

**Summary Module Control №3 (for pharmaceutical faculty -№2)**  
**“Metabolism of basic classes of biomolecules. Molecular biology”**

**- carbohydrates**

1. 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. Make an assumptive diagnosis of the illness.

- \* A. Diabetes mellitus.
- B. Alimentary hyperglycemia.
- C. Acute pancreatitis.
- D. Diabetes insipidus.
- E. Ischemic cardiomyopathy.

2 The intake of aspirin by a 3-year-old child with a fever caused marked erythrocytes hemolysis. The inherited deficiency of what enzyme could be the cause of the hemolytic anemia development?

- A. Glycerol-phosphate dehydrogenase.
- B. Glucose-6-phosphatase.
- C. Glycogen phosphorylase.
- \*D. Glucose-6-phosphate dehydrogenase.
- E.  $\gamma$ -Glutamyl transferase .

3. Post-translational covalent modification is an important factor in the regulation of the enzymes' activity. Choose the mechanism of regulation of glycogen phosphorylase and glycogen synthetase activities from the following:

- A. ADP-ribosilation.
- B. Methylation.
- C. Adenylation.
- D. Restricted proteolysis.
- \*E. Phosphorylation-dephosphorylation.

4. Some hours after an intensive physical training a sportsman showed activated gluconeogenesis. Which of the following is the basic substrate of gluconeogenesis?

- A. Serine.
- B. Aspartate.
- C. Glutamate.
- D.  $\alpha$ -Ketoglutarate.
- \*E. Lactate.

5. The concentration of glucose in the blood plasma of a healthy man varies within the following limits:

- A. 2.0-4.0 mM/L.
- \*B. 3.3-5.5 mM/L.
- C. 10.0-25.0 mM/L.
- D. 6.0-9.5 mM/L.
- E. 1.0-2.0 mM/L.

6. A 34-year-old patient's resistance to heavy physical load is reduced while the skeletal muscles glycogen level is increased. By decreasing of the activity of what enzyme can this phenomenon be explained?

- A. Phosphofructokinase.
- B. Glucose-6-phosphate dehydrogenase.
- \*C. Glycogen phosphorylase.
- D. Glycogen synthetase.
- E. Glucose-6-phosphatase.

7. A child with point mutation has the absence of glucose- 6- phosphate body tissues, hypoglycemia and hepatomegaly detected. Define the type of pathology which these symptoms are characteristic of:

- \*A. Girke's disease.
- B. Measles.
- C. Addison's disease.
- D. Parkinson's disease.
- E. McArdle's disease.

8. A man who fainted while training at the final stage of the marathon distance was brought to a hospital in the comatose state. Define the type of coma that was diagnosed .

- \*A. Hypoglycemic.
- B. Hyperglycemic.
- C. Acidotic.
- D. Hypothyroidal.
- E. Hepatic.

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

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

10. The high speed sprint causes a feeling of pain in skeletal muscles of untrained people that occurs due to lactate accumulation. The activation of what biochemical process is it resulting from?

- A. Gluconeogenesis.
- \*B. Glycolysis.
- C. Pentose phosphate pathway.
- D. Lipogenesis.
- E. Glycogenesis.

11. A 2-year-old boy has the increase of liver and spleen sizes detected and eye cataract present. The total sugar level in blood is increased, but glucose tolerance is within the normal range. The inherited disturbance of the metabolism of what substance is the cause of the indicated state?

- A. Glucose.
- B. Fructose.
- \*C. Galactose.
- D. Maltose.
- E. Saccharose.

12. A worker of a chemical plant was brought to a hospital with signs of poisoning. In the woman's hair a high level of arsenate that blocks the lipoic acid was revealed. The disorder of what biochemical process is the most probable cause of poisoning?

- \*A. Oxidative decarboxylation of pyruvate.
- B. Microsomal oxidation.
- C. Reduction of methemoglobin.
- D. Reduction of organic oxides.
- E. Rendering superoxide radicals harmless.

