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

Biochemistry test bank
Part 3. Hormones. Functional biochemistry.

Self-preparation manual for medical students

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Упорядники:
- зав. кафедри біохімії та фармакології медичного факультету ДВНЗ «УжНУ», к.мед.н., доц. **Ростока Лариса Михайлівна,**
- асистент кафедри біохімії та фармакології медичного факультету ДВНЗ «УжНУ» **Бурмістрова Яна Юріївна**
- асистент кафедри біохімії та фармакології медичного факультету ДВНЗ «УжНУ» **Сіткар Андрій Дмитрович**

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

РЕЦЕНЗЕНТИ:
Дербак М.А. – д.мед.н., професор, зав. кафедри факультетськох терапії медичного факультету ДВНЗ «УжНУ»
Сірчак Є.С. – д.мед.н., професор, зав. кафедри пропедевтики внутрішніх хвороб медичного факультету ДВНЗ «УжНУ»

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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: regulation of metabolism, hormones, biochemistry of nutrition, vitamins, biochemistry and pathobiochemistry of blood, biochemistry of liver, xenobiotics and detoxification processes, biochemistry of kidneys and urine, water-mineral metabolism, biochemistry of muscle, connective tissue and nervous system. The tests are divided into five chapters, each of which includes tasks of different types of difficulty: multiple choice questions, theoretical questions and situational tasks. 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. Regulation of metabolism. Hormones.

List of the exam questions:

1. General principles of the metabolic processes regulation in the human organism. Hormones: characteristic, classification, mechanism of action.
2. Hypothalamic-pituitary axis. Liberins and statins. The posterior pituitary hormones: oxytocin, vasopressin. Diabetes insipidus.
3. Hormones of anterior pituitary. Gigantism, acromegaly, dwarfism. Hyperprolactinemia. Hypopituitarism.
4. Pineal gland hormones.
5. Hormones of thyroid gland. Cretinism, myxedema, endemic goiter. Hyperthyroidism.
6. Hormones of adrenal medulla: catecholamines. Pheochromocytoma.
7. Hormones of adrenal cortex: glucocorticoids. Addison's disease. Cushing's syndrome and disease.
8. Mineralocorticoids. Renin-angiotensin system. Conn's syndrome. Kinin-kallikrein system.
9. Hormones of pancreas: insulin and glucagon. Diabetes mellitus: causes, clinical symptoms, diagnostic.
10. Hormonal regulation of calcium and phosphorus metabolism. Hypo- and hyperparathyroidism.
11. Sex glands hormones. Disorders associated with an imbalance of sex hormones.
12. Tissue hormones. Gastrointestinal hormones. Cytokines.

Multiple Choice Questions:

1. During removal of the hyperplastic thyroid gland of a 47-year-old woman, the parathyroid gland was damaged. One month after the surgery the patient developed signs of hypoparathyroidism: frequent convulsions, hyperreflexia, laryngospasm. What is the most likely cause of the patient's condition?

A. Hypocalcemia
B. Hyponatremia
C. Hyperchlorhydria
D. Hypophosphatemia
E. Hyperkalemia

2. On examination the patient presents with hirsutism, moon-shaped face, stretch marks on the abdomen. BP is 190/100 mm Hg, blood glucose is 17,6 mmol/l. What pathology is such clinical presentation characteristic of?

A. Adrenocortical hyperfunction
B. Hyperthyroidism
C. Hypothyroidism
D. Gonadal hypofunction
E. Hyperfunction of the insular apparatus

3. 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

4. A 30-year-old woman developed the signs of virilism (body hair growth, balding temples, disturbed menstrual cycle). What hormone can cause this condition when hyperproduced?

A. Testosterone
B. Estriol
C. Relaxin
D. Oxytocin
E. Prolactin

5. Corticosteroid hormones regulate the adaptation processes of the body as a whole to environmental changes and ensure the maintenance of internal homeostasis. What hormone activates the hypothalamopituitary- adrenal axis?

A. Corticoliberin

B. Somatoliberin
C. Somatostatin
D. Corticostatin
E. Thyroliberin

6. On examination the patient is found to have low production of adrenocorticotropic hormone. How would this affect production of the other hormones?

A. Decrease adrenal cortex hormones synthesis
B. Decrease hormone synthesis in the adrenal medulla
C. Decrease insulin synthesis
D. Increase sex hormones synthesis
E. Increase thyroid hormones synthesis

7. A 46-year-old patient suffering from the diffuse toxic goiter underwent resection of the thyroid gland. After the surgery the patient presents with appetite loss, dyspepsia, increased neuromuscular excitement. The body weight remained unchanged. Body temperature is normal. Which of the following has caused such a condition in this patient?

A. Reduced production of parathormone
B. Increased production of thyroxin
C. Increased production of calcitonin
D. Increased production of thyroliberin
E. Reduced production of thyroxin

8. The secretion of which hypophysial hormones will be inhibited after taking the oral contraceptives containing sex hormones?

A. Gonadotropic hormone
B. Vasopressin
C. Thyrotrophic hormone
D. Somatotropic hormone
E. Ocytocin

9. A 12-year-old teenager has significantly put off weight within 3 months; glucose concentration rose up to 50 millimole/l. He fell into a coma. What is the main mechanism of its development?

A. Hyperosmolar
B. Hypoglycemic
C. Ketonemic
D. Lactacidemic
E. Hypoxic

10. A concentrated solution of sodium chloride was intravenously injected to an animal. This caused decreased reabsorption of sodium ions in the renal tubules. It is the result of the following changes of hormonal secretion:

A. Aldosterone reduction
B. Aldosterone increase
C. Vasopressin reduction
D. Vasopressin increase
E. Reduction of atrial natriuretic factor

11. 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

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

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

13. Tissue inosytol triphosphates are generated as a result of the phosphatidylinositol diphosphate hydrolysis and act as secondary agents (mediators) in the mechanism of hormone action. Their effect in cells is directed at:

A. Calcium ion liberation from cellular depot
B. Adenylate cyclase activation
C. Protein kinase A activation
D. Phosphodiesterase inhibition
E. Protein kinase A inhibition

14. A 30-year-old woman has subnormal concentration of enzymes in the pancreatic juice. This might be caused by the hyposecretion of the following gastrointestinal hormone:

A. Cholecystokinin-pancreozymin
B. Somatostatin
C. Secretin
D. Gastro-inhibiting peptide
E. Vaso-intestinal peptide

15. A month after surgical constriction of rabbit's renal artery the considerable increase of systematic arterial pressure was observed. What of the following regulation mechanisms caused the animal's pressure change?

A. Angiotensin-II
B. Vasopressin
C. Adrenaline
D. Noradrenaline
E. Serotonin

16. A child has abnormal formation of tooth enamel and dentin as a result of low concentration of calcium ions in blood. Such abnormalities might be caused by deficiency of the following hormone:

A. Parathormone
B. Thyrocalcitonin
C. Thyroxin
D. Somatotropic hormone
E. Triiodothyronine

17. A man has a considerable decrease in diuresis as a result of 1,5 l blood loss. The primary cause of such diuresis disorder is the hypersecretion of the following hormone:

A. Vasopressin
B. Corticotropin
C. Natriuretic
D. Cortisol

E. Parathormone

18. Before the cells can utilize the glucose, it is first transported from the extracellular space through the plasmatic membrane inside them. This process is stimulated by the following hormone:

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

19. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth mineralization and inhibits tissue resorption. What hormone is it?

A. Calcitonin
B. Parathormone
C. Adrenalin
D. Aldosterone
E. Thyroxine

20. A 20-year-old patient complains of morbid thirst and huperdiuresis (up to 10 l daily). Glucose concentration in blood is normal but it is absent in urine. The patient has been diagnosed with diabetes insipidus. What hormonal drug is the most appropriate for management of this disorder?

A. Vasopressin
B. Cortisol
C. Thyroxin
D. Oxytocin
E. Insulin

21. Atria of an experimental animal were superdistended by blood that resulted in decreased reabsorption of Na+ and water in renal tubules. This can be explained by the influence of the following factor upon kidneys:

A. Natriuretic hormone
B. Aldosterone
C. Renin
D. Angiotensin
E. Vasopressin

22. 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 Ca2+

23. A 5-month-old boy was hospitalized for tonic convulsions. He has a lifetime history of this disease. Examination revealed coarse hair, thinned and fragile nails, pale and dry skin. In blood: calcium - 1,5 millimole/l, phosphor - 1,9 millimole/l. These changes are associated with:

A. Hypoparathyroidism
B. Hyperparathyroidism
C. Hyperaldosteronism
D. Hypoaldosteronism
E. Hypothyroidism

24. Examination of a 42-year-old patient revealed a tumour of adenohypophysis. Objectively: the patient's weight is 117 kg, he has moon-like hyperemic face, redblue striae of skin distension on his belly. Osteoporosis and muscle dystrophy are present. AP is 210/140 mm Hg. What is the most probable diagnosis?

A. Cushing's disease
B. Cushing's syndrome
C. Conn's disease
D. Diabetes mellitus
E. Essential hypertension

25. A 19-year-old male was found to have an elevated level of potassium in the secondary urine. These changes might have been caused by the increase in the following hormone level:

A. Aldosterone
B. Oxytocin
C. Adrenaline
D. Glucagon
E. Testosterone

26. A 26-year-old woman at 40 weeks pregnant has been delivered to the maternity ward. Objectively: the uterine cervix is opened, but the contractions are absent. The doctor has administered her a hormonal drug to stimulate the labor. Name this drug:

A. Oxytocin
B. Hydrocortisone
C. Estrone
D. Testosterone
E. ACTH

27. A patient with signs of osteoporosis and urolithiasis has been admitted to the endocrinology department. Blood test revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:

A. Parathyroid hormone
B. Calcitonin
C. Cortisol
D. Aldosterone
E. Calcitriol

28. A 30-year-old female exhibits signs of virilism (growth of body hair, balding temples, menstrual disorders). This condition can be caused by the overproduction of the following hormone:

A. Testosterone
B. Oestriol
C. Relaxin
D. Oxytocin
E. Prolactin

29. A patient who had been continuously taking drugs blocking the production of angiotensin II developed bradycardia and arrhythmia. A likely cause of these disorders is:

A. Hyperkalemia
B. Hypokalemia
C. Hypernatremia
D. Hypocalcemia

E. Hypercalcemia

30. As a result of a home injury, a patient suffered a significant blood loss, which led to a fall in blood pressure. Rapid blood pressure recovery after the blood loss is provided by the following hormones:

A. Adrenaline, vasopressin
B. Cortisol
C. Sex hormones
D. Oxytocin
E. Aldosterone

31. 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

32. A patient has insufficient blood supply to the kidneys, which has caused the development of pressor effect due to the constriction of arterial resistance vessels. This is the result of the vessels being greately affected by the following substance:

A. Angiotensin II
B. Angiotensinogen
C. Renin
D. Catecholamines
E. Norepinephrine

33. In the course of an experiment adenohypophysis of an animal has been removed. The resulting atrophy of thyroid gland and adrenal cortex has been caused by deficiency of the following hormone:

A. Tropic hormones
B. Thyroid hormones
C. Somatotropin
D. Cortisol
E. Thyroxin

34. A patient with signs of osteoporosis and urolithiasis has been admitted to the endocrinology department. Blood test has revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:

A. Parathyroid hormone
B. Calcitonin
C. Cortisol
D. Aldosterone
E. Calcitriol

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

A. It 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

36. 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. Aldosterone
C. Glucagon
D. Adrenalin
E. Thyroxin

37. A 41-year-old man has a history of recurrent attacks of heartbeats (paroxysms), profuse sweating, headaches. Examination revealed hypertension, hyperglycemia, increased basal metabolic rate, and tachycardia. These clinical presentations are typical for the following adrenal pathology:

A. Hyperfunction of the medulla
B. Hypofunction of the medulla
C. Hyperfunction of the adrenal cortex
D. Hypofunction of the adrenal cortex
E. Primary aldosteronism

38. Atria of an experimental animal were superdistended with blood, which resulted in decreased reabsorption of Na+ and water in renal tubules. This can be explained by the influence of the following factor on kidneys:

A. Natriuretic hormone
B. Angiotensin
C. Renin
D. Vasopressin
E. Aldosterone

39. A patient with hypertensic crisis has increased content of angiotensin II in blood. Angiotensin pressor effect is based on:

A. Contraction of arteriole muscles
B. Activation of biogenic amine synthesis
C. Prostaglandin hyperproduction
D. Vasopressin production stimulation
E. Activation of kinin–kallikrein system

40. For people adapted to high external temperatures profuse sweating is not accompanied by loss of large volumes of sodium chloride. This is caused by the effect the following hormone has on the perspiratory glands:

A. Aldosterone
B. Vasopressin
C. Cortisol
D. Thyroxin
E. Natriuretic

41. Emotional stress causes activation of hormone-sensitive triglyceride lipase in the adipocytes. What secondary mediator takes part in this process?

A. Cyclic adenosine monophosphate
B. Cyclic guanosine monophosphate
C. Ions of Ca2+
D. Adenosine monophosphate
E. Diacylglycerol

42. A patient has insufficient blood supply to the

kidneys, which has caused the development of pressor effect due to constriction of arterial resistance vessels. This condition results from the vessels being strongly affected by the following substance:

A. Angiotensin II
B. Renin
C. Norepinephrine
D. Catecholamines
E. Angiotensinogen

43. Examination of a 42-year-old patient revealed a tumour of adenohypophysis. Objectively: the patient's weight is 117kg, he has moon-like hyperemic face, red-blue striae of skin distension on his belly. Osteoporosis and muscle dystrophy are present. AP is 210/140 mm Hg. What is the most probable diagnosis?

A. Cushing's disease
B. Diabetes mellitus
C. Conn's disease
D. Cushing's syndrome
E. Essential hypertension

44. A 4-year-old child with hereditary, renal lesion has signs of rickets; vitamin D concentration in blood is normal. W Impaired synthesis of calcitriol hat is the most probable cause of rickets development?

A. Impaired synthesis of calcitriol
B. Hyperfunction of parathyroid gland
C. Hypofunction of parathyroid glands
D. Increased excretion of calcium
E. Lack of calcium in food

45. A 15-year-old patient has fasting plasma glucose level 4,8 mmol/1, one hour after glucose challenge it becomes 9,0 mmol/1, in 2 hours it is 7,0 mmol/1, in 3 hours it is 4,8 mmol/1. 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

46. Prolonged treatment of hypothyroidism has caused general dystrophy, dental caries, tachycardia, tremor of extremities. What drug is the cause of these side effects?

A. L-thyroxin
B. Parathyreoidinum
C. Thyrocalcitonin
D. Prednisolone
E. Humulin (Human insulin)

47. A 41-year-old man has a history of recurrent attacks of heartbeats (paroxysms), profuse sweating, headaches. Examination revealed hypertension, hyperglycemia, increased basal metabolic rate, and tachycardia. These clinical presentations are typical of the following adrenal pathology:

A. Hyperfunction of medulla
B. Hypofunction of medulla
C. Hypofunction of the adrenal cortex
D. Hyperfunction of the adrenal cortex
E. Primary aldosteronism

48. Atria of an experimental animal were superdistended with blood, which resulted in decreased reabsorption of Na+ and water in influence of the following factor on kidneys:

A. Natriuretic hormone
B. Renin
C. Aldosterone
D. Vasopressin
E. Angiotensin

49. 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 lipogenesis
C. Increased ketogenesis
D. Increased glycogenolysis
E. Decreased glyconeogenesis

50. Examination of a 56-year-old woman with a history of type 1 diabetes mellitus revealed a disorder of protein metabolism that is manifested by aminoacidemia in the laboratory blood test values, and clinically by the delayed wound healing and decreased synthesis of antibodies. Which of the following mechanisms causes the development of aminoacidemia?

A. Increased proteolysis
B. Decrease in the concentration of amino acids in blood
C. Increase in the oncotic pressure in the blood plasma
D. Increase in low-density lipoprotein level
E. Albuminosis

51. A patient with signs of osteoporosis and urolithiasis has been admitted to an endocrinology department. Blood test revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:

A. Parathyroid hormone
B. Aldosterone
C. Calcitriol
D. Calcitonin
E. Cortisol

52. A 30-year-old woman exhibits signs of virilism (growth of body hair, balding temples, menstrual disorders). This condition can be caused by overproduction of the following hormone:

A. Testosterone
B. Oestriol
C. Prolactin
D. Oxytocin
E. Relaxin

53. A 6-year-old child suffers from delayed growth, disrupted ossification processes, decalcification of the teeth. What can be the cause?

A. Vitamin D deficiency
B. Vitamin C deficiency

C. Decreased glucagon production
D. Hyperthyroidism
E. Insulin deficiency

54. Pancreas in knows 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 activates GS
D. It does not affect the activity of GP and GS
E. It activates GP and inhibits GS

55. Increased amount of free fat acids is observed in the blood of the patients with diabetes mellitus. It can be caused by:

A. Increased activity of triglyceridelipase adipocytes
B. Storage of palmitatoil-CoA
C. Activation of the ketone bodies utilization
D. Activation of the synthesis of the apolipoproteins
E. Decreased activity of phosphatidylcholine-cholesterol-acyltransferase blood plasma

56. A patient is ill with diabetes mellitus that is accompanied by hyperglycemia of over 7,2 millimole/l on an empty stomach. The level of what blood plasma protein allows to estimate the glycemia rate retrospectively (4-8 weeks before examination)?

A Glycated hemoglobin
B Albumin
C Fibrinogen
D C-reactive protein
E Ceruloplasmin

57. The formation of a secondary mediator is obligatory in membrane-intracellular mechanism of hormone action. Point out the substance that is unable to be a secondary mediator:

A Glycerol
B Diacylglycerol
C Inositol-3,4,5-triphosphate
D CAMP
E Ca2+

58. On some diseases it is observed aldosteronism with hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected on aldosteronism?

A. Adrenal glands
B. Testicle
C. Ovaries
D. Pancreas
E. Hypophysis

59. A 52-year-old patient with bronchial asthma was treated with glucocorticoids. Fever reaction appeared as a result of postinjective abscess. The patient had subfebrile temperature, which didn't correspond to latitude and severity of inflammatory process. Why did patient have low fever reaction?

A. Inhibited endogen pyrogens production
B. Violation of heat loss through lungs
C. Inflammatory barrier formation in injection place
D. Violation of heat-producing mechanisms
E. Thermoregulation center inhibition

60. 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

61. Aspirin has antiinflammatory effect due to inhibition of the cyclooxygenase activity. Level of what biological active acids will decrease?

A Prostaglandins
B Leucotriens
C Catecholamines
D Biogenic amines
E Iodinethyronyns

62. Increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, psychic excitement and so on present on thyrotoxicosis. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?

A Disconnect oxidation and oxidated phosphorylation
B Activates phosphorylation of substance
C Stops phosphorylation of substance
D Stops respiratory chain
E Activates oxidated phosphorylation

63. 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 from the 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

64. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth mineralization and inhibits tissue resorption. What hormone is it?

A Calcitonin
B Parathormone
C Adrenalin
D Aldosterone
E Thyroxine

65. A 50-year-old patient complains about general weakness, appetite loss and cardiac arrhythmia. The patient presents with muscle hypotonia, flaccid paralyses, weakened peristaltic activity of the bowels.

Such condition might be caused by:

A Hypokaliemia
B Hypoproteinemia
C Hyperkaliemia
D Hypophosphatemia
E Hyponatremia

66. 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

67. On the empty stomach in the patient's blood glucose level was 5,65 mmol/L, in an hour after usage of sugar it was 8,55 mmol/L, in a 2 hours - 4,95 mmol/L. Such indicators are typical for:

A Healthy person
B Patient with hidden diabetes mellitus
C Patient with insulin-dependent diabetes mellitus
D Patient with non-insulin dependent diabetes mellitus
E Patient with tireotoxicosis

68. Albinos can't stand sun impact - they don't aquire sun-tan but get sunburns. Disturbed metabolism of what aminoacid underlies this phenomenon?

A Phenilalanine
B Methionine
C Tryptophan
D Glutamic acid
E Histidine

69. Products of some proteins hydrolysis and modification are the biologically active substances called hormones. Lipotropin, corticotropin, melanotropin and endorphins are synthesized in the hypophysis of the following protein:

A Proopiomelanocortin (POMC)
B Neuroalbumin
C Neurostromin
D Neuroglobulin
E Thyreoglobulin

70. During examination of an 11-month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:

A Cholecalciferol
B Thiamin
C Pantothenic acid
D Bioflavonoids
E Riboflavin

71. In course of histidine catabolism a biogenic amin is formed that has powerful vasodilatating effect. Name it:

A Histamine
B Serotonin
C Dioxyphenylalanine
D Noradrenalin
E Dopamine

72. Utilization of arachidonic acid via cyclooxigenase pathway results in formation of some bioactive substances. Name them:

A Prostaglandins
B Thyroxine
C Biogenic amins
D Somatomedins
E Insulin-like growth factors

73. 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 Ca2+

74. 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

75. Diabetes mellitus causes ketosis as a result of activated oxidation of fatty acids. What disorders of acid-base equilibrium may be caused by excessive accumulation of ketone bodies in blood?

A Metabolic acidosis
B Metabolic alcalosis
C Any changes woun't happen
D Respiratory acidosis
E Respiratory alcalosis

76. Depressions and emotional insanities result from the deficit of noradrenalin, serotonin and other biogenic amines in the brain. Their concentration in the synapses can be increased by means of the antidepressants that inhibit the following enzyme:

A Monoamine oxidase
B Diamine oxidase
C L-amino-acid oxidase
D D-amino-acid oxidase
E Phenylalanine-4-monooxygenase

77. A 5-month-old boy was hospitalized for tonic convulsions. He has a life-time history of this disease. Examination revealed coarse hair, thinned and fragile nails, pale and dry skin. In blood: calcium - 1,5 millimole/l, phosphor - 1,9 millimole/l. These changes are associated with:

A Hypoparathyroidism
B Hyperparathyroidism
C Hyperaldosteronism
D Hypoaldosteronism
E Hypothyroidism

78. A doctor examined a child and revealed symptoms of rachitis. Development of this desease was caused by deficiency of the following compound:

A 1,25 [OH]-dichydroxycholecalciferol
B Biotin
C Tocopherol
D Naphtaquinone
E Retinol

79. 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

80. A 4-year-old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is normal. What is the most probable cause of rickets development?

