with Met whereas in eukaryotes it is initiated with fMet.

○ In prokaryotes translation and transcription are coupled whereas in eukaryotes they are not.

Situational tasks:

1. The formation of a primary transcript occurs during transcription in eukaryotes. However, the ribosome comes with mature RNA that is different from the primary transcript.
a) What processes occur when converting a primary transcript into a mature mRNA?
b) What is the significance of these processes for eukaryotes?
c) Which of these processes takes place during the maturation of all types of RNA?

2. The alkylating agent dimethyl sulfate converts guanine to 6-methoxyguanine, which loses the ability to form complementary bonds with cytosine, and therefore drops out of the codon.
a) What type of mutation (genomic, chromosomal, gene) causes dimethyl sulfate?
b) Will there be a shift in the reading frame under these conditions?
c) What are the major repair steps that are needed to correct this mistake?

3. After surgical removal of a part of a stomach at patients there is a malignant macrocytic anemia of Addison-Birmer that is connected with the broken absorption of vitamin B12.
a) Which coenzyme group 2 is formed from vitamin B12?
b) What enzymes is it part of and in what reactions is it involved?
c) Disruption of the synthesis of which substances causes Addison-Birmer anemia?

4. Methotrexate is a structural analogue of folic acid used as an antitumor agent (cytostatic).
a) Which enzyme activity is inhibited by methotrexate?
b) What type of inhibitors does it belong to?
c) The synthesis of which coenzyme and which compounds is disturbed?

5. A large number of DNA abnormalities are constantly present in human cells. However, the effect of repair mechanisms allows to maintain the relative constancy of the genotype.
a) What are the main repair enzymes and their values?
b) What is the basic condition for reparation?
c) What are the effects of inefficient repair for somatic cells?

6. The main property of hereditary material to ensure continuity of generations is the ability to replicate.

a) What are the major enzymes involved in replication that provide despiralization and unraveling of DNA?
b) What is a replicative plug and "ori points"?
c) What are Okazaki fragments and how are they formed?

7. The family doctor recommended that the patient receive interferon for influenza prevention.
a) 1nhibitor of which matrix process in bacterial cells is interferon?
b) What is the biochemical mechanism of antiviral action of interferons?
c) Give examples of substances that have an effect on this matrix process.

8. A mutation occurred in a DNA molecule in a patient under UV irradiation.
a) Specify the mechanism of mutagenic action of UV irradiation?
b) What are the successive stages of repair under these conditions?
c) Under what conditions does the patient develop a pigmented xeroderma?

9. An A1DS patient turned to the doctor. Human immunodeficiency virus (H1V) is known to be RNA-containing and damage T-lymphocytes by integrating into their genome.
a) Which virus enzyme is involved in integrating them into the T lymphocyte genome?
b) What direction will the flow of genetic information have in HIV-infected cells?
c) What direction of transmission of genetic information is universal for all eukaryotic cells?

10. During microscopy of human pancreatic cells, round-shaped organelles containing DNA topoisomerase and DNA helicase enzymes were found.
a) What organelles were analyzed?
b) What is the meaning of these enzymes?
c) During what period of the cell cycle does this process take place and what is its significance?

11. Blood was collected for genetic examination in order to establish paternity in the child and the alleged father.
a) Which substance contained in nuclear blood cells will be analyzed to determine paternity?
b) What method will be used for this analysis?
c) Explain the principle of this method.

12. The prolonged consumption of nitrite causes the development of a mutation associated with the ability of these substances to convert cytosine to uracil.
a) What type of mutation (genomic, chromosomal, gene) is caused by nitrites?
b) Will there be a shift in the reading frame under these conditions?
c) Under what conditions will this mutation lead to changes in protein synthesis?

13. Lactose was added to the culture medium, which contains bacteria from E. coli.
a) How does the activity of the repressor protein change?
b) How does the transcription of structural genes in b-galactosidase change?
c) What kind of regulation of gene expression is observed?

14. A patient with pneumonia is assigned a drug from the group of fluoroquinolones - gatifloxacin.
a) 1nhibition of which process in microorganisms is observed under these conditions?
b) The activity of which enzyme is inhibited?
c) What is the biological role of this enzyme?

15. Antibiotic afidicolin is assigned to the patient for the treatment of oncopathology.
a) 1nhibition of which matrix process occurs under these conditions?
b) The activity of which enzymes is inhibited?
c) What is the biological role of these enzymes?

16. A patient with bacterial pneumonia is assigned an antibiotic of the tetracycline group.
a) 1nhibition of which matrix process occurs under these conditions?
b) Explain the mechanism of the bactericidal action of tetracycline?
c) What antibiotics are inhibitors of the same matrix process?

17. Histidine has been added to the culture medium, which contains Escherichia coli bacteria.
a) How does the activity of the protein repressor change?
b) How does the transcription of structural genes of histaminease change?
c) What kind of regulation of gene expression is observed?

18. Organs containing translocase and peptidyltransferase enzymes were found during the study of pancreatic cells.
a) What organelles were studied?
b) What is the stage in which they transmit genetic information?
c) What reactions in the cell catalyze these enzymes?