13. A 57-year-old patient, suffering from insulin dependent diabetes mellitus, showed the development of ketoacidosis. The biochemical mechanism of the development of this pathology is decreasing of acetyl-CoA utilization due to the deficiency of:

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

14. Under Girke's glycogenosis the conversion of glucose-6-phosphate into glucose is disturbed, which results in excessive glycogen accumulation in liver and kidneys. The deficiency of what enzyme is the cause of the disease?

- A. Phosphorylase.
- B. Glycogen synthase.
- \*C. Glucose-6-phosphatase.
- D. Hexokinase.
- E. Aldolase.

15. A child is sluggish and inert. His liver is enlarged. The liver biopsy showed the excess of glycogen. The concentration of glucose in blood plasma is below the normal range. What is the cause of the glucose level decrease in blood?

- \*A. Reduced (or absent) activity of glycogen phosphorylase in the liver.
- B. Reduced (or absent) activity of hexokinase.
- C. High activity of glycogen synthase.
- D. Reduced (or absent) activity of glucose-6-phosphatase.
- E. Deficiency of the gene, which is responsible for the synthesis of glucose-1-phosphate uridine transferase.

16. A 38-year-old man is receiving treatment for schizophrenia in hospital. The initial levels of glucose, ketone bodies and urea in the blood are within the normal range. Shock therapy put into practice by regular insulin injections resulted in the development of the comatose state which improved the clinical status of the patient. What is the most probable cause of insulin coma?

- A. Hyperglycemia.
- B. Dehydration of tissues.
- C. Metabolic acidosis.
- D. Ketonemia.
- \*E. Hypoglycemia.

17. A 7-year-old girl manifests obvious signs of anemia. Laboratory tests showed the deficiency of pyruvate kinase activity in erythrocytes. The disorder of what biochemical process is a major factor in the development of anemia?

- A. Deamination of amino acid.
- B. Oxidative phosphorylation.
- C. Tissue respiration.
- D. Breaking up of peroxides.
- \*E. Anaerobic glycolysis.

18. A newborn child with the signs of cataract, growth and mental retardation, who manifested vomiting and diarrhea, was brought to an emergency clinic. A presumptive diagnosis of galactosemia was made. The deficiency of what enzyme occurs in case of this disease?

- \*A. Galactose-1-phosphate uridyl transferase.
- B. Glucokinase.
- C. UDP-galactose-4-epimerase.
- D. Hexokinase.
- E. Glucose-6-phosphate dehydrogenase.

19. An untrained person who has not been practicing physical exercises for a long time complains of muscle pain which accompanies intensive manual work. What is the probable reason of pain syndrome?

- A. Decreasing of lipids level in muscles.
- B. Increased disintegration of muscle proteins.
- C. Accumulation of creatinine in muscles.
- \*D. Accumulation of lactate in muscles.
- E. Increase of ATP level in muscles.

20. A 45-year-old woman does not have any symptoms of insulin dependent diabetes mellitus but testing on an empty stomach showed the increase of the blood glucose level (7.5 mM/l). What additional laboratory test needs to be done to substantiate the diagnosis?

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

21. In the patient's blood the glucose level on an empty stomach was 5.65 mM/l, an hour after sugar loading the corresponding number was 8.55 mM/l, and two hours later it became 4.95 mM/l. Such indexes are typical of the state of:

- A. Insulin dependent diabetes mellitus.
- B. Latent diabetes mellitus.
- \*C. Complete health.
- D. Non-insulin dependent diabetes mellitus.
- E. Thyrotoxicosis.

22. What biochemical process is stimulated in the liver and kidneys of a patient exhausted by starvation?

- A. Synthesis of bilirubin.
- B. Synthesis of urea.
- \*C. Gluconeogenesis.
- D. Formation of hippuric acid.
- E. Synthesis of uric acid.

23. Erythrocytes require energy of ATP for their vital functions. What process provides these cells with the necessary amount of ATP?

- \*A. Anaerobic glycolysis.
- B. Aerobic oxidation of glucose.
- C. Pentose phosphate pathway.
- D.  $\beta$ -Oxidation of fatty acids.
- E. Citric acid cycle.

24. Due to the lack of thiamine (vitamin B<sub>1</sub>) vitamin deficiency a disease called "beri-beri" develops and carbohydrate metabolism becomes disturbed. What metabolite accumulates in blood under beri-beri?