A. Impaired synthesis of calcitriol
B. Increased excretion of calcium
C. Hyperfunction of parathyroid glands
D. Hypofunction of parathyroid glands
E. Lack of calcium in food

81. It is known that the monoamine oxidase (MAO) enzyme plays an important part in the metabolism of catecholamine neurotransmitters. In what way does the enzyme inactivate these neurotransmitters (norepinephrine, epinephrine, dopamine)?

A. Oxidative deamination
B. Addition of an amino group
C. Removal of a methyl group
D. Carboxylation
E. Hydrolysis

82. Products of some proteins hydrolysis and modification are the biologically active substances called hormones. Lipotropin, corticotropin, melanotropin and endorphins are synthesized in the hypophysis of the following protein:

A Proopiomelanocortin (POMC)
B Neuroalbumin
C Neurostromin
D Neuroglobulin
E Thyreoglobulin

83. A 4-year-old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is normal. What is the most probable cause of rickets development?

A Impaired synthesis of calcitriol
B Increased excretion of calcium
C Hyperfunction of parathyroid glands
D Hypofunction of parathyroid glands
E Lack of calcium in food

84. A doctor examined a child and revealed symptoms of rachitis. Development of this desease was caused by deficiency of the following compound:

A 1,25 [OH]-dichydroxycholecalciferol
B Biotin
C Tocopherol
D Naphtaquinone
E Retinol

85. The patient with complaints to constant thirst has addressed to the doctor. It is revealed hyperglycemia, polyuria and 17-ketosteroids concentration in urine is raised. What disease is probable?

A. Steroid diabetes
B. Insulin-dependent diabetes
C. Myxedema
D. Glycogen disease, I type
E. Addison's disease

86. Diabetes mellitus causes ketosis as a result of activated oxidation of fatty acids. What disorders of acid-base equilibrium may be caused by excessive accumulation of ketone bodies in blood?

A. Metabolic acidosis.
B. Metabolic alkalosis.
C. Any changes woun't happen.
D. Respiratory acidosis.
E. Respiratory alkalosis.

87. The formation of a secondary mediator is obligatory in membrane-intracellular mechanism of hormone action. Point out the substance that is unable to be a secondary mediator:

A. Glycerol.
B. Diacylglycerol.
C. Inositol-3,4,5-triphosphate.
D. CAMP.
E. Ca2

88. Aspirin has its effects due to inhibition of the cyclooxygenase activity. Level of what biological active substances will decrease?

A. Prostaglandins.
B. Leucotriens.
C. Catecholamines.
D. Biogenic amines.
E. Iodinethyronyns.

89. Increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, psychic excitement and so on present on thyrotoxicosis. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?

A. Disconnect oxidation and oxidated phosphorylation.
B. Activates phosphorylation of substance.
C. Stops phosphorylation of substance.
D. Stops respiratory chain.
E. Activates oxidated phosphorylation.

90. Products of some proteins hydrolysis and modification are the biologically active substances called hormones. Lipotropin, corticotropin, melanotropin and endorphins are synthesized in the hypophysis of the following protein:

A. Proopiomelanocortin (POMC).
B. Neuroalbumin.

C. Neurostromin.
D. Neuroglobulin.
E. Thyreoglobulin.

91. Utilization of arachidonic acid via cyclooxigenase pathway results in formation of some bioactive substances. Name them:
A. Prostaglandins.
B. Thyroxine.
C. Biogenic amins.
D. Somatomedins.
E. Insulin-like growth factors.

92. 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 Ca2+.

93. A 40-year-old patient complains of intensive heartbeats, sweating, nausea, visual impairment, arm tremor, hypertension. From his anamnesis: 2 years ago he was diagnosed with pheochromocytoma. Hyperproduction of what hormones causes the given pathology?
A. Catecholamines.
B. Aldosterone.
C. Glucocorticoids.
D. Thyroidal hormones.
E. ACTH.

94. A patient is ill with diabetes mellitus that is accompanied by hyperglycemia of over 7,2 millimole/l on an empty stomach. The level of what blood plasma protein allows to estimate the glycemia rate retrospectively (4-8 weeks before examination)?
A. Glycated hemoglobin.
B. Albumin.
C. Fibrinogen.
D. C-reactive protein.
E. Ceruloplasmin.

95. 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.

96. 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.

97. 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 from the 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.

98. 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.

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

100. 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. Noradrenalin

101. A 45 y.o. woman suffers from Cushing's syndrome - steroid diabetes. Biochemical examination revealed: hyperglycemia, hypochloremia. Which of the undermentioned processes is the first to be activated?
A. Gluconeogenesis.
B. Glycogenolysis.
C. Glucose reabsorption.
D. Glucose transport to the cell.
E. Glycolysis.

102. Inhabitants of territories with cold climate have high content of an adaptive thermoregulatory hormone. What hormone is meant?
A. Thyroxin.
B. Insulin.
C. Somatotropin.
D. Glucagon.
E. Cortisol.

103. The patient with complaints of permanent

thirst applied to the doctor. Hyperglycemia, polyuria and increased concentration of 17-ketosteroids in the urine were reveale What disease is the most likely?

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

104. Patients suffering from severe diabetes and don't receive insulin have ketoacidosis. Ketone bodies are formed from:

A. AcetylCoA.
B. SuccinylCoA.
C. PropionylCoA.
D. MethylmalonylCoA.
E. MalonylCoA.

105. 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.

106. 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. Noradrenaline.
C. Somatotropin.
D. Lidase.
E. Insulin.

107. Before the cells can utilize the glucoze, it is first transported from the extracellular space through the plasmatic membrane inside them. This process is stimulated by the following hormone:

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

108. 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.

109. A patient with diabetes mellitus has been delivered in hospital in the state of unconsciousness. Arterial pressure is low. The patient has acidosis. Point substances, which accumulation in the blood results in these manifestations:

A. Ketone bodies.
B. Monosaccharides.
C. Amino acids.
D. High fatty acids.
E. Cholesterol esters.

110. Diabetes mellitus causes ketosis as a result of activated oxidation of fatty acids. What disorders of acid-base equilibrium may be caused by excessive accumulation of ketone bodies in blood?

A. Metabolic acidosis.
B. Metabolic alkalosis.
C. Any changes woun't happen.
D. Respiratory acidosis.
E. Respiratory alkalosis.

111. Aspirin has antiinflammatory effect due to inhibition of the cyclooxygenase activity. Level of what biological active acids will decrease?

A. Prostaglandins.
B. Leucotriens.
C. Catecholamines.
D. Biogenic amines.
E. Iodinethyronyns.

112. Increased amount of free fat acids is observed in the blood of the patients with diabetes mellitus. It can be caused by:

A. Increased activity of triglyceridelipase adipocytes.
B. Storage of palmitatoil-CoA.
C. Activation of the ketone bodies utilization.
D. Activation of the synthesis of the apolipoproteins.
E. Decreased activity of phosphatidylcholine-cholesterol-acyltransferase blood plasma.

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

114. Increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, psychic excitement and so on present on thyrotoxicosis. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?

A. Disconnect oxidation and oxidated phosphorylation.
B. Activates phosphorylation of substance.
C. Stops phosphorylation of substance.
D. Stops respiratory chain.
E. Activates oxidated phosphorylation.

115. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth

mineralization and inhibits tissue resorption. What hormone is it?

A. Calcitonin.

B. Parathormone.
C. Adrenalin.
D. Aldosterone.
E. Thyroxine.

116. A 50-year-old patient complains about general weakness, appetite loss and cardiac arrhythmi The patient presents with muscle hypotonia, flaccid paralyses, weakened peristaltic activity of the bowels. Such condition might be caused by:
A. Hypokaliemia.
B. Hypoproteinemia.
C. Hyperkaliemia.
D. Hypophosphatemia.
E. Hyponatremia.

117. During examination of an 11-month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:
A. Cholecalciferol.
B. Thiamin.
C. Pantothenic acid.
D. Bioflavonoids.
E. Riboflavin.

118. Utilization of arachidonic acid via cyclooxigenase pathway results in formation of some bioactive substances. iabetesenas
A. Prostaglandins.
B. Thyroxine.
C. Biogenic amins.
D. Somatomedins.
E. Insulin-like growth factors.

119. Emotional stress causes activation of hormon-sensitive triglyceride lipase in the adipocytes. What secondary messenger takes part in this process?
A. Cyclic adenosine monophosphate.
B. Cyclic guanosine monophosphate.
C. Adenosine monophosphate.
D. Diacylglycerol.
E. Ions of Ca2+.

120. Emotional stress causes activation of Glycogen phosphosrylase in the miocytes. What secondary messenger takes part in this process?
A. cAMP.
B. cGMP.
C. AMP.
D. DAG.
E. Ions of Ca2+.

121. A 5-month-old boy was hospitalized for tonic convulsions. He has a life-time history of this diseas Examination revealed coarse hair, thinned and fragile nails, pale and dry skin. In blood: calcium - 1,5 millimole/l, phosphor - 1,9 millimole/l. These changes are associated with:
A. Hypoparathyroidism.
B. Hyperparathyroidism.
C. Hyperaldosteronism.
D. Hypoaldosteronism.
E. Hypothyroidism.

122. A doctor examined a child and revealed symptoms of rachitis. Development of this desease was caused by deficiency of the following compound:
A. 1,25 [OH]-dichydroxycholecalciferol.
B. Biotin.
C. Tocopherol.
D. Naphtaquinon
E. Retinol.

123. People adapted to high external temperatures have such pecularity: profuse sweating isn't accompanied by loss of large volumes of sodium chloride. This is caused by the effect of the following hormone upon the perspiratory glands:
A. Aldosterone.
B. Natriuretic.
C. Cortisol.
D. Thyroxin.
E. Vasopressin.

124. A 4-year-old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is normal. What is the most probable cause of rickets development?
A. Impaired synthesis of calcitriol.
B. Increased excretion of calcium.
C. Hyperfunction of parathyroid glands.
D. Hypofunction of parathyroid glands.
E. Lack of calcium in food.

125. Cardinal symptoms of primary hyperparathyroidism are osteoporosis and renal lesion along with development of urolithiasis. What substance makes up the basis of these calculi in this disease?
A. Calcium phosphate.
B. Uric acid.
C. Cystine.
D. Bilirubin.
E. Cholesterol.

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

127. A person has reduced diuresis, hypernatremia, hypokalemia. Hypersecretion of what hormone can cause such changes?
A. Aldosterone.
B. Parathormone.
C. Auricular sodiumuretic factor.
D. Adrenalin.
E. Vasopressin.

128. A concentrated solution of sodium chloride was intravenously injected to an animal. This caused decreased reabsorption of sodium ions in the renal tubules. It is the result of the following changes of

hormonal secretion:

A. Aldosterone reduction.

B. Aldosterone increase.

C. Reduction of atrial natriuretic factor.

D. Vasopressin increase.

E. Vasopressin reduction.

129. Tissue inosytol triphosphates are generated as a result of the phosphatidylinositol diphosphate hydrolysis and act as secondary agents (mediators) in the mechanism of hormone action. Their effect in cells is directed at:

A. Calcium ion liberation from cellular depot.

B. Protein kinase A activation.

C. Adenylate cyclase activation.

D. Protein kinase A inhibition.

E. Phosphodiesterase inhibition.

130. Examination of a patient revealed glycosuria and hyperglycemia. He complains of dry mouth, itchy skin, frequent urination, thirst. He has been diagnosed with diabetes mellitus. What is the cause of polyuria in this patient?

A. Increased plasma oncotic pressure

B. Decreased cardiac output

C. Increased filtration pressure

D. Increased urine osmotic pressure

E. Decreased plasma oncotic pressure

131. 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. Tyrosinase.

C. Phosphotransferase

D. Glucomutase

E. Phosphatase.

132. Degeneration of glycogen in liver is stimulated by glucagon. What secondary messenger (mediator) is thus formed in the cell?

A. c-AMP

B. CO

C. NO

D. c-GMP

E. Triacylglycerol

133. A child has abnormal formation of tooth enamel and dentin as a result of low concentration of calcium ions in blood. Such abnormalities might be caused by deficiency of the following hormone:

A. Parathormone.

B. Thyrocalcitonin

C. Thyroxin

D. Somatotropic hormone

E. Triiodothyronine

134. A patient has the sudden decrease of Ca^{2+} content in blood. What hormone secretion will increase?

A. Parathormone.

B. Thyrocalcitonin

C. Aldosterone

D. Vasopressin

E. Somatotropin

135. A patient with diabetes mellitus had an insuline injection. It caused loss of consciousness and convulsions. What was the result of biochemic blood analysis on glucose content?

A. 2,5 mmole/l.

B. 3,3 mmole/l

C. 8,0 mmole/l

D. 10 mmole/l

E. 5,5 mmole/l

136. Hormonal form of a certain vitamin induces genome level synthesis of Ca-binding proteins and enterocytes thus regulating the intestinal absorption of Ca^{2+} ions required for dental tissue development. What vitamin is it?

A. D3.

B. A

C. B1

D. E

E. K.

137. A child has disturbed enamel and dentine formation as a result of decreased content of calcium ions in his blood. What hormone deficiency may cause such changes?

A. Parathormone

B. Somatotropin

C. Thyroxin

D. Thyreocalcitonin.

E. Triiodothyronine

138. A 42-year-old woman diagnosed with diabetes mellitus was admitted to the endocrinological department with complaints of thirst, excessive appetite. What pathological components are revealed in course of laboratory examination of the patient's urine?

A. Glucose, ketone bodies.

B. Protein, aminoacids

C. Protein, creatine

D. Bilirubin, urobilin

E. Blood

139. A 49-year-old patient was found to have a disproportionate enlargement of hands, feet, nose, ears, superciliary arches and cheek bones. Blood test revealed hyperglycemia, impaired glucose tolerance. What is the most likely cause of this pathology development?

A. Hypersecretion of growth hormone.

B. Posterior pituitary hormone hypersecretion

C. Insulin hyposecretion

D. Vasopressin hyposecretion

E. Glucocorticoid hypersecretion

140. A 36-year-old patient with diabetes mellitus had seizures with loss of consciousness after an insulin injection. What was the result of blood glucose test?

A. 2,5 mmol/l.

B. 3,3 mmol/l

C. 8,0 mmol/l

D. 10 mmol/l

E. 5,5 mmol/l

141. During examination of an 11-month-old

infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:

A. Cholecalciferol.
B. Thiamin
C. Pantothenic acid
D. Bioflavonoids
E. Riboflavin

142. Analysis of urine from a 24-year-old man revealed the following changes: daily diuresis - 10 l, relative density - 1,001, qualitative alterations are absent. A patient complains of excessive thirst, frequent urination. What is the most likely cause of this disease?

A. Vasopressin hyposecretion.
B. Glucocorticoid hypersecretion
C. Vasopressin hypersecretion
D. Relative insulin insufficiency
E. Aldosteron hypersecretion

143. A child has abnormal formation of tooth enamel and dentin as a result of low concentration of calcium ions in blood. Such abnormalities might be caused by deficiency of the following hormone:

A. Parathormone.
B. Thyrocalcitonin
C. Thyroxin
D. Somatotropic hormone
E. Triiodothyronine

144. A patient has the sudden decrease of Ca2+ content in blood. What hormone secretion will increase?

A. Parathormone.
B. Thyrocalcitonin
C. Aldosterone
D. Vasopressin
E. Somatotropin

145. A patient with diabetes mellitus had an insuline injection. It caused loss of consciousness and convulsions. What was the result of biochemic blood analysis on glucose content?

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B. 3,3 mmole/l
C. 8,0 mmole/l
D. 10 mmole/l
E. 5,5 mmole/l

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C. Protein, creatine
D. Bilirubin, urobilin
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B. Posterior pituitary hormone hypersecretion
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E. Glucocorticoid hypersecretion

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A. Vasopressin hyposecretion.
B. Glucocorticoid hypersecretion
C. Vasopressin hypersecretion
D. Relative insulin insufficiency
E. Aldosteron hypersecretion

152. Due to prolonged stay in the mountains at the altitude of 3000 m above the sea level, a person developed increased oxygen capacity of blood, which was directly caused by intensified production of:

A. Erythropoietins
B. Catecholamines
C. Carbaminohemoglobin
D. 2,3-bisphosphoglycerate
E. Leukopoietins

153. A patient has undergone surgical removal of the pylorus. Decreased secretion of the following hormone can be expected:

A Gastrin
B. Secretin

C. Gastric inhibitory polypeptide
D. Cholecystokinin
E. Histamine

154. 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. Decreased activity of plasma phosphatidylcholine-cholesterol-acyltransferase
D. Activation of ketone bodies utilization
E. Activation of apoAl, apoA2, and apoA4 apolipoprotein synthesis

155. 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. Glucose transport to the cells
C. Glycogenolysis
D. Glycolysis
E. Glucose reabsorption

156. After a case of sepsis a 27-year- old woman developed "bronzed" skin discoloration characteristic of Addison's disease. Hyperpigmentation mechanism in this case is based on increased secretion of:

A. Melanocyte-stimulating hormone
B. Thyroid-stimulating hormone
C. Somatotropin
D. β-lipotropin
E. Gonadotropin

157. In human organism significant blood loss leads to decreased blood pressure, tachycardia, and weakness. Eventually the sensation of thirst appears. What hormone participates in the development of this sensation?

A. Angiotensin 2
B. Adrenalin
C. Cortisol
D. Dopamine
E. Serotonin

158. A 16-year-old girl presents with no hair on the pubis and in the armpits, her mammary glands are underdeveloped, no menstruations. What hormone imbalance can it be indicative of?

A. Ovarian failure
B. Hyperthyroidism
C. Pancreatic islet failure
D. Adrenal medulla hyperfunction
E. Hypothyroidism

159. During removal of the hyperplastic thyroid gland of a 47-year-old woman, the parathyroid gland was damaged. One month after the surgery the patient developed signs of hypoparathyroidism: frequent convulsions, hyperreflexia, laryngospasm. What is the most likely cause of the patient's condition?

A. Hypocalcemia
B. Hyperchlorhydria
C. Hyponatremia
D. Hypophosphatemia
E. Hyperkalemia

160. On examination the patient presents with hirsutism, moon-shaped face, stretch marks on the abdomen. BP is 190/100 mm Hg, blood glucose is 17.6 mmol/L. What pathology is such clinical presentation characteristic of?

A. Adrenocortical hyperfunction
B. Gonadal hypofunction
C. Hyperthyroidism
D. Hyperfunction.of the insular apparatus
E. Hypothyroidism

161. Atria of a test animal were superdistended with blood, which resulted in decreased reabsorption of Na+ and water in renal tubules. This can be explained by the effect of the following factor on the kidneys:

A. Natriuretic hormone
B. Vasopressin
C. Aldosterone
D. Angiotensin
E. Renin

162. A 40-year-old woman on examination presents with intensified basal metabolic rate. What hormone present in excess leads to such condition?

A. Triiodothyronine
B. Thyrocalcitonin
C. Somatostatin
D. Aldosterone
E. Glucagon

163. A 19-year-old young man was examined in the nephrology clinic. High Potassium was detected in his secondary urine. What hormone is likely to cause such change, if it is produced in excess?

A. Aldosterone
B. Testosterone
C. Glucagon
D. Oxytocin
E. Adrenaline

164. After a case of sepsis a 27-year-old woman developed ”bronzed” skin discoloration characteristic of Addison’s disease. Hyperpigmentation mechanism in this case is based on increased secretion of:

A. Melanocyte-stimulating hormone
B. Somatotropin
C. Gonadotropin
D. β-lipotropin
E. Thyroid-stimulating hormone

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A. Hypocalcemia
B. Hyponatremia
C. Hyperchlorhydria
D. Hypophosphatemia

E. Hyperkalemia

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A. Natriuretic hormone
B. Aldosterone
C. Renin
D. Angiotensin
E. Vasopressin

167. To stimulate the labor activity a parturient woman was prescribed a drug - a posterior pituitary hormone that does not affect the blood pressure. As the pregnancy progresses, the sensitivity to this hormone increases. Name the prescribed drug:

A. Oxytocin
B. Dinoprostone
C. Dinoprost
D. Pituitrin
E. Ergotal

168. A 30-year-old woman complains of intense thirst and dryness of the mouth that developed after a severe emotional shock. Laboratory analysis revealed increase of the patient's blood sugar level up to 10 mmol/L. What endocrine gland is affected in the patient?

A. Pancreas
B. Thyroid gland
C. Gonads
D. Adrenal glands
E. Pineal gland

169. Corticosteroid hormones regulate the adaptation processes of the body as a whole to environmental changes and ensure the maintenance of internal homeostasis. What hormone activates the hypothalamo-pituitary-adrenal axis?

A. Corticoliberin
B. Somatoliberin
C. Somatostatin
D. Corticostatin
E. Thyroliberin

170. A 41-year-old man has a history of recurrent attacks of heartbeats (paroxysms), profuse sweating, headaches. Examination revealed hypertension, hyperglycemia, increased basal metabolic rate, and tachycardia. These clinical presentations are typical of the following adrenal pathology:

A. Hyperfunction of the medulla
B. Hypofunction of the medulla
C. Hyperfunction of the adrenal cortex
D. Hypofunction of the adrenal cortex
E. Primary aldosteronism

171. A comatose patient was taken to the hospital. He has a history of diabetes mellitus. Objectively: Kussmaul breathing, low blood pressure, acetone odor of breath. After the emergency treatment the patient's condition improved. What drug had been administered?