19. The patient with a diagnosed pneumonia doctor prescribed an antibacterial agent from the macrolide group - azithromycin.
a) What inhibitor of the matrix process in bacterial cells is azithromycin?
b) Explain the mechanism of the antibacterial action of azithromycin.
c) Give examples of antibacterial agents that are an inhibitor of the same matrix process.

20. 1n patients with diphtheria there is a characteristic lesion of the mucous membrane of the upper respiratory tract (the true cereals), which is caused by the action of diphtheria toxin.
a) What stage of genetic information realization in the upper respiratory epithelium inhibits diphtheria toxin?
b) What is the molecular mechanism underlying its cytotoxic action?
c) What coenzyme of epithelial cells destroys diphtheria toxin?

21. A high insulin production is noted in the patient with insuloma. 1nsulin inhibits the synthesis of gluconeogenesis regulatory enzymes by repressing their genes.
a) What does the term "gene repression" mean?

b) At what level is biosynthesis regulated by enzymes of gluconeogenesis by insulin?
c) Is insulin bound to the attenuator or gene enhancer of these enzymes?

22. Patients receiving glucocorticoids eventually develop steroid diabetes. The hyperglycemic action of these hormones is mainly realized by stimulating the synthesis of enzymes of gluconeogenesis. Glucocorticoids penetrate into the nucleus of a cell and bind to a specific strand of DNA, resulting in activation of gene expression of gluconeogenesis enzymes.
a) At what level is the biosynthesis of glucocorticoid enzymes regulated by glucocorticoids?
b) Are glucocorticoids bound to the attenuator or gene enhancer of these enzymes?
c) What processes are combined by the term "gene expression"?

23. The patient is diagnosed with pale toxin (ammonitin) toxin poisoning.
a) What matrix process is affected by the poison?
b) Explain the mechanism of action of ammonitin?
c) What other substances can affect this matrix process?

24. A patient with 50 years old has a form of tuberculosis. The doctor prescribed him a comprehensive treatment, which includes the antibiotic rifampicin.
a) What matrix process is affected by rifampicin?
b) The activity of which enzyme is inhibited?
c) What other substances have an influence on this matrix process?

REFERENCES

I. Biochemistry: Manual for medical students or interns/ L.D. Popova, A.V. Polikarpova – Kharkiv: KNMU, 2011. – 539 p.
2. Biological and Bioorganic Chemistry in 2 books: national textbook for students and teachers of higher medical education establishments. Book I: Bioorganic Chemistry /B. S. Zimenkovsky, V. A. Muzychenko, I. V. Nizhenkovska, G. O. Syrova. – 3rd edition. – K.: AUS Medicine Publishing, 2020. – 288 p.
3. Biological and Bioorganic Chemistry in 2 books: national textbook for students and teachers of higher medical education establishments. Book 2: Biological Chemistry /Yu.I. Gubsky, I.V. Nizhenkovska, M.M. Korda [et al.] – K.: AUS Medicine Publishing, 2020. – 544 p.
4. Vidya Sagar MCQ`s in Biochemistry – New Age International Publisher; Ist Ed. edition (2008) – 301 p.
5. GRE Biochemistry, Cell and Molecular Biology Test: The Best Test Preparation (Paperback) – Research & Education Association – 2007 – 347 p.
6. Harper's Biochemistry. 30th edition / R. K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 2015. – 927 p.
7. Janson L.W., Tischler M. Medical Biochemistry: The Big Picture / The McGraw-Hill Companies, 2012. – 431 p.
8. Lehninger A. Principles of Biochemistry. – Sixth Edition. David L. Nelson and Michael M. Cox. – 2013. – 1336 p.
9. Mardashko O.O., Yasinenko N.Y. Biochemistry. Texts of lectures. – Odessa. The Odessa State Medical University, 2003. – 416 p.
10. Nelson D.L., Cox M.M. Lehninger Principles of Biochemistry. Seventh edition – New York. – W.H. Freeman and Company. – 2017. – 1328 p.
11. Richard A Harvey, Ph. D.; Denise R Ferrier, Lippincott's Illustrated Reviews: Biochemistry, Fifth Edition. – 2011. – 531 p.
12. Rostoka L.M. «Medicine. Biological chemistry – Krok I» Self-Study guide for students for licensing examination Krok I (medical care) / L.M. Rostoka, A.D. Sitkar, Ya.Yu. Burmistrova, H.E. Reyti – Uzhhorod, 2019. – 172 p.
13. Rostoka L.M., Sitkar A.D. Burmistrova Ya.Yu. Medicine. Biological chemistry – Krok I. Self-Study manual for students for licensing examination Krok I (medicine) / L.M. Rostoka, A.D. Sitkar, Ya.Yu. Burmistrova. – Uzhhorod, 2021. – 174 p.
14. Satyanarayana U., Chakrapani U. "Biochemistry", Fourth Edition. – 2013. – 809 p.
15. USMLE™. Step I Biochemistry and Medical Genetics Lecture Notes – 2013 Kaplan, Inc. – 430 p.

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