- A. Lactate.
- \*B. Pyruvate.
- C. Succinate.
- D. Citrate.
- E. Malate.

25. Anaerobic oxidation of glucose to lactate is regulated by appropriate enzymes. What enzyme is the main regulator of this process ?-

- A. Lactate- dehydrogenase
- B. Glucose-6-phosphate isomerase.
- C. Aldolase.
- D. Enolase.
- \*E. Phosphofructokinase.

26. A cataract and fatty degeneration of the liver develop in the conditions of high galactose and low glucose level in blood. What disease do these symptoms testify to?

- A. Diabetes mellitus.
- \*B. Galactosemia.
- C. Lactosemia.
- D. Steroid diabetes.
- E. Fructosemia.

27. 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. Atherosclerosis.
- \* B. Diabetes mellitus.
- C. Toxic hepatitis.
- D. Pancreatitis.
- E. Myocardial infarction.

28. 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. Glycogenesis.
- D. Gluconeogenesis.
- E. Glycogenolysis.

29. A woman in the unconscious state was brought to an emergency clinic. Laboratory research revealed that the blood glucose level makes 1.98 mM/l, the level of hemoglobin is 82 g/L, the amount of erythrocytes is  $2.1 \cdot 10^{12}$ , SSE (speed of erythrocytes settling) is 18 mm/hour and the amount of leucocytes is  $4.3 \cdot 10^9$ /L. Make a possible diagnosis.

- \*A. Hypoglycemia.
- B. Diabetes mellitus.
- C. Galactosemia.
- D. Somatotropin deficiency.
- E. Diabetes insipidus .

30. Because of prolonged starvation, the tissue carbohydrate stores are quickly exhausted and hypoglycemia ensues in a human body. Which of the following metabolic pathways can restore the level of glucose in blood?

- A. Aerobic glycolysis.
- B. Anaerobic glycolysis.
- \*C. Gluconeogenesis.
- D. Glycogenolysis.
- E. Pentose phosphate pathway.

31. Girke's disease is an inherited pathology due to which the superfluous accumulation of glycogen occurs in liver and kidneys. The deficiency of which enzyme is the cause of this disease?

- A. Glycogen phosphorylase.
- \*B. Glucose-6-phosphatase.
- C. Phosphorylase kinase.
- D. Phosphoglucomutase .
- E. Glucokinase.

32. 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. Methylmalonyl-CoA.
- B. Succinyl -CoA.
- C. Propionyl-CoA.
- D. Malonyl-CoA.
- \*E. Acetyl-CoA.

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

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

34. A 40-year-old man complains of intolerance to dairy produce. The deficiency of what enzyme of the digestive system accounts for the phenomenon?

- A. Amylase.
- B. Lactate dehydrogenase.
- C. Maltase.
- D. Lipase.
- \*E. Lactase.

35. A patient suffering from diabetes mellitus fainted after the introduction of insulin, then cramps appeared. What level of sugar was determined in the patient's blood by means of biochemical analysis?

- A. 10.0 mM/l.
- B. 3.3 mM/l.
- C. 8.0 mM/l.
- \*D. 1.5 mM/l.
- E. 5.5 mM/l.

36. 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.

37. Skeletal muscle pain during physical work is a characteristic sign of glycogenosis. The inherited deficiency of what enzyme does this pathology result from?

- \*A. Glycogen phosphorylase.
- B. Glucose-6-phosphatase.
- C. Glycogen synthetase.
- D. Amylo-1.6-glicosidase.
- E. Lysosomal glycosidase.

## *Lipids*

38. 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 as the components of:

- A. LDL.
- B. Globulins.
- C. HDL.
- \*D. Serum albumins.
- E. Chylomicrons.

39. 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. Phospholipids.
- B. Fatty acids.
- C. Chylomicrons.
- D. Triacylglycerols.
- \*E. Bile acids.

40. A patient suffers from arterial hypertension due to atherosclerotic injury of blood vessels. The consumption of what dietary lipid needs to be limited?

- A. Lecithine.
- B. Oleic acid .
- \*C. Cholesterol.
- D. Monooleateglycerol.
- E. Phosphatidylserine.