A. Insulin
B. Adrenaline
C. Isadrinum
D. Glibenclamide
E. Furosemide

172. A patient with signs of osteoporosis and urolithiasis has been admitted to the endocrinology department. Blood test revealed hypercalcemia and hypophosphatemia. These changes are associated with abnormal synthesis of the following hormone:

A. Parathyroid hormone
B. Calcitonin
C. Cortisol
D. Aldosterone
E. Calcitriol

173. As a result of a home injury, a patient suffered a significant blood loss, which led to a fall in blood pressure. Rapid blood pressure recovery after the blood loss is provided by the following hormones:

A. Adrenaline, vasopressin
B. Cortisol
C. Sex hormones
D. Oxytocin
E. Aldosterone

174. A child has abnormal formation of tooth enamel and dentin as a result of low concentration of calcium ions in blood. Such abnormalities might be caused by deficiency of the following hormone:

A. Parathormone
B. Thyrocalcitonin
C. Thyroxin
D. Somatotropic hormone
E. Triiodothyronine

175. A man has a considerable decrease in diuresis as a result of 1.5 l blood loss. The primary cause of such diuresis disorder is the hypersecretion of the following hormone:

A. Vasopressin
B. Corticotropin
C. Natriuretic
D. Cortisol
E. Parathormone

176. Before the cells can utilize the glucoze, it is first transported from the extracellular space through the plasmatic membrane inside theml. This process is stimulated by the following hormone:

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

177. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth mineralization and inhibits tissue resorption. What hormone is it?

A. Parotin
B. Parathormone
C. Adrenalin
D. Aldosterone

E. Thyroxine

178. A 20-year-old patient complains of morbid thirst and huperdiuresis (up to 10 l daily). Glucose concentration in blood is normal but it is absent in urine. The patient has been diagnosed with diabetes insipidus. What hormonal drug is the most appropriate for management of this disorder?

A. Vasopressin
B. Cortisol
C. Thyroxin
D. Oxytocin
E. Insulin

179. A student, who did not go to the university, by chance met a dean in the street and got very nervous. 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 Ca2+

180. A 5-month-old boy was hospitalized for tonic convulsions. He has a life-time history of this disease. Examination revealed coarse hair, thinned and fragile nails, pale and dry skin. In blood: calcium – 1.5 millimol/l, phosphorri – 1.9 millimol/l. These changes are associated with:

A. Hypoparathyroidism
B. Hyperparathyroidism
C. Hyperaldosteronism
D. Hypoaldosteronism
E. Hypothyroidism

181. The minute blood volume in a patient with transplanted heart has increased as a result of physical activity. What regulative mechanism is responsible for these changes?

A. Catecholamines
B. Sympathetic unconditioned reflexes
C. Parasympathetic unconditioned reflexes
D. Sympathetic conditioned reflexes
E. Parasympathetic conditioned reflexes

182. The secretion of which hypophysial hormones will be inhibited after taking the oral contraceptives containing sex hormones?

A. Gonadotropic hormone
B. Vasopressin
C. Thyrotrophic hormone
D. Somatotropic hormone
E. Ocytocin

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

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

184. A 46-year-old patient suffering from the diffuse toxic goiter underwent resection of the thyroid gland. After the surgery the patient presents with appetite loss, dyspepsia, increased neuromuscular excitement. The body weight remained unchanged. Body temperature is normal. Which of the following has caused such a condition in this patient?

A. Reduced production of parathormone
B. Increased production of thyroxin
C. Increased production of calcitonin
D. Increased production of thyroliberin
E. Reduced production of thyroxin

185. Products of some proteins hydrolysis and modification are the biologically active substances called hormones. Lipotropin, corticotropin, melanotropin and endorphins are synthesized in the hypophysis of the following protein:

A. Proopiomelanocortin (POMC)
B. Neuroalbumin
C. Neurostromin
D. Neuroglobulin
E. Thyreoglobulin

186. A patient has osmotic pressure of blood plasma at the rate of 350 mOsmol/l (norm is 300 mOsmol/l). This will cause hypersecretion of the following hormone:

A. Vasopressin
B. Aldosterone
C. Cortisol
D. Adrenocorticotropin
E. Natriuretic

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

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

188. A 40-year-old patient complains of intensive heartbeats, sweating, nausea, vi- sual impairment, arm tremor, hypertension. From his anamnesis: 2 years ago he was diagnosed with pheochromocytoma. Hyperproduction of what hormones causes the given pathology?

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

189. Kidneys of a man under examinaton show increased reabsorbtion of calcium ions and decreased resorbtion of phosphate ions. What hormone causes this phenomenon?

A. Parathormone
B. Thyrocalcitonin

C. Hormonal form D3
D. Aldosterone
E. Vasopressin

190. A 2-year-old child experienced convulsions because of lowering calcium ions concentration in the blood plasma. Function of what structure is decreased?
A. Parathyroid glands
B. Hypophysis
C. Adrenal cortex
D. Pineal gland
E. Thymus

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

192. A man after 1.5 litre blood loss has suddenly reduced diuresis. The increased secretion of what hormone caused such diuresis alteration?
A. Vasopressin
B. Corticotropin
C. Natriuretic
D. Cortisol
E. Parathormone

193. A 30-year-old woman complains of intense thirst and dryness of the mouth that developed after a severe emotional shock. Laboratory analysis revealed increase of the patient's blood sugar level up to 10 mmol/L. What endocrine gland is affected in the patient?
A. Pancreas
B. Thyroid gland
C. Gonads
D. Adrenal glands
E. Pineal gland

194. A patient with diabetes mellitus was injected a drug to manage hypoglycemia but probably was overdosed it and now he is in the state of hypoglycemic coma. What hormone can cause this condition if overdosed?
A. Insulin
B. Progesterone
C. Cortisol
D. Somatotropin
E. Corticotropin

195. Due to morbid affection of the supraoptic and paraventricular nuclei of the hypothalamus a 40-year-old patient has developed polyuria (10-12 liters per day) and polydipsia. The following hormone is deficient, thus leading to this disturbance:
A. Vasopressin
B. Oxytocin
C. Corticotropin
D. Somatotropin
E. Thyrotropin

196. 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

197. A 49-year-old patient was found to have a disproportionate enlargement of hands, feet, nose, ears, superciliary arches and cheek bones. Blood test revealed hyperglycemia, impaired glucose tolerance. What is the most likely cause of this pathology development?
A. Hypersecretion of growth hormone
B. Posterior pituitary hypersecretion
C. Insulin hyposecretion
D. Vasopressin hyposecretion
E. Glucocorticoid hypersecretion

198. A 40-year-old patient was revealed to have blood clotting time of 2 minutes under a stressful condition. It is primarily caused by the following hormon affecting hemocoagulation:
A. Catecholamine
B. Cortisol
C. Aldosterone
D. Somatotropin
E. Vasopressin

199. A patient with pituitary tumor complains of increased daily diuresis (polyuria). Glucose concentration in blood plasma equals 4.8 mmol/l. What hormone can be the cause of this if its secretion is disturbed?
A. Vasopressin
B. Aldosterone
C. Natriuretic hormone
D. Insulin
E. Angiotensin I

200. Physical activity caused an increase in the cardiac output in a patient with a transplanted heart. What regulative mechanism is responsible for these changes?
A. Catecholamines
B. Sympathetic unconditioned reflexes
C. Parasympathetic unconditioned reflexes
D. Sympathetic conditioned reflexes
E. Parasympathetic conditioned reflexes

201. Anterior pituitary produces hormones, regulating the function of peripheral endocrine glands. The interaction between the anterior pituitary and target glands is functioning according to feedback mechanism. Choose from the mentioned beow a hormone secreted from anterior pituitary:
A. Growth hormone
B. Vasopressin
C. Oxytocin
D. Epinephrine
E. Norepinephrine

202. Secondary messengers diacylglycerol and inositol triphosphate are produced from subsequent phospholipid of plasma membrane due to the activity of the following enzyme:

A. Phospholipase C
B. Phospholipase A1
C. Phospholipase A2
D. Phospholipase D
E. Phosphodiesterase

203. Utilization of glucose occurs by means of sugar transport from the extracellular matrix through the plasma membrane membrane into the cell. What hormone stimulates this process?

A. Insulin
B. Glucagon
C. Thyroxine
D. Aldosterone
E. Adrenaline

204. In patient S. blood glucose level is 10 mmoles/l, polyuria, glucosuria and ketonuria are observed. What pathological state can be suggested?

A. Diabetes mellitus
B. Starvation
C. Hypercorticism
D. Addison disease
E. Hyperthyreosis

205. Due to morbid affection of the supraoptic and paraventricular nuclei of the hypothalamus a 40-year-old patient has developed polyuria (10-12 liters per day) and polydipsia. The following hormone is deficient, thus leading to this disturbance:

A. Vasopressin
B. Oxytocin
C. Corticotropin
D. Somatotropin
E. Thyrotropin

206. A 49-year-old patient was found to have a disproportionate enlargement of hands, feet, nose, ears, superciliary arches and cheek bones. Blood test revealed hyperglycemia, impaired glucose tolerance. What is the most likely cause of this pathology development?

A. Hypersecretion of growth hormone
B. Posterior pituitary hypersecretion
C. Insulin hyposecretion
D. Vasopressin hyposecretion
E. Glucocorticoid hypersecretion

207. A severe injury in a 36-year-old patient resulted in a significant blood loss which was accompanied by a blood pressure drop. What hormones provide rapid recovery of blood pressure after the blood loss?

A. Adrenalin, vasopressin
B. Cortisol
C. Sex hormone
D. Oxytocin
E. Aldosterone

208. After a person had drunk 1,5 liters of water, the amount of urine increased significantly, and its relative density decreased to 1,0 0 1. These changes are a result of decreased water reabsorption in the distal nephron portion due to reduced secretion of:

A. Vasopressin
B. Aldosterone
C. Angiotensin II
D. Renin
E. Prostaglandins

209. A 45 years old man visited a doctor because of persistent headache, shaking of hands, increased heart rate, increased arterial pressure, that is not decreased by the antihypertensive drugs he was prescribed several months ago. Blood glucose in fasting condition is 7.0 mmol/l. The ultrosongraphical examination of the adrenal glands did not reveal any solids. What is the most probable diagnosis in this patient?

A. Pheochromocytoma, located in the pancreatic gland
B. Diabetes melitus
C. Impaired tolerance to glucose
D. Cushing disease
E. Migraine

210. A 50 years old woman was hospitalised in the cardiologic department because of arterial hypertension, hypertonic crises, pain in chest, increased heart rate. Blood glucose level is 6.7 mmol/l. The ultrosongraphical examination of the abdominal cavity revealed a tumor of the medullar part of the adrenal glands. Which hormone caused the mentioned above syndromes?

A. Epinephrine
B. Glucagon
C. Cortisol
D. Thyroxin
E. Growth hormone

211. A 48-year-old patient, who 2 months ago was in the traffic accident and stayed in hospital for 6 weeks because of cranial trauma presents with fatigue and astenia. Arterial pressure 90/60 (he used to have it on the level of 130/80), Pulse – 60/min, blood glucose level is 3.4 mmol/l. His skin looks suntanned but he was not in the sun. He also reports erectile dysfunction. What is the most probabe cause of the patient's condition?

A. Panhypopituitarism
B. Adrenal glands insufficiency
C. Endemic goiter
D. Diabetes insipus
E. Bronze disease

212. A 30-year-old woman visited a doctor because of severe fatigue, dizziness, episodes of consiousnessless. The arterial pressure is 110/80, pulse 80/min. Blood glucose is 2.5 mmol/l. USG revealed a tumor in the pancreatic gland. Overproduction of which hormone caused the patient's disorder?

A. Insulin
B. TSH
C. Glucagon
D. Growth hormone
E. Adrenaline

213. A 25-year-old woman has been taking oral contraceptives to prevent unwilling pregnancy. The decrease of the production of which hormone may be

detected in this patient?

A. FSH
B. LH
C. Insulin
D. ADH
E. Melanocyte-stimulating hormone

214. A 40-year-old woman on examination presents with intensified basal metabolic rate. What hormone present in excess leads to such condition?

A. Triiodothyronine
B. Thyrocalcitonin
C. Glucagon
D. Aldosterone
E. Somatostatin

215. A 16-year-old girl presents with no hair on the pubis and in the armpits, her mammary glands are underdeveloped, no menstruations. What hormone imbalance can it be indicative of?

A. Ovarian failure
B. Hyperthyroidism
C. Hypothyroidism
D. Pancreatic islet failure
E. Adrenal medulla hyperfunction

216. On examination the patient presents with hirsutism, moon-shaped face, stretch marks on the abdomen. BP is 190/100 mm Hg, blood glucose is 17.6 mmol/L. What pathology is such clinical presentation characteristic of?

A. Adrenocortical hyperfunction
B. Hyperthyroidism
C. Hypothyroidism
D. Gonadal hypofunction
E. Hyperfunction of the insular apparatus

217. A 19-year-old young man was examined in the nephrology clinic. High potassium was detected in his secondary urine. What hormone is likely to cause such change, if it is produced in excess?

A. Aldosterone
B. Oxytocin
C. Adrenaline
D. Glucagon
E. Testosterone

218. A 43-year-old female complains of weight loss, hyperhidrosis, low-grade fever, increased irritability. She has been found to have hyperfunction of the sympathetic adrenal system and basal metabolism. These disorders can be caused by hypersecretion of the following hormone:

A. Thyroxine
B. Somatotropin
C. Corticotropin
D. Insulin
E. Aldosterone

219. After a severe stress the patient presents with eosinopenia in the blood test. In this case the decreased number of eosinophils can explain changes in the level of the following hormones:

A. Glucocorticoids
B. Adrenaline
C. Insulin
D. Mineralocorticoids
E. Vasopressin

220. A 35-year-old man with peptic ulcer disease has undergone antrectomy. After the surgery secretion of the following gastrointestinal hormone will be disrupted the most:

A. Gastrin
B. Histamine
C. Secretin
D. Cholecystokinin
E. Neurotensin

221. For people adapted to high external temperatures profuse sweating is not accompanied by loss of large volumes of sodium chloride. This is caused by the effect the following hormone has on perspiratory glands:

A. Aldosterone
B. Vasopressin
C. Cortisol
D. Tyroxin
E. Natriuretic

222. Autopsy of a 40-year-old woman, who died of cerebral hemorrhage during hypertensic crisis, revealed: upper- body obesity, hypertrichosis, hirsutism, stretchmarks on the skin of thighs and abdomen. Pituitary basophil adenoma is detected in the anterior lobe. What diagnosis is the most likely?

A. Cushing’s disease
B. Essential hypertension
C. Alimentary obesity
D. Simmonds’ disease
E. Hypothalamic obesity

223. A 12-year-old child is of short stature, has disproportionate body structure and mental retardation. These characteristics might be caused by the hyposecretion of the following hormone:

A. Thyroxine
B. Insulin
C. Cortisol
D. Somatotropin
E. Glucagon

224. A patient who had been taking diclofenac sodium for arthritis of mandibular joint developed an acute condition of gastric ulcer. Such side effect of this medicine is caused by inhibition of the following enzyme:

A. Cyclooxygenase-1 (COX-1)
B. Cyclooxygenase-2 (COX-2)
C. Lipoxygenase
D. Phosphodiesterase
E. Monoamine oxidase

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

A. It reduces the activity of cyclooxygenase
B. It reduces the activity of phospodi- esterase
C. It enhances the activity of platelet adenylate cyclase
D. It enhances the synthesis of prostacyclin
E. It has membrane stabilizing effect

226. A 19-year-old male was found to have an elevated level of potassium in the secondary urine. These changes might have been caused by the increase in the following hormone level:
A. Aldosterone
B. Oxytocin
C. Adrenaline
D. Glucagon
E. Testosterone

227. Deficiency of linoleic and linolenic acids in the body leads to the skin damage, hair loss, delayed wound healing, thrombocytopenia, low resistance to infections. These changes are most likely to be caused by the impaired synthesis of the following substances:
A. Eicosanoids
B. Interleukins
C. Interferons
D. Catecholamines
E. Corticosteroids

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

229. A 30-year-old woman has subnormal concentration of enzymes in the pancreatic juice. This might be caused by the hyposecretion of the following gastrointestinal hormone:
A. Cholecystokinin-pancreozymin
B. Somatostatin
C. Secretin
D. Gastro-inhibiting peptide
E. Vaso-intestinal peptide

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

231. A concentrated solution of sodium chloride was intravenously injected to an animal. This caused decreased reabsorption of sodium ions in the renal tubules. It is the result of the following changes of hormonal secretion:
A. Aldosterone reduction
B. Aldosterone increase
C. Vasopressin reduction
D. Vasopressin increase
E. Reduction of atrial natriuretic factor

232. 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

233. A female patient presents with endocrine dysfunction of follicular cells of the ovarian follicles resulting from an inflammation. The synthesis of the following hormone will be inhibited:
A. Estrogen
B. Progesterone
C. Lutropin
D. Follicle stimulating hormone
E. Follistatine

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

235. A concentrated solution of sodium chloride was intravenously injected to an animal. This caused decreased reabsorption of sodium ions in the renal tubules. It is the result of the following changes of hormonal secretion:
A. Aldosterone reduction
B. Aldosterone increase
C. Vasopressin reduction
D. Vasopressin increase
E. Reduction of atrial natriuretic factor

236. A patient with hypoparathyreosis has multiple carious lesions of teeth. This pathology is caused by insufficiency of the following hormone:
A. Calcitonin B. Thyroxin C. Triiodothyronine D. Thyroid-stimulating hormone
E. Somatotropin

237. A 44-year-old woman complains of general weakness, heart pain, significant increase of body weight. Objectively: moon face, hirsutism, AP is 165/100 mm Hg, height - 164 cm, weight - 103 kg; the fat is mostly accumulated on her neck, thoracic girdle, belly. What is the main pathogenetic mechanism of obesity?
A. Increased production of glucocorticoids
B. Reduced production of thyroid hormones
C. Increased insulin production

D. Reduced glucagon production
E. Increased mineralocorticoid production

238. Parents of a 10-year-old boy consulted a doctor about extension of hair-covering, growth of beard and moustache, low voice. Intensified secretion of which hormone must be assumed?
A. testosterone
B. somatotropin
C. oestrogen
D. progesterone
E. cortisol

239. A girl is diagnosed with adrenogenital syndrome (pseudohermaphroditism). This pathology was caused by hypersecretion of the following adrenal hormone:
A. Androgen
B. Estrogen
C. Aldosterone
D. Cortisol
E. Adrenalin

240. Following thyroid surgery, a 47-year- old female patient had fibrillary twitching of muscles in the arms, legs and face. These disorders can be treated by the introduction of the following hormone:
A. Parathyroid hormone
B. Triiodothyronine C. Thyrotropin D. Thyroxine
E. Thyroid-stimulating hormone

241. Examination of a patient revealed hyperkaliemia and hyponatremia. Low secretion of which hormone may cause such changes?
A. Aldosteron
B. Vasopressin
C. Cortisol
D. Parathormone
E. Natriuretic

242. Under some diseases it is observed aldosteronism accompanied by hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected under aldosteronism?
A. Adrenal glands
B. Testicle
C. Ovaries
D. Pancreas
E. Hypophysis

243. A person addressed to a doctor bcause of increased arterial pressure, reduced diuresis, hypernatremia, hypokalemia. Hypersecretion of what hormone can cause such changes?
A. Aldosterone
B. Vasopressin
C. Auricular sodiumuretic factor
D. Adrenalin
E. Parathormone

244. Thyrotoxicosis leads to increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, psychic excitement and so on. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?
A. Disconnect oxidation and oxidative phosphorylation
B. Activate substrate phosphorylation
C. Stop substrate phosphorylation
D. Stop respiratory chain
E. Activate oxidative phosphorylation

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

246. An 18-year-old student presents with enlarged thyroid gland accompanied by accelerated metabolism and increased heart rate. These signs can be observed during hypersecretion of thyroxin. What organelles of thyroid cells are primarily responsible for hormone production and secretion?
A. Golgi apparatus
B. Mitochondria
C. Ribosomes
D. Centrosomes
E. Lysosomes

247. Endemic goiter is known to be widespread in certain geochemical areas. This is an important medica and social problem, significantly affecting general health and development of growing organism. The deficiency of what chemical element causes this disease?
A. Iodine
B. Iron
C. Zinc
D. Copper
E. Cobalt

248. A patient appealed to the doctor with complaints about tremor and hypokinesia. The biochemical analysis of blood showed the reduced amount of dopamine. Name its methabolite-precursor.
A. Tyrosine
B. Dioxyphenylalanine
C. Tyramine
D. Phenylalanine
E. Phenylpyruvate

249. The activity of cyclooxygenase can be suppressed by some medical preparations. What preparation exhibits irreversible inhibitory action upon this enzyme?
A. Acetylsalicylic acid
B. Insulin
C. Allopurinol
D. Oligomycine
E. Aminalone

250. Cushing’s disease, which is characterized by obesity, hypertension and elevated blood glucose level, is caused by disorder in production and secretion of the next hormones:

A. ACTH and glucocorticoids overproduction
B. Insulin insufficiency
C. ACTH and glucocorticoids insufficiency
D. Thyroxine insufficiency
E. Estriol overproduction

251. Addison's disease or so called bronze disease is a severe disorder of sodium-potassium turnover due to failure in production of the following hormone:
A. Aldosterone
B. Thyroxine
C. Triiodothyronine
D. Testosterone
E. Progesterone

252. Some hormone induce uncoupling of respiration and oxidative phosphorylation in mitochondria and lower the efficiency of ATP production. What is this hormone?
A. Thyroxine
B. Adrenalin
C. ACTH
D. Oxytocine
E. Testosterone

253. Due to trauma the patient's parathyroid glands have been removed, which resulted in inertness, thirst, sharp increase of neuromuscular excitability. Metabolism of the following substance is disturbed:
A. Calcium
B. Manganese
C. Chlorine
D. Molybdenum
E. Zinc

254. After a traffic accident a man presents with severe blood loss, consciousness disturbance, low blood pressure, as well as compensatory activation of the renin-angiotensin system, which results in:
A. Hyperproduction of aldosterone
B. Increased blood coagulation
C. Intensification of erythropoiesis
D. Hyperproduction of vasopressin
E. Intensification of heart contractions

255. A doctor has established significant growth retardation, disproportional body build, and mental deficiency of a child. What is the most likely cause of this pathology?
A. Hypothyroidism
B. Insufficient nutrition
C. Hyperthyroidism
D. Genetic defects
E. Hypopituitarism

256. 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

257. A 62-year-old woman complains with burning pain in epigastrium. The intragastric pH-metry revealed that stomach pH was 1.3 (normal is 1.5-3.5). Which hormone can reverse the hyperacidity noted in this patient?
A. Secretin
B. Gastrin
C. Growth hormone
D. Cholecystokinin
E. Pepsin

258. An 11-week pregnant patient visited her obstetrician, complaining of severe nausea, usually in the morning. Due to physical examination the size of uterus was bigger than expected for her period of pregnancy. The level of human chorionic gonadotropine-β makes 17 mMO/l. The heart action of the foetus was not detected and USG picture gives evidence of chorionepithelioma. Which endocrine disorder may be detected in this patient?
A. Increased function of the thyroid gland
B. Impaired tolerance to glucose
C. Diabetes insipidus
D. Diabetes mellitus
E. Hypofunction of the thyroid gland

259. A 40-year-old woman came to a surgeon bacause of pain in her right leg. The right calf is swalled, hot and thicker than the left one. The onset of this condition was about a week ago after she came back from her journey to Canada. Body temperature is 36.7 C, she has an increased heart rate, increased arterial pressure and increased

rate of breaths per minute. Which changes in the system of eicosanoids mediate this patient's condition?
A. Increased thromboxane A2
B. Decreased thromboxane A2
C. Increased leukotriene B4
D. Increased PGE2
E. Increased PGE2 and leukotriene B4

260. The patient was prescribed paracetamol because of fever due to influenza. The production of which arachidonic acid derivative will be increased by the effect of this drug?
A. Leukotriene B4
B. Prostaglandin E2
C. Thromboxane A2
D. thromboxane I2
E. Leukotriene B3

261. The patient underwent several courses of radiation therapy because of brain cancer. After some time, she noted that her skin looks suntanned. The family doctor revealed arterial hypotension, decreased heart rate. The failure of which endocrine gland the most evidently developed in this patient?
A. Adrenal cortex
B. Adrenal medullar
C. Pancreas
D. Hypothalamus

E. Anterior pituitary

262. The patient after the removal of a big part of thyroid gland because of multiple nodes was prescribed a lifelong therapy with a drug, that should prevent the manifestations of thyroid gland insufficiency. This drug is based on the hormone:

A. Tyroxine
B. Parathormone
C. TSH
D. Cortisol
E. Aldosteron

263. A 45-year-old female patient with a severe form of lupus erythematosus was treated with prednisolone (a synthetic form of cortisol) for several months Because of clinical improvement the doctor recommended a step decrease of the dose of drug but the patient ceased therapy because she was gaining weight under the effect of steroid. Next day the patient was brought to hospital by ambulance because of the hypotonic crisis, loss of consciousness, decreased heart rate. What caused the patient's condition

A. Acute insufficiency of adrenal glands
B. Hyperfunction of adrenal glands
C. Decreased production of adrenaline
D. Increased production of adrenaline
E. Steroid diabetes

264. A 42-year-old man developed the manifestations of graft-versus-host disease after he was transplanted an alogenic bone marrow from the unrelated donor for the treatment of blood malignancy. Which drug should be prescribed to inhibit immunoaggression in this patient?