41. Which of the following enzymes accelerates the lipolysis under the action of epinephrine?

- \*A. Triacylglycerol lipase.
- B. Lipoprotein lipase.
- C. Phospholipase A<sub>2</sub>
- D. Phospholipase C.
- E. Cholesterol esterase.

42. 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.

43. In a human body the adipose tissue is the basic location of triacylglycerols (TAG) deposit. At the same time their synthesis takes place in hepatocytes. In the form of what molecular complex are TAG transported from the liver into the adipose tissue?

- A. Chylomicrons.
- \*B. VLDL.
- C. LDL.
- D. HDL.
- E. Complexes with albumin.

44. Laboratory investigation of a patient revealed a high level of plasma LDL. What disease can be diagnosed?

- A. Gastritis.
- B. Nephropathy.
- C. Acute pancreatitis.
- \*D. Atherosclerosis.
- E. Pneumonia.

45. Laboratory testing of the patient's blood and urine showed the following biochemical indexes: blood: sugar - 16.0 mM/l, ketone bodies 0.52 mM/l; urine: diuresis - 10 1/24 h, sugar - 2.0 %, ketone bodies - ++++. What is a credible diagnosis?

- A. Kidney diabetes.
- B. Diabetes insipidus.
- C. Steroid diabetes.
- \*D. Diabetes mellitus.
- E. Cushing's disease.

46. 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.

47. After the consumption of a diet rich in fats, a patient complains of languor and nausea. Later signs of steatorrhea appear. The level of blood cholesterol makes 9.2 mM/l. The shortage of what substances causes this state of a patient?

- A. Fatty acids.
- B. Triacylglycerols.
- \*C. Bile acids.
- D. Phospholipids.
- E. Chylomicrons.

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

- \*A. Methionine.
- B. Ascorbic acid.
- C. Glucose.
- D. Glycerol.
- E. Citrate.

49. Clinical signs and laboratory testing of a patient allow to make the assumption of gall-bladder inflammation, colloid properties of bile disorder, the occurrence of gall-stones. Which substances can underlie the formation of gall-stones?

- A. Oxalates.
- B. Urates.
- \*C. Cholesterol.
- D. Chlorides.
- E. Phosphates.

50. A diet enriched with lipotropic substances is recommended to a 65-year-old patient with signs of total obesity and fatty dystrophy of the liver. Which substances from the listed below are lipotropic?

- A. Vitamin C.
- B. Cholesterol.
- C. Glucose.
- \*D. Methionine.
- E. Glycine.

51. Arachidonic acid, an essential component of a human diet, acts as a precursor of the vitally important physiologically active biomolecules. Which substances are synthesized from arachidonic acid?

- A. Ethanolamine.
- B. Choline.
- C. Noradrenaline.
- \*D. Prostaglandin E<sub>1</sub>
- E. Triiodothyronine.

52. Laboratory investigation of the patient's blood plasma, which was performed 4 hours after a consumption of a fat diet, displayed a marked increase of plasma turbidity. The most credible cause of this phenomenon is the increase of ... in the plasma.

- A. HDL.
- \*B. Chylomicrons.
- C. LDL.
- D. Cholesterol.
- E. Phospholipids.

53. The insufficient secretion of what enzyme is the cause of incomplete fats degradation in the digestive tract and appearance of great quantity of neutral fats in feces?

- A. Pepsin.
- B. Phospholipase.
- C. Enterokinase.
- D. Amylase.
- \*E. Pancreatic lipase.

***-amino acids and simple proteins***

54. Albinos suffer badly from the influence of ultraviolet light - they get sunburnt because of spending too much time in the sun. Metabolism disturbance of what amino acid is the reason for this phenomenon?

- A. Tryptophan.
- B. Methionine .
- \*C. Phenylalanine.
- D. Glutamate.
- E. Histidine.

55. There is a peptide in a human body in which the formation of the  $\gamma$ -carboxylic group of glutamate takes part. What is this peptide called?

- A. Vasopressin.
- B. Carnosine.
- C. Anserine.
- D. Oxytocin.
- \*E. Glutathione.

56. High levels of serotonin is 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.

57. 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. Aspartate aminotransferase.
- B. Glucose-6-phosphate dehydrogenase.
- C. Glycerol kinase.
- \*D. Dehydrogenase of branched-chain  $\alpha$ -keto acids.
- E. UDP-glucuronyl transferase.

58. Laboratory analysis of the urine of a six-day infant displayed excessive concentration of phenyl pyruvate and phenylacetate. Metabolism of what amino acid is disturbed in the child?

- A. Methionine.
- B. Tryptophan.
- \*C. Phenylalanine.
- D. Histidine.
- E. Arginine.

59. A 46-year-old female has been suffering from progressive myodystrophy (Duchenne's disease) for a long time. The change of catalytic activity of what blood enzyme proves to be a diagnostic test for the disease?

- A. Lactate dehydrogenase.
- \*B. Creatine kinase.
- C. Pyruvate dehydrogenase.
- D. Glutamate dehydrogenase.
- E. Adenylate kinase.

60. Albinos become tanned poorly, instead they get sunburns. The disorder of what amino acid metabolism causes this phenomenon?

- A. Glutamate.
- B. Methionine.
- C. Tryptophan.
- \*D. Phenylalanine.
- E. Histidine.

61. A patient with a cranial trauma manifests repeated epileptoid seizures. The biosynthesis of what biogenic amine is disturbed in this clinical situation?

- A. Histamine.
- \*B. GABA.
- C. Adrenaline.
- C. Serotonin.
- E. Dopamine.

62. A patient suffering from collagenose manifests signs of connective tissue destruction. The rise of blood concentration of what substances confirms the presumptive diagnosis of the disease?

- A. Isoforms of LDH.
- B. Creatine and creatinine.
- \*C. Oxyproline and oxylysine.
- D. Transaminases.
- E. Urates.

63. A 53-year-old man had Paget's disease diagnosed. The sharp increase of oxyproline level was detected in the patient's daily urine output that first and foremost testifies to the stimulation of the disintegration of:

- A. Keratin.
- \*B. Collagen.
- C. Albumin.
- D. Elastin.
- E. Fibrinogen.

64. In psychiatric practice, biogenic amines and their derivatives are 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. Dopamine.
- B. Histamine.
- C. Serotonin.
- \*D. GABA.
- E. Taurine.

65. Wilson's disease, so-called hepato cerebral degeneration, is manifested by the lowered blood ceruloplasmin level. Insufficiency of this transport protein leads to:

- A. Decarboxylation of amino acids.
- B. Degradation of tissue albumins.
- \*C. Formation of complexes of amino acids with copper.
- D. Synthesis of urea.
- E. Transamination of amino acids.

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

- \*A. Alkaptonuria.
- B. Albinism.
- C. Cystinuria.
- D. Porphyrinuria.
- E. Isosthenuria

67. A 9-year-old boy was brought to a hospital with signs of mental and physical retardation. A biochemical blood test revealed the increased level of phenylalanine. The blockage of what enzyme can result in such state of the patient?

- A. Glutamate decarboxylase.
- B. Homogentisate oxidase.
- C. Glutamine transaminase.
- D. Aspartate aminotransferase.
- \*E. Phenylalanine-4-monooxygenase.

68. A mother of a 6-year-old child has noticed that the child's urine is too dark. The child does not have any complaints. Bile pigments are not present in the urine. The diagnosis of alcaptonuria is set. The deficiency of what enzyme is observed in this case?

- A. Oxyphenylpyruvate oxidase.
- B. Phenylalanine hydroxylase.
- C. Tyrosinase.
- \*D. Homogentisate oxidase.
- E. Decarboxylase of phenylpyruvate.

69. 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 amino acids level in the blood.
- B. Determination of concentration of urea in the blood and urine.
- C. Determination of creatine level in the blood.
- D. Measurement of urease activity in the blood.
- \*E. Determination of uric acid level in the blood and urine.

70. Ammonia is a very poisonous chemical, especially for the nervous system. What substance takes a particularly active part in the detoxication of ammonia in the brain tissue?

- A. Lysine .
- \*B. Glutamic acid.
- C. Proline.
- D. Histidine.
- E. Alanine.