A. Cortisol
B. Aldosteron
C. ACTH
D. Testosteron
E. Insulin

True or False:

1. Acromegaly is an excess of growth hormone in children.
2. Adrenal medulla hyperfunction causes hypertension.
3. Adrenaline by chemical structure is a derivative of amino acids.
4. Adrenaline decreases blood pressure and heart rate.
5. Adrenocorticotropic hormone affects adrenal medulla and stimulates catecholamine synthesis.
6. Adrenocorticotropic hormone can synthesize in tumor cells, such as lung cancer.
7. Adrenocorticotropic hormone has melanocyte stimulating activity.
8. Adrenocorticotropic hormone stimulates the production of glucocorticoids.
9. After surgical removal of the entire thyroid gland, thyroxine replacement therapy is required.
10. Aldosterone and cortisol by chemical structure are derivatives of amino acids.
11. Another name for adrenaline is epinephrine.
12. Another name for liberins and statins is releasing factors.
13. Another name for vasopressin is the antidiuretic hormone.
14. Argon is required for the synthesis of thyroid hormones.
15. Beta-endorphins and enkephalins are synthesized from proopiomelanocortin.
16. Calcium ions are involved in the phosphatidyl inositol system.
17. Central endocrine glands include the hypothalamus, pituitary and epiphysis.
18. Clinical symptoms of diabetes insipidus are polyuria and dehydration.
19. Cretinism is a hyperfunction of the thyroid gland since childhood.
20. Cushing's disease is an excess of adrenocorticotropic hormone.
21. Cyclic AMP is a secondary messenger.
22. Diabetes insipidus is an antidiuretic hormone deficiency.
23. Diacylglycerol is a secondary messenger.
24. Endocrine glands hormones affect organs far from the site of their synthesis.
25. Epinephrine activates glycogen phosphorylase.
26. Epinephrine increases blood glucose levels.
27. Epinephrine inhibits lipolysis.
28. Follicle-stimulating hormone stimulates the formation of follicles in the thyroid gland.
29. For the prevention of endemic goiter use common salt (NaCl).
30. Gigantism is an excess of somatotropin since childhood.
31. Graves' disease is a hyperfunction of the thyroid gland.
32. Growth hormone inhibits the synthesis of proteins and nucleic acids.

33. Hormones are inactivated mainly in the liver.
34. Hormones are produced only by exocrine glands.
35. Hormones by chemical structure are divided into protein-peptide, steroid, amino acid derivatives and arachidonic acids.
36. Hydrophobic hormones are released into the blood by exocytosis.
37. Iodine is required for the synthesis of thyroid hormones.
38. Iodine preparations are used to treat endemic goiter.
39. Liberins inhibit the production of adenohypophysis hormones.
40. Lunar face, striae, hirsutism and hyperpigmentation are symptoms of Cushing's disease.
41. Luteinizing hormone stimulates testosterone secretion.
42. Melatonin is synthesized from the amino acid tryptophan.
43. Melatonin is synthesized in skin melanocytes.
44. Myxedema is a hypofunction of the thyroid gland in adults.
45. Nanism (dwarfism) is an excess of growth hormone since childhood.
46. Neurophysin is involved in the transport of oxytocin and vasopressin to the pituitary gland.
47. Norepinephrine is also synthesized in the sympathetic nervous system.
48. Norepinephrine is inactivated by monoamine oxidase.
49. Norepinephrine is synthesized from the amino acid tyrosine.
50. Oxytocin is used to stimulate labor.
51. Oxytocin stimulates uterine muscle contraction.
52. Peripheral endocrine glands include salivary and mammary glands.
53. Pheochromacytoma is an adrenal medulla tumor.
54. Phospholipase A2 catalyzes the cleavage of arachidonic acid from phospholipids.
55. Prolactin is produced in the adenohypophysis.
56. Protein kinase C is involved in the adenylate cyclase messenger system.
57. Sexual glands by function are only exocrine glands.
58. Somatoliberin is a growth hormone.
59. Somatomedins are insulin-like growth fastors.
60. Somatostatin inhibits the production of insulin, glucagon, and hydrochloric acid.
61. Somatototropin stimulates somatic body growth.
62. Somatotropin activates insulinase in the liver.
63. Somatotropin and prolactin by chemical structure are protein-peptide hormones.
64. Somatotropin stimulates lipolysis and fatty acid oxidation.
65. Statins stimulate the production of adenohypophysis hormones.
66. Steroid hormones act on cells through the adenylate cyclase messenger system.
67. Symptoms of thyrotoxicosis include tremor, exophthalmos, and emotional lability.
68. Testosterone by chemical structure is a steroid.
69. The cause of acromegaly may be a tumor of the anterior pituitary.
70. The cause of the endemic goiter is a lack of chlorine in the diet.
71. The daily requirement for iodine is approximately 150-200 mcg.
72. The function of protein kinases is the phosphorylation of the corresponding proteins.
73. The hormones are released directly into the bloodstream.
74. The hormones only affect the target organs at very high concentrations.
75. The incorporation of iodine into the tyrosine ring is catalyzed by thyroperoxidase.
76. The incorporation of iodine into the tyrosine ring is catalyzed by tyrosine hydroxylase.
77. The lipotropin hormone is formed from proopiomelanocortin.
78. The melanocyte-stimulating hormone is formed from proopiomelanocortin.
79. The pancreas is a mixed secretion (endo- and exocrine).
80. The pineal gland controls daily and seasonal biorhythms.
81. The synthesis and secretion of hormones is regulated by the feedback principle.
82. There is a portal venous system between the hypothalamus and the pituitary gland.
83. Thyroid hormones are derivatives of the amino acids isoleucine.
84. Thyroid hormones at high concentrations stimulate the synthesis of proteins and nucleic acids.

85. Thyroid hormones directly penetrate the nucleus and stimulate gene expression.
86. Thyroid hormones stimulate lipolysis and glycogenolysis.
87. Thyrotoxicosis is an excess of thyroid hormones.
88. Thyrotropic hormone by chemical structure is a glycoprotein.
89. Thyrotropic hormone production is stimulated by high levels of thyroid hormones in the blood.
90. Thyrotropic hormone regulates the metabolism of calcium and phosphorus.
91. Thyrotropic hormone stimulates iodine accumulation in the thyroid gland.
92. Thyroxine is tetraiodothyronine.
93. Thyroxine reduces heat generation and increases ATP synthesis.
94. Thyroxine uncouples tissue respiration and oxidative phosphorylation.
95. Tissue hormones affect organs far from the site of their synthesis.
96. Tropic pituitary hormones are produced only by the neurohypophysis.
97. Vasopressin and oxytocin by chemical structure are peptides.
98. Vasopressin increases daily diuresis.
99. Vasopressin increases the reabsorption of water in the kidneys.
100. Vasopressin is synthesized in the neurohypophysis.
101. Acidosis in diabetes occurs as a result of increased ammonia synthesis in the liver.
102. Addison's disease is adrenal cortex hyperfunction.
103. Aldosterone activates the excretion of potassium in the kidneys.
104. Aldosterone inhibits the reabsorption of sodium and water in the kidneys.
105. Androgens are also formed in the adrenal glands.
106. Angiotensin II increases blood pressure.
107. Anti-insulin hormones are parathyroid hormone, aldosterone, bradykinin and prolactin.
108. Anti-insulin hormones are somatotropin, glucagon, glucocorticoids, and thyroid hormones.
109. Bradykinin increases blood pressure.
110. By insulin deficiency, blood glucose levels are increased.
111. By insulin deficiency, the synthesis of ketone bodies increases.
112. By insulin deficiency, the synthesis of ketone bodies is reduced.
113. Calcitonin decreases the level of calcium in the blood.
114. Calcitonin inhibits the reabsorption of phosphorus in the kidneys.
115. Chorionic gonadotropin is formed in the placenta.
116. Cytochrome P450 is involved in the synthesis of corticosteroids.
117. Diabetes mellitus is an insulin deficiency.
118. Diabetes mellitus is glucagon deficiency.
119. Eicosanoids are involved in the inflammation process.
120. Estrogens and androgens in chemical structure are derivatives of arachidonic acid.
121. Estrogens are produced only in the female body.
122. Estrogens inhibit the release of calcium from the bones.
123. For the treatment of type I diabetes use hypoglycemic drugs (metformin, glibenclamide).
124. Gastrointestinal hormones include secretin and cholecystokinin.
125. Glucagon inhibits gluconeogenesis.
126. Glucagon inhibits glycogen synthetase.
127. Glucagon is synthesized in beta-cells of the pancreas.
128. Glucagon stimulates the breakdown of glycogen.
129. Glucocorticoids have anti-inflammatory and anti-allergic effects.
130. Glucocorticoids increase blood glucose level.
131. Glucocorticoids inhibit gluconeogenesis.
132. Glucocorticoids stimulate catabolic processes in muscle and connective tissue.
133. Glucocorticoids stimulate lipolysis.
134. Glucocorticoids stimulate protein synthesis in the liver.
135. Glucosuria, polyuria, thirst and dehydration are symptoms of diabetes.
136. Glycated hemoglobin indicates the level of glycemia in the last 3 months.
137. Glycogen stimulates lipolysis.

138. Gucagon decreases blood glucose level.
139. Histamine is a tissue hormone.
140. Histamine is involved in allergic and inflammatory reactions.
141. Histamine reduces the secretion of hydrochloric acid.
142. Hyperglycemia is one of the signs of Cushing's syndrome.
143. Hyperpigmentation is symptom of Addison's disease.
144. Hypokalemia is one of the signs of Conn's disease.
145. Insulin activates gluconeogenesis.
146. Insulin activates glycogen synthetase.
147. Insulin activates hexokinase.
148. Insulin affects cells through tyrosine kinase receptors.
149. Insulin also affects gene expression.
150. Insulin decreases blood glucose level.
151. Insulin increases blood glucose level.
152. Insulin inhibits gluconeogenesis.
153. Insulin inhibits glycogen phosphorylase.
154. Insulin inhibits glycolysis.
155. Insulin inhibits phosphodiesterase.
156. Insulin is inactivated by insulinase in the liver.
157. Insulin is produced by alpha cells of the pancreas.
158. Insulin is produced by beta cells of the pancreas.
159. Insulin is secreted in combination with C-peptide and zinc by exocytosis.
160. Insulin is synthesized from proinsulin by limited proteolysis.
161. Insulin is synthesized from proinsulin by phosphorylation and methylation.
162. Insulin reduces the level of cyclic AMP in the cell.
163. Insulin resistance is type II diabetes.
164. Insulin secretion is independent of blood glucose.
165. Insulin stimulates glucose transport into brain cells.
166. Insulin stimulates glycolysis.
167. Insulin stimulates lipid synthesis.
168. Insulin stimulates lipolysis.
169. Insulin stimulates protein and nucleic acid synthesis.
170. Microsomal oxidation is used for the synthesis of steroid hormones.
171. Natriuretic hormone is synthesized in the heart.
172. Parathyroid hormone decreases blood calcium.
173. Parathyroid hormone inhibits reabsorption of phosphorus in the kidneys.
174. Progesterone is the hormone of pregnancy preservation.
175. Prostaglandins, prostacyclins, thromboxanes and leukotrienes are derivatives of gamma-aminobutyric acid.
176. Renin is produced in the kidneys.
177. Serotonin is a CNS inhibitory neurotransmitter.
178. Somatostatin is also synthesized in D-cells of the pancreas.
179. Steroid hormones are cholesterol derivatives.
180. Testosterone decreases muscle mass and inhibits protein synthesis.
181. Testosterone stimulates anabolic processes.
182. The active form of vitamin D is synthesized in the kidneys.
183. The acute complication of diabetes is hyperglycemic ketoacidotic coma.
184. The C-peptide is part of proinsulin.
185. The cause of Cushing's syndrome is an excess of glucocorticoids.
186. The cause of osteoporosis may be a decrease in the level of calcitonin and an increase in the level of the parathyroid hormone.
187. The gold standard in the diagnosis of diabetes is the glucose tolerance test.
188. The level of glycated hemoglobin is normally less than 6,5%.

189. The normal glucose level is 3,3-5,5 mmol/L.
190. The placenta is also the endocrine organ.
191. The renal threshold for glucose is 9,0 mmol/L.
192. The symptom of parathyroid gland hyperfunction is tetanus.
193. The target organs for insulin are liver, muscle and adipose tissue.
194. The target organs for insulin are the brain and adrenal medulla.
195. Type I diabetes is caused by absolute insulin deficiency.
196. Type I diabetes is caused by relative insulin deficiency (insulin resistance).
197. Typical complications of diabetes are gastritis, cholecystitis and appendicitis.
198. Typical complications of diabetes are retinopathy, microangiopathy and polyneuropathy.
199. Tyrosine kinase receptors can phosphorylate enzymes by serine and threonine residues.
200. Tyrosine kinase receptors have autophosphorylation activity.

Situational Tasks:

1. A 45-year-old patient showed disproportionate intensive growth of the hands, feet, legs, chin, eyebrow arches, nose, tongue.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Specify the mechanism of action of the hormone.

2. A young man after a severe viral infection has polydipsia, polyuria (daily diuresis - 25 liters), urine specific gravity - 1002, serum glucose content of 4.4 mmol / liter.
a) What pathology occurs?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Specify the mechanism of action of the hormone.

3. At the patient, 30 years, after the transferred flu weakness, irritability, sweating. The patient lost weight, there was trembling of the hands, palpitations, irritability, hyperthermia. On examination: facial skin is hyperemic, moist, exophthalmos, enlarged thyroid gland, soft, painless.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormones is observed in this pathology? Name their chemical nature.
c) Indicate the mechanism of action of these hormones.

4. During the clinical examination of the patient revealed a decrease in basal metabolism by 40%, weight gain, decrease in body temperature, puffiness of the face, sexual dysfunction, lethargy and apathy, decreased intelligence.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormones is observed in this pathology? Name their chemical nature.
c) Indicate the mechanism of action of these hormones.

5. A 50-year-old woman complained to her doctor about high blood pressure, especially after stressful situations. Ultrasound revealed an increase in the right adrenal gland due to the cerebral substance.
a) Violation of the secretion of which hormones is observed in this pathology? Name their chemical nature.
b) Specify the mechanism of action of these hormones.
c) Indicate the effect of these hormones on metabolism.

6. The patient was diagnosed with hypernatremia, hypokalemia, increased osmotic blood pressure, edema.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Specify the mechanism of action of the hormone.

7. A 29-year-old sick woman has a moon-shaped face, obesity of the upper torso, stretch marks on the anterior abdominal wall, hirsutism, and elevated levels of 17-ketosteroids in the urine.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Specify the mechanism of action of this hormone.

8. In the endocrinology department of the regional hospital there is a patient with complaints of fatigue, poor appetite, tachycardia and skin hyperpigmentation. From the anamnesis it is known: for a long time he was treated with corticosteroids for bronchial asthma.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Indicate the mechanism of anti-inflammatory and anti-allergic action of these hormones.

9. 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?

10. 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.

11. 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.

12. A 6-year-old boy suffering from tetanic seizures was diagnosed with hypocalcemia, hyperphosphatemia, and hypophosphaturia.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature.
c) Specify the mechanism of action of this hormone.

13. A 19-year-old patient often suffered from infectious diseases as a child. Examination revealed that the secondary sexual characteristics are poorly developed, the primary sexual characteristics do not correspond to age, the testicles are atrophied.
a) What pathology occurs in the patient?
b) Violation of the secretion of which hormone is observed in this pathology? Name its chemical nature and mechanism of action.
c) Name the enzyme that provides the formation of the active form of the hormone? Clinical significance of the use of inhibitors of this enzyme.

14. 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?

15. 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.

16. 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.

17. 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?

18. A patient with diabetes has developed ketoacidosis.
1) Name the compounds whose accumulation causes the development of ketoacidosis.
2) From what substance and in what organ are ketone bodies synthesized?
3) Indicate the reasons for the development of ketoacidosis in diabetes.

Chapter II. Biochemistry of nutrition. Vitamins.

List of the exam questions:

1. General characteristics of vitamins. Vitamin classification depending on physical and chemical properties, function (cofactor, regulatory, antioxidant) and biological role.
2. Daily vitamin requirement. Causes of hyper-, hypo- and avitaminoses.
3. Classification of vitamins according to the clinical and physiological effects.
4. Fat-soluble vitamins: general characteristics. Provitamins. Hypervitaminoses.
5. Vitamin A (Retinol): biochemical functions, hypovitaminosis.
6. Vitamin D (Calciferol): biochemical functions, hypovitaminosis.
7. Vitamin E (Tocopherol): biochemical functions, hypovitaminosis.
8. Vitamin K (Naphthoquinone): biochemical functions, hypovitaminosis.
9. Vitamin F (Polyunsaturated fatty acids): biochemical functions, hypovitaminosis.
10. Water-soluble vitamins: general characteristics.
11. Vitamin B1 (Thiamine): biochemical functions, hypovitaminosis.
12. Vitamin B2 (Riboflavin): biochemical functions, hypovitaminosis.
13. Pantothenic Acid (vitamin B5): biochemical functions, hypovitaminosis.
14. Vitamin PP (Niacin, vitamin B3): biochemical functions, hypovitaminosis.
15. Vitamin B6 (Pyridoxine): biochemical functions, hypovitaminosis.
16. Biotin (vitamin H, B7): biochemical functions, hypovitaminosis.
17. Folic Acid (vitamin Bc, B9): biochemical functions, hypovitaminosis.
18. Vitamin B12 (Cobalamin): biochemical functions, hypovitaminosis.
19. Vitamin C (Ascorbic Acid) and P (Bioflavonoids): biochemical functions, hypovitaminosis.
20. Basic biochemical functions of vitamin-like substances (lipoic acid, choline, inositol, paraaminobenzoic acid, orotic acid, pangamic acid, S-methyl-methionine, carnitine, ubiquinone etc.). Antivitamins: general characteristics and application in medicine.