71. Biogenic amines, namely histamine, serotonin, dopamine etc., are very active substances that affect markedly various physiological functions of the organism. What biochemical process is the principal pathway for biogenic amines production in body tissues?

- \*A. Decarboxylation of amino acids.
- B. Deamination of amino acids.
- D. Transamination of amino acids.
- C. Oxidation of amino acids.
- D. Reductive amination.

72. Parents of a 5-year-old child consulted a doctor. Examination of the child discovered retardation in mental development and growth, as well as abasement of the child's agility. The basal metabolism is lowered. What disease does the child suffer from?

- A. Lesch-Nyhan syndrome.
- \*B. Cretinism.
- C. Phenylketonuria.
- D. Hyperparathyroidism.
- E. Endemic goiter.

73. A citrullin and a high level of ammonia are determined in the urine of a newborn child. The formation of what substance is the most credible to be disturbed?

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

74. Fats, proteins, carbohydrates, vitamins, mineral salts, and water constitute the daily diet of a healthy adult. Name the amount of proteins, which provides normal vital functions of the organism:

- \*A. 100-120 g daily.
- B. 50-60 g daily.
- C. 10-20 g daily.
- D. 70-80 g daily.
- E. 40-50 g daily.

75. A 13-year-old patient complains of general weakness, rapid fatigue. There is retardation in his mental development. Laboratory investigation revealed high concentrations of valine, isoleucine and leucine in his blood and urine. The urine has a specific smell. What can the cause of such state be?

- A. Histidinemia.
- B. Addison's disease.
- C. Tyrosinosis.
- \*D. «Maple syrup» disease.
- E. Diffuse toxic goiter.

76. Which of the substances listed below is an acceptor of  $\text{NH}_2$ -groups in the reactions of amino acids transamination?

- A. Argininosuccinate.
- \*B.  $\alpha$ -Ketoglutarate.
- C. Lactate.
- D. Citrulline.
- E. Ornithine.

77. Krebs cycle plays an essential role in the realization of gluconeogenic effect of certain amino acids. It is caused by the obligatory transformation of their anazotic carbon skeletons into:

- A. Malate.
- \*B. Oxaloacetate.
- C. Succinate.
- D. Fumarate.
- E. Citrate.

78. A 2-year-old boy has been admitted to a hospital because of recurrent vomiting, especially after meals. The child does not gain weight, his physical development is retarded. His hair is dark with grey locks here and there. Prescribe proper treatment to him.

- A. Introduction of specific amino acid mixtures.
- B. Enzymatic therapy.
- C. A diet with the lowered content of phenylalanine.
- \*D. A diet with the increased content of carbohydrates (or fats) and the lowered content of proteins.
- E. A protein-free diet.

79. A 7-year-old child was admitted to an emergency clinic in the state of allergic shock provoked by a wasp sting. High concentration of histamine was determined in the patient's blood. Which biochemical reaction leads to the production of this amine:

- A. Reduction.
- B. Hydroxylation.
- C. Dehydration.
- D. Deamination.
- \*E. Decarboxylation.

80. A ten-month-old child, whose parents are dark-haired, is fair-haired, fair-complexioned, and blue-eyed. The neonate seemed to be healthy, but during the last three months the cerebral circulation disorder and the retardation of mental development appeared. The cause of such state is:

- \*A. Phenylketonuria.
- B. Galactosemia.
- C. Glycogenosis.
- D. Acute porphyria.
- E. Histidinemia.

81. A newborn child has dark coloring of scleras and mucous membranes. The excreted urine darkens in the air. Laboratory tests of blood and urine have revealed the occurrence of homogentisic acid. What can the cause of this state be?

- A. Cystinuria.
- B. Albinism.
- C. Galactosemia.
- \*D. Alcaptonuria.
- E. Histidinemia.

82. An unusually active amine, a mediator of inflammation and allergy, appears via decarboxylation of histidine. Which of the following is it?

- A. Serotonin.
- \*B. Histamine.
- C. Dopamine.
- D.  $\gamma$ -Aminobutyrate.
- E. Tryptamine.