Multiple Choice Questions:

Vitamins

1. One of the causes of pernicious anemia is disturbed synthesis of transcorrin - Castle's intrinsic factor - by the parietal cells of the stomach. What substance is called Castle's extrinsic factor?
A. Cobalamin
B. Riboflavin
C. Folic acid
D. Biotin
E. Pyridoxine

2. Patients with bile duct obstruction typically present with inhibited blood clotting and develop hemorrhages due to insufficient assimilation of vitamin:
A. K
B. C
C. D
D. A
E. E

3. 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 B2
C. Vitamin B1
D. Vitamin PP
E. Vitamin C

4. A 25-year-old young man came to the doctor complaining of general weakness, rapid fatigability, irritability, reduced working ability, and bleeding gums. What vitamin is likely to be deficient in this case?
A. Ascorbic acid
B. Riboflavin
C. Thiamine
D. Folic acid
E. Retinol

5. An 8-year-old girl presents with signs of disturbed twilight vision. This condition is caused by the deficiency of vitamin:
A. A
B. E

C. K
D. D
E. F

6. A pregnant woman with several miscarriages in anamnesis is prescribed a therapy that includes vitamin preparations. What vitamin facilitates carrying of a pregnancy?
A. Alpha-tocopherol
B. Folic acid
C. Cyanocobalamin
D. Pyridoxal phosphate
E. Rutin

7. During regular check-up a child is determined to have interrupted mineralization of the bones. What vitamin deficiency can be the cause?
A. Calciferol
B. Riboflavin
C. Tocopherol
D. Folic acid
E. Cobalamin

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

9. A 10-year-old girl has a history of repeated acute respiratory viral infection. After recovering she presents with multiple petechial hemorrhages on the sites of friction from clothing rubbing the skin. What kind of hypovitaminosis has this girl?
A. C
B. B6
C. B1
D. A
E. B2

10. A doctor recommends a patient with duodenal ulcer to drink cabbage and potato juice after the therapy course. Which substances contained in these vegetables help to heal and prevent the ulcers?
A. Vitamin U
B. Pantothenic acid
C. Vitamin C
D. Vitamin B1
E. Vitamin K

11. 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

12. Vitamin B1 deficiency causes disturbance of oxidative decarboxylation of α-ketoglutaric acid. This leads to the impaired synthesis of the following coenzyme:
A. Thiamine pyrophosphate
B. Nicotinamide adenine dinucleotide
C. Flavine adenine dinucleotide
D. Lipoic acid
E. Coenzyme A

13. Examination of a child who hasn't got fresh fruit and vegetables during winter revealed numerous subcutaneous hemorrhages, gingivitis, carious cavities in teeth. What vitamin combination should be prescribed in this case?
A. Ascorbic acid and rutin
B. Thiamine and pyridoxine
C. Folic acid and cobalamin
D. Riboflavin and nicotinamide
E. Calciferol and ascorbic acid

14. Vitamin A together with specific cytoreceptors penetrates through the nuclear membranes, induces transcription processes that stimulate growth and differentiation of cells. This biological function is realized by the following form of vitamin A:
A. Trans-retinoic acid
B. Trans-retinal
C. Cis-retinal
D. Retinol
E. Carotin

15. To prevent postoperative bleeding a 6-year-old child was administered vicasol that is a synthetic analogue of vitamin K. Name post-translational changes of blood coagulation factors that will be activated by vicasol:
A. Carboxylation of glutamic acid
B. Phosphorylation of serine radicals
C. Partial proteolysis
D. Polymerization
E. Glycosylation

16. Blood test of a patient suffering from atrophic gastritis gave the following results: RBCs - 2,0 • 1012/l, Hb- 87 g/l, colour index - 1,3, WBCs - 4, 0 • 109/l, thrombocytes - 180 • 109/l. Anaemia migh have been caused by the following substance deficiency:
A. Vitamin B12
B. Vitamin A
C. Vitamin K
D. Iron
E. Zinc

17. A 64-year-old woman has impairment of twilight vision (hemeralopy). What vitamin should be recommended in the first place?
A. A
B. B2
C. E
D. C
E. B6

18. A 4-year-old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is

normal. What is the most probable cause of rickets development?
A. Impaired synthesis of calcitriol
B. Increased excretion of calcium
C. Hyperfunction of parathyroid glands
D. Hypofunction of parathyroid glands
E. Lack of calcium in food

19. A patient diagnosed with focal tuberculosis of the upper lobe of the right lung had been taking isoniazid as a part of combination therapy. After some time, the patient reported of muscle weakness, decreased skin sensitivity, blurred vision, impaired motor coordination. Which vitamin preparation should be used to address these phenomena?
A. Vitamin B6
B. Vitamin A
C. Vitamin D
D. Vitamin B12
E. Vitamin C

20. A number of diseases can be diagnosed by evaluating activity of blood transaminases. What vitamin is one of cofactors of these enzymes?
A. B6
B. B2
C. B1
D. B8
E. B5

21. A 20-year-old male patient complains of general weakness, rapid fatigability, irritability, decreased performance, bleeding gums, petechiae on the skin. What vitamin deficiency may be a cause of these changes?
A. Ascorbic acid
B. Riboflavin
C. Thiamine
D. Retinol
E. Folic acid

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

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

24. Steatosis is caused by the accumulation of triacylglycerols in hepatocytes. One of the mechanisms of this disease development is a decrease in the utilization of VLDL neutral fat. What lipotropics prevent the development of steatosis?
A. Methionine, B6, B12
B. Arginine, B2, B3
C. Alanine, B1, PP
D. Valine, B3, B2
E. Isoleucine, B1, B2

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

26. A 36-year-old female patient has a history of B2-hypovitaminosis. The most likely cause of specific symptoms (epithelial, mucosal, cutaneous, corneal lesions) is the deficiency of:
A. Flavin coenzymes
B. Cytochrome A1
C. Cytochrome oxidase
D. Cytochrome B
E. Cytochrome C

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

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

29. During regular check-up a child is detected with interrupted mineralization of bones. What vitamin deficiency can be the cause?
A. Calciferol
B. Cobalamin
C. TocopherоI
D. Folic acid
E. Riboflavin

30. A patient, who has been suffering for a long time from intestine disbacteriosis, has increased hemorrhaging caused by disruption of posttranslational modification of blood-coagulation factors II, VII, IX, and X in the liver. What vitamin deficiency is the cause of this condition?
A. K
B. P
C. B12
D. C
E. B9

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

32. A patient is diagnosed with chronic atrophic gastritis attended by deficiency of Castle's intrinsic factor. What type of anemia does the patient have?
A. B12-deficiency anemia
B. Iron-deficiency anemia
C. Hemolytic anemia
D. Iron refractory anemia
E. Protein-deficiency anemia

33. It has been determined that one of 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. Glutathione reductase
C. Methemoglobin reductase
D. Microsomal oxidation
E. Glutathione peroxidase

34. 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. Uric acid
C. Malate
D. Phenyl pyruvate
E. Methyl malonic acid

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

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

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

38. Coenzyme A participates in numerous important metabolic reactions. It is a derivative of the following vitamin:
A. Pantothenic acid
B. Calciferol
C. Thiamine
D. Niacin
E. Ubiquinone

39. Pain along large nervous stems and increased amount of pyruvate in the blood were revealed in the patient. Insufficiency of what vitamin can cause such change?
A B1
B B2
C PP
D Pantothenic acid
E Biotin

40. In case of enterobiasis acrihine - the structural analogue of vitamin B2 - is administered. The synthesis disorder of which enzymes does this medicine cause in microorganisms?
A. FAD-dependent dehydrogenases
B. Cytochromeoxidases
C. Peptidases
D. NAD-dependet dehydrogenases
E. Aminotransferases

41. A 10-year-old girl often experiences acute respiratory infections with multiple spotty haemorrages in the places of clothes friction. Hypovitaminosis of what vitamin is present at the girl?
A C
B B6
C B1
D A
E B2

42. Hydroxylation of endogenous substrates and xenobiotics requires a donor of protons. Which of the following vitamins can play this role?
A Vitamin C
B Vitamin P
C Vitamin B6
D Vitamin E
E Vitamin A

43. Tere is observed inhibited fibrillation in the patients with bile ducts obstruction, bleeding due to low level of absorbtion of some vitamin. What vitamin is in deficit?
A K
B A
C D
D E
E Carotene

44. A 35-year-old man under the treatment for pulmonary tuberculosis has acute-onset of right big toe pain, swelling, and low-grade fever. The gouty arthritis was diagnosed and high serum uric acid level was found.

Which of the following antituberculosis drugs are known for causing high uric acid levels?
A Pyrazinamide
B Cycloserine
C Thiacetazone
D Rifampicin
E Aminosalicylic acid

45. While examining the child the doctor revealed symmetric cheeks roughness, diarrhea, disfunction of the nervous system. Lack of what food components caused it?
A Nicotinic acid, tryptophane
B Lysine, ascorbic acid
C Threonine, pantothenic acid
D Methionine, lipoic acid
E Phenylalanine, pangamic acid

46. Increased breaking of vessels, enamel and dentine destruction in scurvy patients are caused by disorder of collagen maturing. What stage of modification of procollagen is disordered in this avitaminosis?
A Hydroxylation of proline
B Formation of polypeptide chains
C Glycosylation of hydroxylysine residues
D Removal of C-ended peptide from procollagen
E Detaching of N-ended peptide

47. Examination of a patient suffering from frequent haemorrhages in the inner organs and mucous membranes revealed proline and lysine being included in collagen fibers. Impairment of their hydroxylation is caused by lack of the following vitamin:
A C
B E
C K
D A
E D

48. A patient has an increased pyruvate concentration in blood. A large amount of it is excreted with the urine. What vitamin is lacking in this patient?
A B1
B E
C B3
D B6
E B2

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

50. A patient consulted a doctor about symmetric dermatitis of open skin areas. It was found out that the patient lived mostly on cereals and ate too little meat, milk and eggs. What vitamin deficiency is the most evident?
A Nicotinamide
B Calciferol
C Folic acid
D Biotin
E Tocopherol

51. Examination of a child who hasn't got fresh fruit and vegetables during winter revealed numerous subcutaneous hemorrhages, gingivitis, carious cavities in teeth. What vitamin combination should be prescribed in this case?
A. Ascorbic acid and rutin
B. Thiamine and pyridoxine
C. Folic acid and cobalamin
D. Riboflavin and nicotinamide
E. Calciferol and ascorbic acid

52. A newborn child has convulsions that have been observed after prescription of vitamin B6. This most probable cause of this effect is that vitamin B6 is a componet of the following enzyme:
A Glutamate decarboxylase
B Pyruvate dehydrostase
C Netoglubarate dehydromine
D Aminolevulinate synthase
E Glycogen phosphorylase

53. Concentration of pyruvate is increased in the patient's blood, the most of which is excreted with urine. What avitaminosis is observed in the patient?
A Avitaminosis B1
B Avitaminosis E
C Avitaminosis B3
D Avitaminosis B6
E Avitaminosis B2

54. A woman who has been keeping to a clean-rice diet for a long time was diagnosed with polyneuritis (beriberi). What vitamin deficit results in development of this disease?
A Thiamine
B Ascorbic acid
C Pyridoxine
D Folic acid
E Riboflavin

55. Removal of gall bladder of a patient has disturbed processes of Ca absorption through the intestinal wall. What vitamin will stimulate this process?
A D3
B PP
C C
D B12
E K

56. Examination of a man who hadn't been consuming fats but had been getting enough carbohydrates and proteins for a long time revealed dermatitis, poor wound healing, vision impairment. What is the probable cause of metabolic disorder?
A Lack of linoleic acid, vitamins A, D, E, K
B Lack of palmitic acid
C Lack of vitamins PP, H
D Low caloric value of diet
E Lack of oleic acid

57. Examination of a patient with frequent hemorrhages from internals and mucous membranes revealed proline and lysine being a part of collagene fibers. What vitamin absence caused disturbance of their hydroxylation?
A Vitamin C
B Vitamin K
C Vitamin A
D Thiamine
E Vitamin E

58. A patient with continious bronchopneumonia was admitted to the therapeutic department. Antibiotic therapy didn't give much effect. What medication for improvement of immune state should be added to the complex treatment of this patient?
A Timaline
B Analgin
C Sulfocamphocaine
D Benadryl
E Paracetamol

59. Vitamin A together with specific cytoreceptors penetrates through the nuclear membranes, induces transcription processes that stimulate growth and differentiation of cells. This biological function is realized by the following form of vitamin A:
A Trans-retinoic acid
B Trans-retinal
C Cis-retinal
D Retinol
E Carotin

60. To prevent postoperative bleeding a 6 y.o. child was administered vicasol that is a synthetic analogue of vitamin K. Name post-translational changes of blood coagulation factors that will be activated by vicasol:
A Carboxylation of glutamin acid
B Phosphorylation of serine radicals
C Partial proteolysis
D Polymerization
E Glycosylation

61. During examination of an 11-month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:
A Cholecalciferol
B Thiamin
C Pantothenic acid
D Bioflavonoids
E Riboflavin

62. Vitamin B1 deficiency results in disturbance of oxidative decarboxylation of α-ketoglutaric acid. This will disturb synthesis of the following coenzyme:
A Thiamine pyrophosphate
B Nicotinamide adenine dinucleotide (NAD)
C Flavine adenine dinucleotide (FAD)
D Lipoic acid
E Coenzyme A

63. According to clinical indications a patient was administered pyridoxal phosphate. What processes is this medication intended to correct?
A Transamination and decarboxylation of aminoacids
B Oxidative decarboxylation of ketonic acids
C Desamination of purine nucleotide
D Synthesis of purine and pyrimidine bases
E Protein synthesis

64. As a result of posttranslative modifications some proteins taking part in blood coagulation, particularly prothrombin, become capable of calcium binding. The following vitamin takes part in this process:
A K
B C
C A
D B1
E B2

65. A 3-year-old child with symptoms of stomatitis, gingivitis and dermatitis of open skin areas was delivered to a hospital. Examination revealed inherited disturbance of neutral amino acid transporting in the bowels. These symptoms were caused by the deficiency of the following vitamin:
A Niacin
B Pantothenic acid
C Vitamin A
D Cobalamin
E Biotin

66. A doctor examined a child and revealed symptoms of rachitis. Development of this desease was caused by deficiency of the following compound:
A 1,25 [OH]-dichydroxycholecalciferol
B Biotin
C Tocopherol
D Naphtaquinone
E Retinol

67. A 9-month-old infant is fed with artificial formulas with unbalanced vitamin B6 concentration. The infant presents with pellagral dermatitis, convulsions, anaemia. Convulsion development might be caused by the disturbed formation of:
A GABA
B Histamine
C Serotonin
D DOPA
E Dopamine

68. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?
A Gastromucoprotein
B Gastrin
C Hydrochloric acid
D Pepsin
E Folic acid

69. A 4-year-old child with hereditary renal lesion has signs of rickets, vitamin D concentration in blood is

normal. What is the most probable cause of rickets development?
A. Impaired synthesis of calcitriol
B. Increased excretion of calcium
C. Hyperfunction of parathyroid glands
D. Hypofunction of parathyroid glands
E. Lack of calcium in food

70. In clinical practice tuberculosis is treated with izoniazid preparation - that is an antivitamin able to penetrate into the tuberculosis bacillus. Tuberculostatic effect is induced by the interference with replication processes and oxidation-reduction reactions due to the buildup of pseudo-coenzyme:
A NAD
B FAD
C FMN
D TDP
E CoQ

71. Plasmic factors of blood coagulation are exposed to post-translational modification with the participation of vitamin K. It is necessary as a cofactor in the enzyme system of γ-carboxylation of protein factors of blood coagulation due to the increased affinity of their molecules with calcium ions. What amino acid is carboxylated in these proteins?
A Glutamic
B Valine
C Serine
D Phenylalanine
E Arginine

72. A number of diseases can be diagnosed by evaluating activity of blood transaminases. What vitamin is one of cofactors of these enzymes?
A B6
B B2
C B1
D B8
E B5

73. A 20-year-old male patient complains of general weakness, rapid fatigability, irritability, decreased performance, bleeding gums, petechiae on the skin. What vitamin deficiency may be a cause of these changes?
A. Ascorbic acid
B. Riboflavin
C. Thiamine
D. Retinol
E. Folic acid

74. Pain along large nervous stems and increased amount of pyruvate in the blood were revealed in the patient. Insufficiency of what vitamin can cause such change?
A B1
B B2
C PP
D Pantothenic acid
E Biotin

75. In case of enterobiasis acrihine - the structural analogue of vitamin B2 - is administered. The synthesis disorder of which enzymes does this medicine cause in microorganisms?
A. FAD-dependent dehydrogenases
B. Cytochromeoxidases
C. Peptidases
D. NAD-dependet dehydrogenases
E. Aminotransferases

76. A 10-year-old girl often experiences acute respiratory infections with multiple spotty haemorrages in the places of clothes friction. Hypovitaminosis of what vitamin is present at the girl?
A C
B B6
C B1
D A
E B2

77. There is observed inhibited fibrillation in the patients with bile ducts obstruction, bleeding due to low level of absorbtion of some vitamin. What vitamin is in deficit?
A K
B A
C D
D E
E Carotene

78. While examining the child the doctor revealed symmetric cheeks roughness, diarrhea, disfunction of the nervous system. Lack of what food components caused it?
A Nicotinic acid, tryptophane
B Lysine, ascorbic acid
C Threonine, pantothenic acid
D Methionine, lipoic acid
E Phenylalanine, pangamic acid

79. Increased breaking of vessels, enamel and dentine destruction in scurvy patients are caused by disorder of collagen maturing. What stage of modification of procollagen is disordered in this avitaminosis?
A Hydroxylation of proline
B Formation of polypeptide chains
C Glycosylation of hydroxylysine residues
D Removal of C-ended peptide from procollagen
E Detaching of N-ended peptide

80. Examination of a patient revealed typical presentations of collagenosis. This pathology is characterized by increase of the following urine index:
A Hydroxyproline
B Arginine
C Glucose
D Mineral salts
E Ammonium salts

81. Examination of a patient suffering from frequent haemorrhages in the inner organs and mucous membranes revealed proline and lysine being included in collagen fibers. Impairment of their hydroxylation is caused by lack of the following vitamin:
A C
B E

C K
D A
E D

82. A patient has an increased pyruvate concentration in blood. A large amount of it is excreted with the urine. What vitamin is lacking in this patient?
A B1
B E
C B3
D B6
E B2

83. A patient consulted a doctor about symmetric dermatitis of open skin areas. It was found out that the patient lived mostly on cereals and ate too little meat, milk and eggs. What vitamin deficiency is the most evident?
A Nicotinamide
B Calciferol
C Folic acid
D Biotin
E Tocopherol

84. A newborn child has convulsions that have been observed after prescription of vitamin B6. This most probable cause of this effect is that vitamin B6 is a cofactor of the following enzyme:
A Glutamate decarboxylase
B Pyruvate dehydrostase
C Netoglubarate dehydromine
D Aminolevulinate synthase
E Glycogen phosphorylase

85. A woman who has been keeping to a clean-rice diet for a long time was diagnosed with polyneuritis (beriberi). What vitamin deficit results in development of this disease?
A Thiamine
B Ascorbic acid
C Pyridoxine
D Folic acid
E Riboflavin

86. Removal of gall bladder of a patient has disturbed processes of Ca absorption through the intestinal wall. What vitamin will stimulate this process?
A D3
B PP
C C
D B12
E K

87. Examination of a patient with frequent hemorrhages from internals and mucous membranes revealed proline and lysine being a part of collagene fibers. What vitamin absence caused disturbance of their hydroxylation?
A Vitamin C
B Vitamin K
C Vitamin A
D Thiamine
E Vitamin E

88. Vitamin A together with specific cytoreceptors penetrates through the nuclear membranes, induces transcription processes that stimulate growth and differentiation of cells. This biological function is realized by the following form of vitamin A:
A Trans-retinoic acid
B Trans-retinal
C Cis-retinal
D Retinol
E Carotin

89. To prevent postoperative bleeding a 6 y.o. child was administered vicasol that is a synthetic analogue of vitamin K. Name post-translational changes of blood coagulation factors that will be activated by vicasol:
A Carboxylation of glutamin acid
B Phosphorylation of serine radicals
C Partial proteolysis
D Polymerization
E Glycosylation

90. According to clinical indications a patient was administered pyridoxal phosphate. What processes is this medication intended to correct?
A Transamination and decarboxylation of aminoacids
B Oxidative decarboxylation of ketoacids
C Desamination of purine nucleotide
D Synthesis of purine and pyrimidine bases
E Protein synthesis

91. As a result of posttranslative modifications some proteins taking part in blood coagulation, particularly prothrombin, become capable of calcium binding. The following vitamin takes part in this process:
A K
B C
C A
D B1
E B2

92. A 3-year-old child with symptoms of stomatitis, gingivitis and dermatitis of open skin areas was delivered to a hospital. Examination revealed inherited disturbance of neutral amino acid transporting in the bowels. These symptoms were caused by the deficiency of thefollowing vitamin:
A Niacin
B Pantothenic acid
C Vitamin A
D Cobalamin
E Biotin

93. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?
A Gastromucoprotein
B Gastrin
C Hydrochloric acid
D Pepsin
E Folic acid

94. In clinical practice tuberculosis is treated with izoniazid preparation - that is an antivitamin able to

penetrate into the tuberculosis bacillus. Tuberculostatic effect is induced by the interference with replication processes and oxidation-reduction reactions due to the buildup of pseudo-coenzyme:
A NAD
B FAD
C FMN
D TDP
E CoQ

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

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

97. There is an increase of the pyruvate level in the patient's blood and urine. What kind of avitaminosis developed in this case?
A. B1 avitaminosis.
B. E avitaminosis.
C. B3 avitaminosis.
D. B6 avitaminosis.
E. B2 avitaminosis.

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

99. Under different pathological states the level of active forms of oxygen rises, which results in the destruction of cellular membranes. In order to prevent the damage of membranes, antioxidants are used. The most powerful natural antioxidant is:
A. a-Tocoferol.
B. Glucose.
C. Vitamin A.
D. Fatty acids.
E. Glycerol.

100. During examination of an 11-month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:
A Cholecalciferol
B Thiamin
C Pantothenic acid
D Bioflavonoids
E Riboflavin

101. In case of enterobiasis acrihine - the structural analogue of vitamin B2 - is administered. The synthesis disorder of which enzymes does this medicine cause in microorganisms?
A. FAD-dependent dehydrogenases.
B. Cytochromeoxidases.
C. Peptidases.
D. NAD-dependent dehydrogenases.
E. Aminotransferases.

102. In order to speed up healing of the thermal injury it is required to prescribe a drug that facilitates epithelization of skin and mucous membranes. What drug is it?
A. Retinol acetate.
B. Tocopherol acetate
C. Nicotinic acid
D. Ergocalciferol
E. Ascorbic acid

103. The patient has the diagnosis of beriberi. What enzyme activity is broken at the patient?
A. Pyruvate dehydrogenase
B. Citrate synthase
C. Malate dehydrogenase
D. Succinate dehydrogenase
E. Fumarase

104. At the patient of 36 years old with chronic alcoholism, in blood pyruvate accumulation is developed, in erythrocytes - decrease in activity transketolase takes place. Name the coenzyme form of vitamin which insufficiency the specified changes are caused?
A. Thiamine pyrophosphate
B. Carboxybiotin
C. Methyl cobalamin
D. Phospho pyridoxal
E. Tetrahydrofolate

105. Pain along large nervous stems and increased amount of pyruvate in the blood were revealed in the patient. Insufficiency of what vitamin can cause such change?
A. B1.
B. B2.
C. PP.
D. Pantothenic acid.
E. Biotin.

106. A 9-month-old infant is fed with artificial formulas with unbalanced vitamin B6 concentration. The infant presents with pellagral dermatitis, convulsions, anaemia. Convulsion development might be caused by the disturbed formation of:
A. GABA.
B. Histamine.
C. Serotonin.
D. DOPA.
E. Dopamine.

107. A woman who has been keeping to a clean-rice diet for a long time was diagnosed with polyneuritis (beriberi). What vitamin deficit results in development of this disease?
A. Thiamine.
B. Ascorbic acid.
C. Pyridoxine.
D. Folic acid.
E. Riboflavin.

108. In case of enterobiasis acrihine - the structural analogue of vitamin B2 - is administere The synthesis disorder of which enzymes does this medicine cause in microorganisms?
A. FAD-dependent dehydrogenases.
B. Cytochromeoxidases.
C. Peptidases.
D. NAD-dependet dehydrogenases.
E. Aminotransferases.

109. A 10-year-old girl often experiences acute respiratory infections with multiple spotty haemorrages in the places of clothes friction. Hypovitaminosis of what vitamin is present at the girl?
A. C.
B. B6.
C. B1.
D. A.
E. B2.

110. Hydroxylation of endogenous substrates and xenobiotics requires a donor of protons. Which of the following vitamins can play this role?
A. Vitamin C.
B. Vitamin P.
C. Vitamin B6.
D. Vitamin E.
E. Vitamin A.

111. Examination of a patient with frequent hemorrhages from internals and mucous membranes revealed proline and lysine being a part of collagene fibers. What vitamin absence caused disturbance of their hydroxylation?
A. Vitamin C.
B. Vitamin K.
C. Vitamin A.
D. Thiamine.
E. Vitamin E.

112. Examination of a patient suffering from frequent haemorrhages in the inner organs and mucous membranes revealed proline and lysine being included in collagen fibers. Impairment of their hydroxylation is caused by lack of the following vitamin:
A. C.
B. E.
C. K.
D. A.
E. D.

113. A patient consulted a doctor about symmetric dermatitis of open skin areas. It was found out that the patient lived mostly on cereals and ate too little meat, milk and eggs. What vitamin deficiency is the most evident?
A. Nicotinamide.
B. Calciferol.
C. Folic acid.
D. Biotin.
E. Tocopherol.

114. Examination of a child who hasn't got fresh fruit and vegetables during winter revealed numerous subcutaneous hemorrhages, gingivitis, carious cavities in teeth. What vitamin combination should be prescribed in this case?
A. Ascorbic acid and rutin.
B. Thiamine and pyridoxine.
C. Folic acid and cobalamin.
D. Riboflavin and nicotinamide.
E. Calciferol and ascorbic acid.

115. Concentration of pyruvate is increased in the patient's blood, the most of which is excreted with urin What avitaminosis is observed in the patient?
A. Avitaminosis B1.
B. Avitaminosis E.
C. Avitaminosis B3.
D. Avitaminosis B6.
E. Avitaminosis B2.

116. A woman who has been keeping to a clean-rice diet for a long time was diagnosed with polyneuritis (beriberi). What vitamin deficit results in development of this disease?
A. Thiamine.
B. Ascorbic acid.
C. Pyridoxine.
D. Folic acid.
E. Riboflavin.

117. While examining the child the doctor revealed symmetric cheeks roughness, diarrhea, disfunction of the nervous system. Lack of what food components caused it?
A. Nicotinic acid, tryptophane
B. Lysine, ascorbic acid.
C. Threonine, pantothenic acid.
D. Methionine, lipoic acid.
E. Phenylalanine, pangamic acid.

118. In clinical practice tuberculosis is treated with izoniazid preparation - that is an antivitamin able to penetrate into the tuberculosis bacillus. Tuberculostatic effect is induced by the interference with replication processes and oxidation-reduction reactions due to the buildup of pseudo-coenzyme:
A. NAD.
B. FAD.
C. FMN.
D. TDP.
E. CoQ.

119. A newborn child has convulsions that have been observed after prescription of vitamin B6. This most probable cause of this effect is that vitamin B6 is a componet of the following enzyme:

A. Glutamate decarboxylase.
B. Pyruvate dehydrogenase.
C. Ketoglutarate dehydrogenase.
D. Aminolevulinate synthase.
E. Glycogen phosphorylase.

120. A 3-year-old child with symptoms of stomatitis, gingivitis and dermatitis of open skin areas was delivered to a hospital. Examination revealed inherited disturbance of neutral amino acid transporting in the bowels. These symptoms were caused by the deficiency of the following vitamin:
A. Niacin.
B. Pantothenic acid.
C. Vitamin A.
D. Cobalamin.
E. Biotin.

121. Increased breaking of vessels, enamel and dentine destruction in scurvy patients are caused by disorder of collagen maturing. What stage of modification of procollagen is disordered in this avitaminosis?
A. Hydroxylation of proline.
B. Formation of polypeptide chains.
C. Glycosylation of hydroxylysine residues.
D. Removal of C-ended peptide from procollagen.
E. Detaching of N-ended peptide.

122. Vitamin B1 deficiency results in disturbance of oxidative decarboxylation of α-ketoglutaric acid. This will disturb synthesis of the following coenzyme:
A. Thiamine pyrophosphate.
B. Nicotinamide adenine dinucleotide (NAD).
C. Flavine adenine dinucleotide (FAD).
D. Lipoic acid.
E. Coenzyme A.

123. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?
A. Gastromucoprotein.
B. Gastrin.
C. Hydrochloric acid.
D. Pepsin.
E. Folic acid.

124. Izoniazid preparation is used in clinical practice to treat tuberculosis. Tuberculostatic effect is induced by the interference with replication processes and oxidation-reduction reactions due to the buildup of pseudo-coenzyme:
A. NAD.
B. TMP.
C. FMN.
D. THF.
E. CoQ.

125. While examining the child the doctor revealed symmetric cheeks roughness, diarrhea, disfunction of the nervous system. Lack of what food components caused it?
A. Nicotinic acid, tryptophane.
B. Lysine, ascorbic acid.
C. Threonine, pantothenic acid.
D. Methionine, lipoic acid.
E. Phenylalanine, pangamic acid.

126. Vitamin B1 deficiency results in disturbance of oxidative decarboxylation of α-ketoglutaric acid. This will disturb synthesis of the following coenzyme:
A. TPP.
B. (NAD).
C. (FAD).
D. THF.
E. CoA.

127. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemi What factor is necessary for absorption of this vitamin?
A. Gastromucoprotein.
B. Gastrin.
C. Hydrochloric acid.
D. Pepsin.
E. Folic acid.

128. Most participants of Magellan expedition to America died from avitominosis. This disease declared itself by general weakness, subcutaneous hemmorhages, falling of teeth, gingival hemmorhages. What is the name of this avitiminosis?
A. Scurvy.
B. Pellagra.
C. Rachitis.
D. Polyneuritis (beriberi).
E. Biermer's anemia.

129. A 3-year-old child with symptoms of stomatitis, gingivitis and dermatitis of open skin areas was delivered to a hospital. Examination revealed inherited disturbance of neutral amino acid transporting in the bowels. These symptoms were caused by the deficiency of the following vitamin:
A. Niacin.
B. Cobalamin.
C. Vitamin A.
D. Biotin.
E. Pantothenic acid.

130. A clinic observes a 49-year-old patient with significant prolongation of coagulation time, gastrointestinal haemorrhages, subcutaneous hematomas. These symptoms might be explained by the deficiency of the following vitamin:
A. K.
B. H.
C. B6.
D. B1.
E. E

131. Blood test of a patient suffering from atrophic gastritis gave the following results: RBCs - 2,0*1012/l, Hb- 87 g/l, colour index - 1,3, WBCs - 4,0*109/l, thrombocytes – 180*109/l. Anaemia migh have been caused by the following substance deficiency:
A. Vitamin B12.

B. Vitamin K.
C. Zinc.
D. Vitamin A.
E. Iron.

132. Increased breaking of vessels, enamel and dentine destruction in scurvy patients are caused by disorder of collagen maturing. What stage of modification of procollagen is disordered in this avitaminosis?
A. Hydroxylation of proline.
B. Formation of polypeptide chains.
C. Glycosylation of hydroxylysine residues.
D. Removal of C-ended peptide from procollagen.
E. Detaching of N-ended peptide.

133. A 9-month-old infant is fed with artificial formulas with unbalanced vitamin B concentration. The infant presents with pellagral dermatitis, convulsions, anaemia. Convulsion development might be caused by the disturbed formation of:
A. GABA.
B. Histamine.
C. Serotonin.
D. DOPA.
E. Dopamine.

134. There is observed inhibited fibrillation in the patients with bile ducts obstruction, bleeding due to low level of absorbtion of some vitamin. What vitamin is in deficit?
A. K.
B. A.
C. D.
D. E.
E. Carotene.

135. Removal of gall bladder of a patient has disturbed processes of Ca absorption through the intestinal wall. What vitamin will stimulate this process?
A. D3.
B. PP.
C. C.
D. B12.
E. K.

136. Vitamin A together with specific cytoreceptors penetrates through the nuclear membranes, induces transcription processes that stimulate growth and differentiation of cells. This biological function is realized by the following form of vitamin A:
A. Trans-retinoic acid.
B. Trans-retinal.
C. Cis-retinal.
D. Retinol.
E. Carotin.

137. In patients with the biliary tract obstruction the blood coagulation is inhibited; the patients have frequent haemorrhages caused by the subnormal assimilation of the following vitamin:
A. K.
B. A.
C. D.
D. E.
E. C.

138. Examination of a man who hadn't been consuming fats but had been getting enough carbohydrates and proteins for a long time revealed dermatitis, poor wound healing, vision impairment. What is the probable cause of metabolic disorder?
A. Lack of linoleic acid, vitamins A, D, E, K.
B. Lack of palmitic acid.
C. Lack of vitamins PP, H.
D. Low caloric value of diet.
E. Lack of oleic acid.

139. To prevent postoperative bleeding a 6 y.o. child was administered vicasol that is a synthetic analogue of vitamin K. Name post-translational changes of blood coagulation factors that will be activated by vicasol:
A. Carboxylation of glutamin acid.
B. Phosphorylation of serine radicals.
C. Partial proteolysis.
D. Polymerization.
E. Glycosylation.

140. As a result of posttranslative modifications some proteins taking part in blood coagulation, particularly prothrombin, become capable of of calcium binding. The following vitamin takes part in this process:
A. K.
B. C.
C. A.
D. B1.
E. B2.

141. Posttranslative modifications of some proteins taking part in blood coagulation, lead to ability of calcium binding. What vitamin takes part in this process:
A. K.
B. C.
C. A.
D. B1.
E. B2.

142. During examination of an 11-month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:
A. Cholecalciferol.
B. Thiamin.
C. Pantothenic acid.
D. Bioflavonoids.
E. Riboflavin.

143. A doctor examined a child and revealed symptoms of rachitis. Development of this deseasewas caused by deficiency of the following compound:
A. 1,25 [OH]-dichydroxycholecalciferol.
B. Biotin.
C. Tocopherol.
D. Naphtaquinone.
E. Retinol.

144. A patient who was previously ill with mastectomy as a result of breast cancer was prescribed

radiation therapy. What vitamin preparation has marked radioprotective action caused by antioxidant activity?
A. Tocopherol acetate.
B. Thiamine chloride.
C. Ergocalciferol.
D. Folic acid.
E. Riboflavin.

145. A patient suffers from vision impairment - hemeralopy (night blindness). What vitamin preparation should be administered the patient in order to restore his vision?
A. Retinol acetate.
B. Pyridoxine.
C. Thiamine chloride.
D. Vicasol.
E. Tocopherol acetate.

146. A patient underwent an operation on account of gall bladder excision that resulted in obstruction of Ca absorption through the bowels wall. What vitamin wil stimulate this process?
A. D3.
B. B12.
C. K.
D. PP.
E. C.

147. A 64-year-old woman has impairment of twilight vision (hemeralopy). What vitamin should be recommended in the first place?
A. Vitamin A.
B. Vitamin E.
C. Vitamin C.
D. Vitamin B6.
E. Vitamin B2.

148. The obstruction of Ca absorption through the bowels wall resulted after the operation on account of gall bladder. What vitamin wil stimulate this process?
A. Cholecalciferol.
B. Cobalamine.
C. Niacine.
D. Folic acid.
E. Riboflavine.

149. A 2-year-old child has got intestinal dysbacteriosis, which resulted in hemorrhagic syndrome. What is the most likely cause of hemorrhage of the child?
A. Vitamin K deficiency
B. Fibrinogen deficiency
C. Hypocalcemia
D. Activation of tissue thromboplastin
E. PP hypovitaminosis

150. To the patient with hypoplasia of dental solid tissue the dentist has appointed vitamins A and D by oral introduction. On what tactics of treatment is based?
A. These vitamins adjust an exchange a dental heteropolysaccharide and promote adjournment of calcium salt
B. These vitamins promote transformation of procollagen into collagen
C. These vitamins activate a power exchange in fabrics of a tooth
D. Promote replacement of strontic apatite by hydroxyapatite
E. –

151. The child has the delay of eruptions and wrong position of teeth. He has complaints about dryness in a mouth, occurrence of cracks in corners of a mouth with the subsequent suppuration. To what lack of vitamin it can be?
A. A
B. D
C. E
D. C
E. K

152. A girl of 10 years old frequently is ill with respiratory infections after which plural hemorrhages in places of friction of clothes are observed. Which hypovitaminosis takes place at the girl?
A. C
B. B6
C. B1
D. A
E. B2

153. At the woman of 35 years with chronic disease of kidneys the osteoporosis has developed. Specify what deficiency from below listed substances is a principal cause of this complication.
A. 1.25 (OH) 2 D3
B. 25 OH D3
C. D3
D. D2
E. Cholesterol

154. Pediatrist has examined the baby after an epileptiform fit, which receives artificial feeding. The baby has dermatitis also. At laboratory inspection decrease alanine-and aspartate aminotransferase activity of erythrocytes is established. What vitamin deficiency can be assumed?
A. Pyridoxine
B. Ascorbic acid
C. Cobalamin
D. Riboflavin
E. Calciferol

155. To the pregnant woman, which had in the anamnesis some stillborn foetus, the therapy is prescripted which contains vitamins. Indicate vitamin, which promotes carrying of a pregnancy.
A. Alfa-tocopherol.
B. Folic acid.
C. Cyanocobalamin
D. Pyridoxal phosphate
E. Rutin.

156. Patients complained of the general weakness and a bleeding from gum. What insufficiency of vitamin can be assumed?
A. Vitamin C
B. Vitamin E

C. Vitamin PP
D. Vitamin D
E. Vitamin B1

157. At inspection of the patient dermatitis, diarrhea, dementia is revealed. Specify, what absence of vitamin is the reason of this condition.
A. Nicotinamide.
B. Ascorbic acid.
C. Folic acid.
D. Biotin.
E. Rutin.

158. The patient has pellagra. At interrogation it became known, that for a long time he ate mainly corn, not enough using meat. What became the reason of pellagra?
A. Deficiency of tryptophan in corn
B. Deficiency of tyrosine in corn.
C. Deficiency of proline in corn
D. Deficiency of alanine in corn
E. Deficiency of histidine in corn

159. During home nursing the doctor has revealed at the child a symmetric roughness of cheeks, diarrhea, infringement of nervous activity. What lack of food factors is the reason of such condition?
A. Nicotinic acid, tryptophan
B. Lysine, ascorbic acid.
C. Threonine, pantothenic acid
D. Methionine, lipoic acid
E. Phenylalanine, pangamic acid.
E. Cysteine, folic acid

160. At the patient after removal of a gall-bladder process of Ca intestinal absorption through a wall of intestines is complicated. What vitamin will stimulate this process?
A. Vitamin D3
B. Vitamin PP
C. Vitamin C
D. Vitamin B12
E. Vitamin K

161. Institute of gerentology advises to people of old age to use a complex of vitamins which contains vitamin E. What main function it carries out?
A. Antioxidant.
B. Antihemorrhagic.
C. Antiscorbutic.
D. Antineuritis.
E. Antidermatitis.

162. Doctor - dietician advises the patient during treatment of the pernicious anemia to use in a diet a half-baked liver. What presence of vitamin in this product promotes treatment of an anemia?
A. Vitamin B12.
B. Vitamin B1
C. Vitamin B2.
D. Vitamin C
E. Vitamin H.

163. Vitamin A in a complex with specific cytoreceptors will penetrate through nuclear membranes, induces processes of a transcription, stimulates growth and a differentiation of cells. This biological function is realized by the following form of vitamin A:
A. Trans retinoic acid
B. Trans retinal
C. Cys retinal
D. Retinol
E. Carotin

164. At the patient such changes are marked: infringement of sight in twilight, dryness of the conjunctiva and a cornea. Such infringements can be at shortage of:
A. Vitamin A
B. Vitamin B
C. Vitamin C
D. Vitamin D
E. Vitamin B12

165. After removal 2/3 of the stomach the amount of erythrocytes has decreased in blood, the level of hemoglobin has decreased. What deficiency of vitamin leads to such changes of a picture of blood?
A. B12
B. C
C. P
D. B6
E. PP

166. To patient with recurrent thromboembolism, artificial anticoagulant pelentan is appointed. What vitamin antagonist is it?
A. Vitamin K
B. Vitamin E
C. Vitamin A
D. Vitamin D
E. Vitamin C

167. At the patient of 43 years with chronic atrophic gastritis, megaloblastic anemia observes. Urinalysis shows increasing of methylmalonic acid. What hypovitaminosis occurrence of the specified infringement caused?
A. Vitamin B12
B. Vitamin B2
C. Vitamin B3
D. Vitamin B5
E. Vitamin B1

168. For diagnostics of some diseases activity of the transaminases in the blood is defined. What vitamin is a cofactor part of these enzymes?
A. B6
B. B2
C. B1
D. B8
E. B5

169. A patient has enamel erosion. What vitamin should be administered for its treatment? A. D3
B. B1
C. PP
D. C
E. K

170. Ionizing radiation or vitamin E deficiency may increase the permeability of lysosome membranes. What consequences may arise from this pathology?
A. Partial or complete cell disintegration
B. Intensive protein synthesis
C. Intense energy synthesis
D. Restoration of the cytoplasmic membrane
E. Formation of cleavage spindle

171. Certain infections caused by bacteria are treated with sulphanilamides that block the synthesis of bacterial growth factor. What is the mechanism of these drugs action?
A. They are antivitamins of p-aminobenzoic acid.
B. They inhibit the folic acid absorption
C. They are allosteric enzyme inhibitors
D. They are involved in redox processes
E. They are allosteric enzymes

172. Hepatic disfunctions accompanied by insufficient inflow of bile to the bowels result in coagulation failure. This phenomenon can be explained by:
A. Vitamin K deficiency.
B. Iron deficiency
C. Thrombocytopenia
D. Erythropenia
E. Leukopenia

173. A patient has increased permeability of blood-vessel walls, increased gingival hemorrhage, small punctate hematomas on his skin, falling of teeth. What disturbance of vitamun metabolism can account for these symptoms?
A. Hypovitaminosis C.
B. Hypervitaminosis D
C. Hypervitaminosis C
D. Hypovitaminosis D
E. Hypovitaminosis A

174. A patient has the folowing changes: disorder of twilight vision, drying out of conjunctiva and cornea. Such disorders may be caused by deficiency of vitamin:
A. Vitamin A.
B. Vitamin B
C. Vitamin C
D. Vitamin D
E. Vitamin B12

175. A 2-year-old child suffers from intestinal dysbacteriosis that lead to the development hemorrhagic syndrome. The most probable cause of hemorrhage is:
A. Vitamin K deficiency.
B. Activation of tissue thromboplastin
C. Hypovitaminosis PP
D. Fibrinogen deficiency
E. Hypocalcemia

176. In patients with the biliary tract obstruction the blood coagulation is inhibited; the patients have frequent haemorrhages caused by the subnormal assimilation of the following vitamin:
A. K.
B. A
C. D
D. E
E. C

177. A 36-year-old female patient has a history of B2-hypovitaminosis. The most likely cause of specific symptoms (epithelial, mucosal, cutaneous, corneal lesions) is the deficiency of:
A. Flavin coenzymes
B. Cytochrome A1
C. Cytochrome oxidase
D. Cytochrome B
E. Cytochrome C

178. In case of enterobiasis acrihine - the structural analogue of vitamin B2 - is administered. The synthesis disorder of which enzymes does this medicine cause in microorganisms?
A. FAD-dependent dehydrogenases
B. Cytochromeoxidases
C. Peptidases
D. NAD-dependet dehydrogenases
E. Aminotransferases

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

180. Examination of a patient with frequent haemorrhages from the internal organs and mucous membranes revealed proline and lysine within the collagen fibers. Disorder of their hydroxylation is caused by lack of the following vitamin:
A. Vitamin C
B. Vitamin K
C. Vitamin A
D. Vitamin B1
E. Vitamin E

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

182. A 4-year-old child with hereditary renal lesion has signs of rickets; vitamin D concentration in blood is normal. What is the most probable cause of rickets development?
A. Impaired synthesis of calcitriol
B. Increased excretion of calcium
C. Hyperfunction of parathyroid glands
D. Hypofunction of parathyroid glands
E. Lack of calcium in food

183. Coenzym A participates in numerous important metabolic reactions. It is a derivative of the following vitamin:
A. Pantothenic acid
B. Thiamine
C. Niacin
D. Calciferol
E. Ubiquinone