83. One of the forms of innate human pathology is accompanied by the blockage of the conversion of phenylalanine into tyrosine. The biochemical manifestation of the disease is the accumulation of certain organic acids in the organism including:

- \*A. Phenylpyruvate.
- B. Acetate
- C. Phosphoenolpyruvate.
- D. Lactate.
- E. Glutamate.

84. The signs of skin depigmentation of a 19-year-old patient are caused by the disorder of melanin synthesis. The disturbance of the metabolism of what amino acid is it caused by?

- A. Histamine.
- B. Tryptophan.
- \*C. Tyrosine.
- D. Proline.
- E. Lysine.

85. Affected by ultraviolet radiation, human skin darkens, which is a protective reaction of the organism. What protective substance, namely amino acid derivative, is synthesized in the cells under these conditions?

- A. Arginine.
- \*B. Melanin.
- C. Methionine.
- D. Phenylalanine.
- E. Thyroxin.

86. Which one of the following statements is FALSE?

- a. Some amino acids are ketogenic and some amino acids are glucogenic.
- b. Acetyl-CoA is a common product of oxidation of some carbohydrates, proteins, and fatty acids.
- c. The conversion of pyruvate to acetyl-CoA as catalyzed by pyruvate dehydrogenase is highly regulated.
- d. Nucleic acids are not a major foodstuff.
- \*e. All fatty acids can be converted to glucose.

87. \_\_\_\_\_ is an intermediate in the synthesis of both ketone bodies and cholesterol.

- a.  $\beta$ -hydroxybutyrate
- b. mevalonic acid
- c. malonyl CoA
- d. farnesyl pyrophosphate
- \*e.  $\beta$ -hydroxymethylglutaryl-CoA (HMG-CoA)

88. What do the amino acids tyrosine, tryptophan, and histidine have in common?

- a. They are methylated by S-adenosyl methionine (SAM).
- b. They serve as precursors for the synthesis of purines and pyrimidines.
- \*c. They are decarboxylated to enable the synthesis of various biogenic amines.
- d. They serve as donors for the synthesis of the least oxidized and intermediate oxidized one-carbon derivatives of FH<sub>4</sub>.
- e. They instruct embryonic stem cells to differentiate into cardiac myocytes

89. Which one of the following is NOT a substrate, product, or intermediate in the biosynthesis of urea?

- a. CO<sub>2</sub>
- b. NH<sub>4</sub><sup>+</sup>
- \*c. phenylalanine
- d. aspartate
- e. arginine

90. What would be the products for a transamination (aminotransferase) reaction in which glutamate and pyruvate are substrates?

- a. glutamine and acetyl-CoA
- b. glutamine and lactate
- c.  $\alpha$ -ketoglutarate and acetyl-CoA
- d.  $\alpha$ -ketoglutarate and lactate
- \*e.  $\alpha$ -ketoglutarate and alanine

*-molecular biology*

91. In most patients with gout as well as those with Lesch-Nyhan syndrome, purines are overproduced and overexcreted. Yet the hypoxanthine analogue allopurinol, which effectively treats gout, has no effect on the severe neurological symptoms of Lesch-Nyhan patients because it does not:

- \*a. Decrease de novo purine synthesis
- b. Decrease de novo pyrimidine synthesis
- c. Diminish urate synthesis
- d. Increase phosphoribosylpyrophosphate (PRPP) levels
- e. Inhibit xanthine oxidase

92. Which statement best describes xanthine?

- a. It is a direct precursor of guanine
- b. It covalently binds to allopurinol
- c. It is a substrate rather than a product of the enzyme xanthine oxidase
- \*d. It is oxidized to form uric acid
- e. It is oxidized to form hypoxanthine

93. Which base derivative can serve as a precursor for the synthesis of two of the other base derivatives shown?

- a. Cytidine triphosphate (CTP)
- \*b. Uridine monophosphate (UMP)
- c. Deoxythymidine monophosphate (dTMP)
- d. Adenosine triphosphate (ATP)
- e. Deoxyadenosine monophosphate (dAMP)

94. Purine nucleotide biosynthesis can be inhibited by which of the following?

- a. Guanosine triphosphate (GTP)
- b. Uridine monophosphate (UMP)
- \*c. Adenosine monophosphate (AMP)
- d. Adenosine triphosphate (ATP)
- e. Inosine diphosphate (IDP)

95. Which of the following compounds is a required substrate for purine biosynthesis?

- a. 5-methyl thymidine
- b. xanthine
- \*c. ribose phosphate
- d. 5-phosphoribosylpyrophosphate
- e. 5-fluorouracil

96. It is well known that DNA polymerases synthesize DNA only in the 5' to 3' direction. Yet, at the replication fork, both strands of parental DNA are being replicated with the synthesis of new DNA. How is it possible that while one strand is being synthesized in the 5' to 3' direction, the other strand appears to be synthesized in the 3' to 5' direction? This apparent paradox is explained by:

- a. 3' to 5' DNA repair enzymes
- b. 3' to 5' DNA polymerase
- \*c. Okazaki fragments
- d. Replication and immediate crossover of the leading strand
- e. Lack of RNA primer on one of the strands

97. Xeroderma pigmentosum (278700) is an inherited human skin disease that causes a variety of phenotypic changes in skin cells exposed to sunlight. The molecular basis of the disease appears to be:

- a. Rapid water loss caused by defects in the cell membrane permeability
- b. The inactivation of temperature-sensitive transport enzymes in sunlight
- c. The induction of a virulent provirus on ultraviolet exposure
- d. The inability of the cells to synthesize carotenoid-type compounds
- \*e. A defect in an excision-repair system that removes thymine dimers from DNA

98. In contrast to DNA polymerase, RNA polymerase:

- a. Fills in the gap between Okazaki fragments
- b. Works only in a 5' to 3' direction
- c. Edits as it synthesizes
- \*d. Synthesizes RNA primer to initiate DNA synthesis
- e. Adds nucleoside monophosphates to the growing polynucleotides

99. Which of the following enzymes can polymerize deoxyribonucleotides into DNA?

- a. Primase
- b. DNA ligase
- c. DNA gyrase
- d. RNA polymerase HI
- \*e. Reverse transcriptase

100. The patient is admitted into the emergency room with nausea, vomiting, diarrhea, and abdominal pain. His family indicates he has eaten wild mushrooms. You note the presence of *Amanita phalloides*, the death-cap mushroom. A major toxin of the death-cap mushroom is the hepatotoxic octapeptide  $\alpha$ -amanitin, which inhibits:

- a. DNA primase
- b. RNA nuclease
- c. DNA ligase
- \*d. RNA polymerase
- e. RNA/DNA endonuclease

101. How many high-energy phosphate-bond equivalents are utilized in the process of activation of amino acids for protein synthesis?

- a. Zero

- b. One
- \*c. Two
- d. Three
- e. Four

102. Which of the following statements regarding eukaryotic cells is true?
- a. Formylated methionyl-tRNA is important for initiation of translation
  - b. Single mRNAs specify more than one gene product
  - \*c. Cycloheximide blocks elongation during translation
  - d. Cytosolic ribosomes are smaller than those found in prokaryotes
  - e. Erythromycin inhibits elongation during translation

103. Guanosine triphosphate (GTP) is required by which of the following steps in protein synthesis?
- a. Aminoacyl-tRNA synthetase activation of amino acids
  - b. Attachment of ribosomes to endoplasmic reticulum
  - \*c. Translocation of tRNA-nascent protein complex from A to P sites
  - d. Attachment of mRNA to ribosomes
  - e. Attachment of signal recognition protein to ribosomes

104. Which one of the following eucaryotic mRNA processing steps is INCORRECTLY paired with its function?

- a. Capping - used to help associate an mRNA with the ribosome
- b. Splicing - done in alternative patterns to produce different versions of a protein
- c. Polyadenylation - used to prevent an mRNA from being translated
- d. Transport - refers to moving the mRNA from nucleus to the cytoplasm
- \*e. Degradation - may be regulated to control the resulting protein levels

105. Which one of the following contributes nitrogen atoms to both purine and pyrimidine rings?

- \*a. Aspartate
- b. Carbamoyl phosphate
- c. Carbon dioxide
- d. Glutamine
- e. Tetrahydrofolate