184. A 3-year-old child with symptoms of stomatitis, gingivitis and dermatitis of open skin areas was delivered to a hospital. Examination revealed inherited disturbance of neutral amino acid transporting in the bowels. These symptoms were caused by the deficiency of the following vitamin:
A. Niacin
B. Pantothenic acid
C. Vitamin A
D. Cobalamin
E. Biotin

186. A doctor examined a child and revealed symptoms of rickets. Development of this desease was caused by deficiency of the following compound:
A. 1,25 [OH]-dichydroxycholecalciferol
B. Biotin
C. Tocopherol
D. Naphtaquinone
E. Retinol

187. A patient, who has been suffering for a long time from intestine disbacteriosis, has increased hemorrhaging caused by disruption of posttranslational modification of blood-coagulation factors II, VII, IX, and X in the liver. What vitamin deficiency is the cause of this condition?
A. K
B. B12
C. B9
D. C
E. P

188. A doctor recommends a patient with duodenal ulcer to drink cabbage and potato juice after the therapy course. Which substances contained in these vegetables help to heal and prevent the ulcers?
A. Vitamin U
B. Pantothenic acid
C. Vitamin C
D. Vitamin B1
E. Vitamin K

189. A 64-year-old woman has impairment of twilight vision (hemeralopy). What vitamin should be recommended in the first place?
A. A
B. B2
C. E
D. C
E. B6

190. Vitamin A together with specific cytoreceptors penetrates through the nuclear membranes, induces transcription processes that stimulate growth and differentiation of cells. This biological function is realized by the following form of vitamin A:
A. Trans-retinoic acid
B. Trans-retinal
C. Cis-retinal
D. Retinol
E. Carotin

191. Increased fragility of vessels, enamel and dentine destruction resulting from scurvy are caused by disorder of collagen maturation. What stage of procollagen modification is disturbed under this avitaminosis?
A. Hydroxylation of proline
B. Formation of polypeptide chains
C. Glycosylation of hydroxylysine residues
D. Removal of C-ended peptide from procollagen
E. Detaching of N-ended peptide

192. Blood test of a patient suffering from atrophic gastritis gave the following results: RBCs - 2, 0 1012/l, Hb- 87 g/l, colour index - 1,3, WBCs - 4,0 109/l, thrombocytes - 180 109/l. Anaemia might have been caused by the following substance deficiency:
A. Vitamin B12
B. Vitamin A
C. Vitamin K
D. Iron
E. Zinc

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

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

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

196. As a result of posttranslative modifications some proteins taking part in blood coagulation, particularly prothrombin, become capable of calcium binding. The following vitamin takes part in this process:
A. K
B. C
C. A
D. B1

E. B2

197. A patient diagnosed with focal tuberculosis of the upper lobe of the right lung had been taking isoniazid as a part of combination therapy. After some time, the patient reported of muscle weakness, decreased skin sensitivity, blurred vision, impaired motor coordination. Which vitamin preparation should be used to address these phenomena?
A. Vitamin B6
B. B. Vitamin A
C. Vitamin D
D. Vitamin B12
E. Vitamin C

198. Examination of a child who hasn't got fresh fruit and vegetables during winter revealed numerous subcutaneous hemorrhages, gingivitis, carious cavities in teeth. What vitamin combination should be prescribed in this case?
A. Ascorbic acid and rutin
B. Thiamine and pyridoxine
C. Folic acid and cobalamin
D. Riboflavin and nicotinamide
E. Calciferol and ascorbic acid

199. A 10-year-old girl has a history of repeated acute respiratory viral infection. After recovering she presents with multiple petechial hemorrhages on the sites of friction from clothing rubbing the skin. What kind of hypovitaminosis has this girl?
A. C
B. B6
C. B1
D. A
E. B2

200. During examination of an 11- month-old infant a pediatrician revealed osteoectasia of the lower extremities and delayed mineralization of cranial bones. Such pathology is usually provoked by the deficit of the following vitamin:
A. Cholecalciferol
B. Thiamin
C. Pantothenic acid
D. Bioflavonoids
E. Riboflavin

201. In clinical practice tuberculosis is treated with izoniazid preparation - that is an antivitamin able to penetrate into the tuberculosis bacillus. Tuberculostatic effect is induced by the interference with replication processes and oxidation-reduction reactions due to the buildup of pseudo-coenzyme:
A. NAD
B. FAD
C. FMN
D. TDP
E. CoQ

202. A pregnant woman with several miscarriages in anamnesis is prescribed a therapy that includes vitamin preparations. What vitamin facilitates carrying of a pregnancy?
A. Alpha-tocopherol
B. Folic acid
C. Cyanocobalamin
D. Pyridoxal phosphate
E. Rutin

203. A patient suffers from vision impairment - hemeralopy (night blindness). What vitamin preparation should be administered the patient in order to restore his vision?
A. Retinol acetate
B. Vicasol
C. Pyridoxine
D. Thiamine chloride
E. Tocopherol acetate

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

205. A 56-year-old patient came to a hospital with complaints about general weakness, tongue pain and burning, sensation of limb numbness. In the past he underwent resection of forestomach. In blood: Hb- 80 g/l; erythrocytes - 2, 0 1012 /l; colour index - 1,2, leukocytes - 3, 5 109/l. What anemia type is it?
A. B12-folate deficient
B. Hemolytic
C. Posthemorrhagic
D. Aplastic
E. Iron-deficient

206. A 9 m.o. child has delayed dentition, it is also out of order. Upper jaw configuration is horizontal ("high"palate); microscopically - irregular mineralization of tooth enamel, wrinkled enamel prisms, some of them are vacuolized. Predentin zone is extended; there are solitary denticles. What disease is it?
A. Early rickets
B. Late rickets
C. Osteomalacia
D. Gout
E. Hypervitaminosis D

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

208. A patient is diagnosed with chronic atrophic gastritis attended by deficiency of Castle's intrinsic factor. What type of anemia does the patient have?
A. B12 -deficiency anemia
B. Iron refractory anemia

C. Hemolytic anemia
D. Iron-deficiency anemia
E. Protein-deficiency anemia

209. A number of diseases, in particular myocardial infarction and liver cirrhosis, can be diagnosed by evaluating activity of blood transaminases. What vitamin is one of cofactors of these enzymes?
A. B6
B. B2
C. B1
D. B8
E. B5

210. 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

211. Hydroxylation of substrates plays important role in the processes of detoxification of xenobiotics. But the reactions of of detoxification of xenobiotics requires a donor of protons. Which of the following vitamins can play this role?
A. Vitamin C
B. Vitamin P
C. Vitamin B6
D. Vitamin E
E. Vitamin A

212. A patient underwent radiation therapy because of Hodgkin's lymphoma. One of the side effecs of radiation therapy was ulceration of oral cavity. In order to accelerate healing of a radiation ulcer a vitamin drug was administered. What drug is it?
A. Retinol acetate
B. Retabolil
C. Prednisolone
D. Levamisole
E. Methyluracil

213. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?
A. Gastromucoprotein
B. Gastrin
C. Hydrochloric acid
D. Pepsin
E. Folic acid

214. According to clinical indications a patient was administered pyridoxal phosphate. What processes is this medication intended to correct?
A. Transamination and decarboxylation of aminoacids
B. Oxidative decarboxylation of ketonic acids
C. Desamination of purine nucleotide
D. Synthesis of purine and pyrimidine bases
E. Protein synthesis

215. A 64-year-old homeless malnourished woman has impairment of twilight vision (hemeralopy). What vitamin should be recommended for the correction of this condition?
A. Vitamin A
B. Vitamin B2
C. Vitamin E
D. Vitamin C
E. Vitamin B6

216. Vitamin B1 deficiency causes disturbance of oxidative decarboxylation of α-ketoglutaric acid. This leads to the impaired synthesis of the following coenzyme:
A. Thiamine pyrophosphate
B. Nicotinamide adenine dinucleotide
C. Flavine adenine dinucleotide
D. Lipoic acid
E. Coenzyme A

217. In patients with the biliary tract obstruction the blood coagulation is inhibited; the patients have frequent haemorrhages caused by the subnormal assimilation of the following vitamin:
A. K
B. A
C. D
D. E
E. C

218. A 20-year-old male patient complains of general weakness, rapid fatigability, irritability, decreased performance, bleeding gums, petechiae on the skin. What vitamin deficiency may be a cause of these changes?
A. Ascorbic acid
B. Riboflavin
C. Thiamine
D. Retinol
E. Folic acid

219. A patient who was only on a plant diet for a long time and avoided oils and fats developed the signs of the skin damage, hair loss, delayed wound healing, thrombocytopenia, low resistance to infections because of the deficiency of vitamin F (linoleic and linolenic acids in the body). These changes are most likely to be caused by the impaired synthesis of the following substances:
A. Eicosanoids
B. Interleukins
C. Interferons
D. Catecholamines
E. Corticosteroids

220. It has been found out that one of the components of insecticides, used in protection of agrocultures from insects, include sodium arsenate that blocks lipoic acid. Which enzyme activity is impaired by this pesticide?
A. Pyruvate dehydrogenase complex
B. Microsomal oxidation
C. Methemoglobin reductase
D. Glutathione peroxidase
E. Glutathione reductase

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

222. During regular check-up a child is detected with interrupted mineralization of the bones, caries, curvature of limbs, deformation of chest. What vitamin deficiency can be the cause?
A. Calciferol
B. Riboflavin
C. Tocopherol
D. Folic acid
E. Cobalamin

223. A woman who has been keepi- ng to a clean-rice diet for a long time was diagnosed with polyneuritis (beri- beri). What vitamin deficit results in development of this disease?
A. Thiamine
B. Ascorbic acid
C. Pyridoxine
D. Folic acid
E. Riboflavin

224. Removal of gall bladder of a patient has disturbed processes of Ca absorption through the intestinal wall. What vitamin will stimulate this process?
A. D3
B. PP
C. C
D. B12
E. K

225. 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

226. A patient underwent an operation on account of gall bladder excision that resulted in obstruction of Ca absorption through the bowels wall. What vitamin wil stimulate this process?
A. D3
B. PP
C. C
D. B12
E. K

227. Examination of a man who hadn't been consuming fats but had been getting enough carbohydrates and proteins for a long time revealed dermatitis, poor wound healing, vision impairment. What is the probable cause of metabolic disorder? A. Lack of linoleic acid, vitamins A, D, E, K
B. Lack of palmitic acid
C. Lack of vitamins PP, H
D. Low caloric value of diet
E. Lack of oleic acid

228. Most participants of Magellan expedition to America died from avitominosis. This disease declared itself by general weakness, subcutaneous hemmorhages, falling of teeth, gingival hemmorhages. What is the name of this avitiminosis?
A. Scurvy
B. Pellagra
C. Rachitis
D. Polyneuritis (beriberi)
E. Biermer's anemia

229. A patient who was previously ill with mastectomy as a result of breast cancer was prescribed radiation therapy. What vitamin preparation has marked radioprotective action caused by antioxidant activity?
A. Tocopherol acetate
B. Ergocalciferol
C. Thiamine chloride
D. Riboflavin
E. Folic acid

230. A clinic observes a 49-year-old patient with significant prolongation of coagulation time, gastrointestinal haemorrhages, subcutaneous hematomas. These symptoms might be explained by the deficiency of the following vitamin:
A. K
B. B1
C. B6
D. H
E. E

231. A consiousnessless patient, found in the street, was brought to hospital to the emergency department. When he came to consciousness he said that he was homeless. The man looks like alcoholic and does not deny alcohol consumption. His body mass index is decreased and he does not care what he eats. Bruises and small petechiae are revealed on his body as well as bleeding of gums. This disorder is caused by:
A. Impaired hydroxylation of proline and lysine in endoplasmatic reticulum
B. Impaired glycosylation of proline and lysine in nucleus
C. Impaired glycosylation of proline and isoleucine in Golgi apparatus
D. Impaired glycosylation of proline and isoleucine in ribosomes
E. Impaired hydroxylation of proline and lysine in cytoplasm

232. A 60-year-old man is in psychiatric clinic undergoing therapy for alcoholism. The vitamin defficient in this patient is the cofactor for the following enzyme:
A. Alfaketoglutarate dehydrogenase
B. Delta-aminolevulinate synthase
C. Dopamine hydroxylase
D. Homocysteinmethyltransferase
E. Pyruvate carboxylase

Nutrition and digestion

1. A woman has been limiting the amount of products in her diet to lose some weight. 3 months later she developed edemas and her diuresis increased. What dietary component deficiency is the cause of this?
A. Proteins
B. Fats
C. Carbohydrates
D. Vitamins
E. Minerals

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

3. One of the causes of pernicious anemia is disturbed synthesis of transcorrin Castle's intrinsic factor-by the parietal cells of the stomach. What substance is called Castle's extrinsic factor?
A. Cobalamin
B. Folic acid
C. Pyridoxine
D. Riboflavin
E. Biotin

4. A patient has developed systemic (megaloblastic) anemia despite eating a balanced diet. The day before he underwent a gastric surgical resection. The anemia in this patient is caused by the deficiency of:
A. Castle factor
B. Vitamin C
C. Vitamin PP
D. Protein
E. Folic acid

5. 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

6. A 35-year-old man with peptic ulcer disease has undergone antrectomy. After the surgery secretion of the following gastrointestinal hormone will be disrupted the most:
A. Gastrin
B. Histamine
C. Secretin
D. Cholecystokinin
E. Neurotensin

7. Name the drug that inhibits excretory function of pancreas during treatment of acute pancreatitis:
A. Contrykal (Aprotinin)
B. Allochol
C. Panzynorm
D. Pancreatin (Mezym forte)
E. Festal

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

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

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

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

12. To prevent attacks of acute pancreatitis a doctor prescribed the patient trasylol (contrycal, gordox), which is an inhibitor of:
A. Trypsin
B. Elastase
C. Carboxypeptidase
D. Chymotrypsin
E. Gastricsin

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

14. A 30-year-old woman has subnormal concentration of enzymes in the pancreatic juice. This might be caused by the hyposecretion of the following gastrointestinal hormone:
A. Cholecystokinin-pancreozymin
B. Somatostatin
C. Secretin
D. Gastro-inhibiting peptide
E. Vaso-intestinal peptide

15. 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

16. A 30-year-old male patient with acute pancreatitis has been found to have a disorder of cavitary protein digestion. The reason for such condition can be the hyposynthesis and hyposecretion of the following enzyme:
A. Tripsin
B. Pepsin
C. Lipase
D. Dipeptidase
E. Amylase

17. A coprological survey revealed lightcolored feces containing drops of neutral fat. The most likely reason for this condition is the disorder of:
A. Bile inflow into the bowel
B. Gastric juice acidity
C. Pancreatic juice secretion
D. Intestinal juice secretion
E. Intestinal absorption

18. A newborn develops dyspepsia after the milk feeding. When the milk is substituted by the glucose solution the dyspepsia symptoms disappear. The newborn has the subnormal activity of the following enzyme:
A. Lactase
B. Invertase
C. Maltase
D. Amylase
E. Isomaltase

19. A patient complains of frequent diarrheas, especially after consumption of rich food, weight loss. Laboratory examination revealed steatorrhea; his feces were hypocholic. What might have caused such condition?
A. Obturation of biliary tracts
B. Inflammation of mucous membrane of small intestine
C. Lack of pancreatic lipase
D. Lack of pancreatic phospholipase
E. Unbalanced diet

20. A newborn child suffers from milk curdling in stomach, this means that soluble milk proteins (caseins) transform to insoluble proteins (paracaseins) by means of calcium ions and a certain enzyme. What enzyme takes part in this process?
A. Renin
B. Pepsin
C. Gastrin
D. Secretin
E. Lipase

21. A patient consumed a lot of reach in proteins food that caused increase of rate of proteolytic enzymes of pancreatic juice. It is also accompanied by increase of rate of the following enzyme:
A. Tripsin
B. Pepsin
C. Enterokinase
D. Gastricsin
E. Renin

22. Examination of a patient suffering from chronic hepatitis revealed a significant decrease in the synthesis and secretion of bile acids. What process will be mainly disturbed in the patient's bowels?
A. Fat emulsification
B. Protein digestion
C. Carbohydrate digestion
D. Glycerin absorption
E. Amino acid absorption

23. After consumption of rich food a patient has nausea and heartburn, steatorrhea. This condition might be caused by:
A. Bile acid deficiency
B. Increased lipase secretion
C. Disturbed tripsin synthesis
D. Amylase deficiency
E. Disturbed phospholipase synthesis

24. Surgical removalof a part of stomach resulted in disturbed absorption of vitamin B12, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?
A. Gastromucoprotein
B. Gastrin
C. Hydrochloric acid
D. Pepsin
E. Folic acid

25. Examination of a 35-year-old patient revealed high acidity of gastric juice. What receptors should be blocked in order to reduce it?
A. Histamine
B. α1-adrenoreceptors
C. α2-adrenoreceptors
D. β1-adrenoreceptors
E. β2-adrenoreceptors

26. After intake of rich food a patient feels nausea and sluggishness; with time there appeared signs of steatorrhea. Blood cholesterine concentration is 9,2 micromole/l. This condition was caused by lack of:
A. Bile acids
B. Triglycerides
C. Fatty acids
D. Phospholipids
E. Chylomicrons

27. A patient has a disturbed absorbtion of fat hydrolysates. It might have been caused by a deficit in the small intestine cavity:
A. Of bile acids
B. Of bile pigments
C. Of lipolytic enzymes
D. Of sodium ions
E. Of liposoluble vitamins

28. Secretion of what gastrointestinal hormones will be primarily decreased as a result of iduodenum removal?
A. Cholecystokinin and secretin
B. Gastrin
C. Histamine
D. Gastrin and histamine
E. Neurotensin

29. A patient with encephalopathy was admitted to the neurological inpatient department. There was revealed a correlation between increasing of encephalopathy and substances absorbed by the bloodstream from the intestines. What substances that are formed in the intestines can cause endotoxemia?
A. Indole
B. Butyrate
C. Acetacetate
D. Biotin
E. Ornithine

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

31. A patient with hypersecretion of the gastric juices was recomended to exclude concentrated bouillons and vegetable decoctions from the diet because of their stimulation of gastric secretion. What is dominating mechanism of stimulation of secretion in this case?
A. Stimulation of gastrin production by G-cells
B. Irritation of taste receptor
C. Irritation of mechanoreceptors of the oral cavity
D. Irritation of mechanoreceptors of the stomach
E. Stimulation of excretion of secretin in the duodenum

32. Indican excretion is a diagnostic criterion of intencified protein putrefaction in the intestine. Name the end product of tryptophan" decay" occurring in the large intestine:
A. Indole
B. Hydrogen sulfide
C. Putrescine
D. Benzoic acid
E. Mercaptan

33. A 5-year-old child presents with abdominal distension, abdominal cramps, and diarrhea occurring 1-4 hours after drinking milk. Described symptoms are caused by the lack of enzymes that break up:
A. Lactose
B. Fructose
C. Glucose
D. Maltose
E. Saccharose

34. The end product of starch hydrolysis is:
A. D-glucose
B. D-fructose
C. Saccharose
D. Maltose
E. D-galactose

35. Contrykal is used to prevent pancreatic autolysis. This drug is the inhibitor of the following enzymes:
A. Proteases
B. Lipases
C. Glycosidases
D. Nucleases
E. Synthetases

36. After drinking milk a 1-year-old child developed diarrhea, flatulence. The baby is likely to have de ficiency of the following enzyme:
A. Lactase
B. Maltase
C. Aldolase
D. Hexokinase
E. Glycosidase

37. 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

38. During calculous cholecystitis attack the patient has developed the following symptoms: saponated feces and steatorrhea. What stage of fats metabolism is disrupted according to those symptoms?
A. Fat digestion, absorption and secretion
B. Fat absorption
C. Intermediary metabolism of fats
D. Fats metabolism in adipose tissue
E. Depositing disruption

39. During gastric secretory function research decrease of hydrochloric acid concentration in gastric juice was detected. What enzyme will be less active in such a condition?
A. Pepsin
B. Amylase
C. Lipase
D. Dipeptidase
E. Hexokinase

40. The 55-year-old female patient has developed a case of acute pancreatitis caused by greasy food. What is the main pathogenesis step of this disorder?
A. Premature activation af enzymes in gland ducts and cells
B. Pancreatic juice deficiency
C. Low bile production in liver
D. Fats digestion disruption
E. Acute bowel obstruction

41. A 42-year-old woman, who has been keeping to a vegetarian diet for a long period of time, consulted a doctor. Examination revealed negative nitrogen balance in the patient. What factor is the most likely cause of such a condition?
A. Insufficient amount of proteins in the diet
B. Insufficient amount of dietary fiber
C. Excessive amount of fats in the diet
D. Insufficient amount of fats in the diet
E. Decreased rate of metabolic processes

42. Protein digestion in the stomach is carried out by pepsin secreted in form of an inactive pepsinogen. Pepsinogen is converted to pepsin by the removal of the N-terminal peptide that is provoked by:
A. Perchloric acid
B. Sulfuric acid

C. Acetic acid
D. Bile acids
E. Amino acids

43. Digestion of proteins in the digestive tract is a complex process of their hydrolysis till peptides and free amino acids. What enzymes decompose proteins in the duodenum?
A. Trypsin, chemotrypsin
B. Enterokinase, lipase
C. Amylase, maltase
D. Pepsin, gastricsin
E. Lipase, phospholipase

44. A patient has undergone surgical removal of the pylorus. Decreased secretion of the following hormone can be expected:
A. Gastrin
B. Histamine
C. Secretin
D. Cholecystokinin
E. Gastric inhibitory polypeptide

45. An experimental animal, a dog, received a weak solution of hydrochloric acid through a tube inserted into the duodenum. Primarily it will result in increased secretion of the following hormone:
A. Secretin
B. Gastrin
C. Histamine
D. Cholecystokinin
E. Neurotensin

46. During experiment the processes of food and water hydrolysis products absorption were studied. It was determined that these processes mainly occur in the following gastrointestinal segment:
A. Small intestine
B. Stomach
C. Large intestine
D. Rectum
E. Oral cavity

47. 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. Chylomicrons
B. LDL
C. HDL
D. Cholesterol
E. Phospholipids

48. Note substance, which activates pepsinogen to pepsin:
A. Hydrochloric acid
B. Enterokinase
C. Trypsin
D. Bile acids
E. Adenosine triphosphate

49. Chose the enzyme which plays an important role in production of hydrochloric acid by parietal cells of gastric mucosa glands:
A. Carbonic anhydrase
B. Catalase
C. Pyruvate dehydrogenase
D. Cytochrome oxidase
E. Peroxidase

50. Zymogens of proteolytic enzymes are activated by the next process:
A. Limited proteolysis
B. Hydroxylation of lysine
C. Carboxylation of glutamic acid
D. Decarboxylacion of aspartic acid side chain
E. Phosphorylation of serine residues in protein molecule

Situational Tasks:

1. The patient went to the doctor with complaints of increased bleeding (especially gums), the appearance of "petechiae" on the skin and mucous membranes, loosening and loss of teeth. During the survey it was found that the patient consumed little plant food for a long time.
a) What pathology occurs in the patient?
b) Deficiency of which vitamins is the cause of this avitaminosis.
c) Indicate the reasons for the development of symptoms in the patient.

2. The patient after removal of 2/3 of the stomach in the blood decreased the number of erythrocytes, increased their volume, changed the shape of cells, decreased hemoglobin. Addison-Birmer malignant anemia was diagnosed on the basis of clinical and biochemical examination.
a) What vitamin deficiency does the patient have?
b) Indicate the cause of deficiency of this vitamin?
c) Justify the mechanism of anemia?

3. A patient with alcoholism has disorders of the nervous and cardiovascular systems, psychosis, memory loss, high levels of pyruvate and lactate in the blood

a) Specify the name of the pathological condition.
b) What vitamin deficiency does the patient have?
c) Explain the mechanism of development of symptoms in the patient.

4. At the patient of 37 years against long use of antibiotics the increased bleeding at small damages, the reduced activity of coagulation factors II, VII, X, the extended time of blood coagulation is observed.
a) Which vitamin deficiency is caused by these changes?
b) What is the cause of hypovitaminosis?
c) Explain the mechanism of action of this vitamin on blood clotting processes.

5. After examination of the patient revealed dermatitis on symmetrical areas of skin (erythema), intellectual impairment and gastrointestinal disorders.
a) Specify the name of the pathological condition.
b) What vitamin deficiency does the patient have?
c) Name the amino acid that is the source of this vitamin. Give examples of products that are depleted and enriched in this amino acid

6. A patient who has been treated with the anti-TB drug isoniazid for a long time has hypochromic anemia and pellagra-like dermatitis.
a) What vitamin deficiency does the patient have? Indicate the reason for its occurrence.
b) Specify the biochemical mechanism of hypochromic anemia
c) Deficiency of any other vitamin may occur under these conditions.

7. A patient who eats several raw eggs every morning has developed seborrheic dermatitis, hair loss, nail lesions.
a) What vitamin deficiency does the patient have?
b) Name the cause of this avitaminosis.
c) Indicate the role of this vitamin in lipid metabolism.

8. A patient who had been taking sulphonylamides for a long time developed megaloblastic anemia.
a) What vitamin deficiency does the patient have?
b) Name the cause of hypovitaminosis.
c) Specify the mechanism of development of megaloblastic anemia.

9. A 1-year-old child who is exposed to little sunlight has muscle hypotension, skeletal deformities (O-shaped legs, beaded ribs), low calcium and phosphorus levels in the blood, and increased alkaline phosphatase activity.
a) Specify the name of the pathological condition. Which vitamin deficiency does the patient have?
b) Name the cause of hypovitaminosis.
c) Name the target organs through which the effect of this vitamin on phosphorus-calcium metabolism.

10. The child has gemeralopia, xerophthalmia and keratomalacia.
a) What vitamin deficiency does a child have?
b) What form of this vitamin is involved in the act of vision.
c) Specify the mechanism of antiserophthalmic action of this vitamin.

11. Indirect anticoagulants (dicoumarins) disrupt the synthesis of prothrombin and other blood clotting proteins in the liver.
a) Structural analogues of which vitamin are they?
b) The activity of which enzyme is inhibited by dicoumarins?
c) What type of inhibition occurs?

12. 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?

13. 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) Is it advisable to prescribe the patient chenodeoxycholic acid?

14. In order to improve redox processes in clinical practice, patients are prescribed vitamin PP.
a) What coenzyme forms of this vitamin do you know?
b) Specify the energy yield during the oxidation of their reduced forms in mitochondria?
c) Give examples of redox processes in which they participate.

15. In malaria, drugs are prescribed - structural analogues of vitamin B2 (riboflavin).
a) Disorders of the synthesis of which enzymes in Plasmodium cause these drugs?
b) Which coenzymes contain riboflavin?
c) Give the mechanism of their action.

16. The respiratory chain includes a coenzyme (vitamin-like substance), which is not associated with the apoenzyme.
a) Name this coenzyme. What group does he belong to?
b) Explain the mechanism of its action.
c) What other coenzymes are part of the respiratory chain?

17. In the process of metabolism of some amino acids, fatty acids and cholesterol, methylmalonic acid (methyl-malonyl-CoA) is formed, which has a neurotoxic effect.
a) Which coenzyme is involved in its metabolism?
b) Which metabolite of CAC (Krebs cycle) is converted by methylmalonic acid with the participation of this coenzyme?
c) What is the name of the enzyme of which it is a part?

18. In 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?

19. In order to diagnose lesions of the pancreas (acute pancreatitis, pancreatic necrosis) in the serum and urine determine the activity of amylase and trypsin.
a) To which classes do they belong according to the International Classification of Enzymes.
b) What types of chemical bonds break down these enzymes? List the substrates of these enzymes.
c) Which of these enzymes is also produced by the salivary glands?

20. 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?

21. Pepsin hydrolyzes peptide bonds in the process of digestion of proteins in the stomach.
a) To which class of enzymes (according to International Classification of Enzymes it belongs?).
b) What type of chemical bonds breaks down this enzyme? List the substrates of this enzyme.
c) Is pepsin structurally a simple or complex enzyme? What is the pH optimum it has?

22. At the patient with chronic gastritis decrease in activity of pepsin is noted, pH of gastric juice makes 5,0.
a) Name the mechanism of regulation of pepsin activity.
b) For what purpose are such patients prescribed to take a weak solution of hydrochloric acid before meals?
c) What type of specificity is characteristic of this enzyme?

22. In acute pancreatitis is the activation of proteolytic enzymes (trypsin, chymotrypsin) in the cells of the pancreas. To avoid autolysis of the pancreas (self-digestion of its own proteins) in the preclinical stage, complete starvation and cooling of the abdominal wall in the area of the pancreas is recommended.
a) What can explain the need to use these measures?
b) In what units is the activity of trypsin and other enzymes measured
c) Which amino acids are most often part of the active site of these enzymes?

23. After taking sulfonamide drugs, the patient developed bloating and diarrhea due to a violation of the intestinal microflora (dysbacteriosis).
a) What is the mechanism underlying the bactericidal action of sulfonamides?
b) What type of inhibitors are sulfonamides?
c) Which vitamin should be prescribed to the patient?

24. In the treatment of many diseases, the pharmaceutical preparation cocarboxylase (thiamine diphosphate) is used to provide cells with energy.
a) What process is being activated?
b) Specify the energy balance of the reaction?
c) List the components of this complex.

25. In patients with chronic alcoholism observed increase of pyruvate content in blood serum and increase its excretion in the urine due to thiamine deficiency.
a) The activity of what metabolic process is reduced in these patients?
b) Indicate enzymes and coenzymes of the process.
c) Using of which coenzyme enhance the metabolic activity of this pathway?

26. A chemical plant worker with signs of poisoning was hospitalized. An increased concentration of arsenate was found in the woman's hair, and an increased content of pyruvate was found in her blood.
a) Violation of which process caused the arsenate?
b) Which coenzyme is blocked by arsenate?
c) Which multi-enzyme complexes include this coenzyme?

27. 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.

28. 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 consequences of the accumulation of lactate in tumor cells?

29. 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?

30. 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.

31. 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?

32. 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?

33. 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?

34. 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.

35. 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.

36. 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.

37. 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?

38. 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.

39. 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.

40. In 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 III. Biochemistry and pathobiochemistry of blood.

List of the exam questions:

1. Blood as a specialized tissue of the body, its composition. Functions of blood. Blood preparations.
2. Physical and chemical properties of blood. Inorganic components of blood. Imbalance of blood electrolytes (Na, K, Ca).
3. Acid-base balance, its regulation. Buffer blood systems. Acidosis and alkalosis: types, causes, mechanisms of compensation.
4. Blood plasma proteins. Albumins and globulins, their biological role. Hyper-, hypo- and dysproteinemia: causes, clinical symptoms. Paraproteinemia. Acute phase proteins.
5. Blood plasma lipoproteins. Atherosclerosis.
6. Non-protein organic compounds of blood. Residual nitrogen. Azotemia.
7. Blood plasma enzymes. Enzymodiagnostics.
8. Respiratory function of erythrocytes. Hemoglobin (structure, properties). Transport of oxygen and carbon dioxide. Factors affecting the binding of hemoglobin to oxygen. Hemoglobin derivatives.
9. Hemoglobin metabolism, its synthesis. Metabolism of porphyrins.
10. Disorders of hemoglobin metabolism: hemoglobinopathy, thalassemia, porphyria. Metabolism of iron. Iron deficiency anemia.
11. System of hemostasis. Blood coagulation system, factors of blood plasma. Role of vitamin K in blood clotting. Inherited coagulopathies.
12. Anticoagulant and fibrinolytic systems of blood.

Multiple Choice Questions:

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

62 y.o. woman complains of frequent pains in the area of her chest and backbone, rib fractures. A doctor assumed myelomatosis (plasmocytoma). What of the following laboratory characteristics will be of the greatest diagnostic importance?
A) Proteinuria
B) Hypoproteinemia
C) Hypoglobulinemia
D) Hyperalbuminemia
E) Paraproteinemia

A 2-year-old boy began to suffer from respiratory diseases, stomatitis, pustular skin lesions. Even small damages of gums and mucous membranes were complicated by long-lasting inflammation. It was found out that immunoglobulins of all classes were practically absent in his blood. The decrease in the functional activity of a cell population that underlies the described syndrome is observed. Which cell population is affected?
A) Neutrophils
B) NK-lymphocytes
C) T-lymphocytes
D) B-lymphocytes
E) Macrophages

A 28-year-old patient undergoing treatment in a pulmonological department has been diagnosed with pulmonary emphysema caused by splitting of alveolar septum by elastase and trypsin. The disease is caused by the congenital deficiency of the following protein:
A) Alpha-1-proteinase inhibitor
B) Haptoglobin
C) Cryoglobulin

D) Alpha-2-macroglobulin
E) Transferrin

A 34-year-old patient was diagnosed with chronic glomerulonephritis 3 years ago. Edema has developed within the last 6 months. What caused the edema?
A) Liver dysfunction of protein formation
B) Hyperosmolarity of plasma
C) Proteinuria
D) Hyperproduction of vasopressin
E) Hyperaldosteronism

A 4 y.o. child with signs of durative proteinic starvation was admitted to the hospital. The signs were as follows: Growth inhibition, anemia, oedema, mental deficiency. Choose the cause of oedema development:
A) Reduced synthesis of lipoproteins
B) Reduced synthesis of glycoproteins
C) Reduced synthesis of hemoglobin
D) Reduced synthesis of globulins
E) Reduced synthesis of albumins

A 47-year-old patient was brought to an emergency department with the diagnosis of myocardial infarction. What enzyme activity would prevail in the patient's blood serum during the first 3-4 hours after the beginning of this pathological state?
A) LDH1
B) Aspartate amino transferase
C) LDH3
D) Creatine phosphate kinase MM isozyme
E) LDH5

A 49-year-old male patient with acute pancreatitis was likely to develop pancreatic necrosis, while active pancreatic proteases were absorbed into the blood stream and tissue proteins broke up. What protective factors of the body can inhibit these processes?
A) Immunoglobulin
B) Ceruloplasmin, transferrin
C) a2-macroglobulin, a1-antitrypsin
D) Cryoglobulin, interferon
E) Hemopexin, haptoglobin

A 55 y.o. women consulted a doctor about having continuous cyclic uterine hemorrhages for a year, weakness, dizziness. Examination revealed skin pallor. Hemogram: Hb – 70 g/L, erythrocytes-3.2 x 1012/L, color index – 0.6; leukocytes – 6.0 x 109/L, reticulocytes – 1%, erythrocyte hypochromia. What anemia is it?
A) Iron-deficiency anemia
B) B12-folate-deficiency anemia
C) Hemolytic anemia
D) Aplastic anemia
E) Chronic posthemorrhagic anemia

A 63-year-old woman developed symptoms of rheumatoid arthritis. Their increase of which blood values indicators could be most significant in proving the diagnosis?
A) R-glycosidase
B) Acid phosphatase
C) Lipoproteins
D) General cholesterol
E) Additive glycosaminoglycans

A 67-year-old male patient consumes eggs, pork fat, butter, milk and meat. Blood test results: cholesterol – 12.3 mmol/l, total lipids – 8.2 g/l, increased low-density lipoprotein fraction (LDL). What type of hyperlipoproteinemia is observed in the patient?
A) Hyporlipoproteinemia type I.
B) Hyperlipoproteinemia type IV
C) Cholesterol, hyperlipoproteinemia
D) Hyperlipoproteinemia type IIa
E) Hyperlipoproteinemia type IIb

A breastfed child suffers from diarrhea due to improper feeding. One of its main consequences is the excretion of large amounts of sodium bicarbonat~Which form of acid-base disorder is observed in this case?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) No changes in acid-base balance

A child with signs of prolonged protein starvation was hospitalized: growth retardation, anemia, edema, and mental retardation. The reason for the development of edema in this child is a decrease in the synthesis of:
A) Hemoglobin
B) Globulins
C) Albumins
D) Lipoproteins
E) Glycoproteins

A decrease in blood residual (rest) nitrogen level was revealed in a patient with liver insufficiency. The diminished blood non-protein nitrogen was due to:
A) Urea
B) Ammonium
C) Amino acids
D) Bilirubin
E) Uric acid

A female complains of frequent chest and spine pain, fractures of ribs. A doctor suspected myeloma (plasmacytoma). Which of the laboratory parameters mentioned below will be of the greatest diagnostic significance?
A) Hypoproteinemia
B) Hyperalbuminemia
C) Hypoalbuminemia
D) Proteinuria
E) Paraproteinemia

A female patient, a worker of a paint and varnish factory, complains of general weakness, weight loss, apathy, drowsiness. Chronic lead intoxication was confirmed by laboratory methods: hypochromic anemia was reveale~Blood protoporphyrin level is increased and δ-aminolevulinic acid level is lowered, which indicates the abnormal synthesis of:
A) DNA
B) RNA
C) Protein
D) Mevalonic acid
E) Heme

A group of children ate watermelon. One of the children had weakness, dizziness, vomiting, shortness of breath, tachycardia, acrocyanosis. Laboratory analysis of watermelon showed the high content of nitrates. What is the leading mechanism in the pathogenesis of poisoning in this child?
A) Superoxide dismutase insufficiency
B) Cytochrome oxidase inhibition
C) Methaemoglobin reductase insufficiency
D) Glutathione peroxidase deficiency
E) Catalase insufficiency

A male patient with type 1 diabetes mellitus is hospitalized due to coma. Laboratory tests revealed hyperglycemia, ketonemia. Which of the metabolic disorders mentioned below can be found in this patient?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) No changes in acid-base balance

A patient complains of general weakness, dizziness, and rapid fatigue. The content of hemoglobin is 80 g/L. Microscopically, erythrocytes have abnormal shape. The cause of this condition is:
A) Parenchymal jaundice
B) Addison's disease
C) Acute intermittent porphyria
D) Obturative jaundice
E) Sickle-cell anemia

A patient complains of vomiting, general weakness. Residual (rest) nitrogen in blood is 35 mmol/L, renal function is not affected. Which type of azotemia is developed?
A) Relative azotemia
B) Renal azotemia
C) Retention azotemia
D) Productive azotemia

A patient had a hemoglobin gene mutation. This led to the development of sickle cell anemia. How is the pathological hemoglobin, formed in this disease, called?
A) Bart-Hb
B) HbF
C) HbS
D) HbA
E) HbA1

A patient had airway obstruction at the level of small and middle-sized bronchi. Which changes in the acid-base balance can develop in a patient?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) No changes in acid-base balance

A patient had pathological changes in the liver and brain. A sharp increase of copper in the urine and its decrease in the blood are observe~Wilson disease was diagnosed. Which enzyme activity in the blood serum should be investigated to confirm the diagnosis?
A) Carbonic anhydrase
B) Xanthine oxidases
C) Leucine aminopeptidases
D) Ceruloplasmin
E) Alcohol dehydrogenase

A patient had visually seen blisters and enhanced pigmentation after exposure to UV rays. Urine turns red after exposing to the air. Which parameter of the urine makes it possible to verify Gunther's disease?
A) Hemoglobin
B) Uroporphyrinogen I
C) Bilirubin
D) Creatinine
E) Acetone

A patient has an increased skin sensitivity to sunlight. When exposing to the air, urine turns dark red. What is the most likely cause of this condition?
A) Hemolitic jaundice
B) Porphyria
C) Albinism
D) Pellagra
E) Alkaponuria

A patient has been ill for 10 years. Periodically he complaints of acute pain in the abdomen, convulsions, impaired vision. His relatives have similar symptoms. Urine is red. The patient was hospitalized with acute intermittent porphyri~The cause of the disease may be the abnormal synthesis of:
A) Insulin
B) Bile acids
C) Heme
D) Prostaglandin
E) Collagen

A patient has experienced thirst, frequent urination, weight loss, and fatigu~Analysis of his blood reveals below normal pH, above normal glucose level. What is the primary cause for the decrease of normal pH in this patient?
A) Hyperventilation
B) Water loss due to frequent urination
C) Diabetes insipidus
D) Renal failure
E) Ketoacidosis

A patient has hemorrhagic strok~An increased concentration of kinins was found in the blood. The doctor prescribed contrical, which is an inhibitor of one of the foloowing proteinases:
A) Pepsin
B) Trypsin
C) Chymotrypsin
D) Collagenase
E) Kallikrein

A patient has high levels of hydroxyproline, sialic acids, and C-reactive protein in the blood. Which pathology is exacerbated?
A) Rheumatic fever
B) Enterocolitis
C) Hepatitis
D) Bronchitis
E) Pancreatitis

A patient has low blood pH values and hydrocarbonate ions (decreased alkaline reserve of blood), increased levels of lactic and pyruvic acids in blood and urine. Which type of acid-base balance disorder is observed?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis

A patient has rheumatic fever in the active phas~Which blood serum parameter is of diagnostic significance in this pathology?
A) C-reactive protein
B) Uric acid
C) Urea
D) Creatinine
E) Transferrin

A patient has sickle-cell anemia. Which amino acid is replaced in the polypeptide chain of hemoglobin for valine?
A) Glutamic acid
B) Aspartic acid
C) Leucine
D) Arginine
E) Threonine

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

A patient shows signs of mountain sickness: dizziness, dyspnea, tachycardi~Blood pH is 7.5, pCO2 is 30 mm Hg, the buffer base shift is +4 mmol/L. Which acidbase disorder developed?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) Excretory acidosis

A patient suffering from chronic renal failure has an increase in the level of residual (rest) nitrogen to 35 mmol/L. More than half of its is ure~This type of azotemia is called:
A) Hepatic
B) Productive
C) Retentional
D) Residual
E) Mixed

A patient underwent an examination and was diagnosed with hyperglycemia, ketonuria, polyuria, and glucosuria. Which form of acid-base balance disorders is observed?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) No changes in acid-base balance

A patient was diagnosed with erythropoietic porphyria (Gunther's disease): urine is red, a noticeable red coloration of teeth is observed under the ultraviolet radiation. Which substance metabolism is affected?
A) Heme
B) Globin
C) Adenine
D) Creatine
E) Cholesterol

A patient was diagnosed with iron-deficiency sideroachristic anemia, which was accompanied by skin hyperpigmentation, development of pigment liver cirrhosis, damage to the pancreas and heart. The content of iron in the blood serum is increased. What is the reason for the abnormal iron metabolism?
A) Excessive intake of iron from food
B) Abnormal iron absorption in the intestine
C) Iron is not used and is deposited in tissues

D) Increased consumption of iron by the body

A patient was diagnosed with myelom~The total blood protein level is 180 g/L. Such protein level was due to:
A) Transferrin
B) Albumins
C) Paraproteins
D) Haptoglobin
E) Immunoglobulin

A patient was examined in a hospital. Since childhood, his hemoglobin has been varying from 90 to 95 g/L. Treatment with iron supplements was ineffectiv~There are the following blood indices: RBCs-3.2, Hb-85 g/L, color index – 0.78, anisocytosis, poikilocytosis, target cells, reticulocytes - 16%. The diagnosis is thalassemi~To which kind of hemolytic anemia belongs this disease?
A) Hereditary membranopathy
B) Acquired enzymopathy
C) Hereditary hemoglobinopathy
D) Hereditary enzymopathy
E) Acquired membranopathy

A patient who had been working hard under condition of elevated temperature of the environment has now a changed quantity of blood plasma proteins. What phenomenon is the case?
A) Absolute hyperproteinemia
B) Relative hyperproteinemia
C) Absolute hypoproteinemia
D) Disproteinemia
E) Paraproteinemia

A patient who is being treated for hepatitis B shows signs of liver failure. Which blood changes that indicate abnormal protein metabolism are most likely observed in this case?
A) Absolute hyperglobulinemia
B) Blood protein spectrum is not affected
C) Absolute hyperproteinemia
D) Absolute hypoproteinemia
E) Absolute hyperfibrinogenemia

A patient with acute pancreatitis had a threat of pancreatic necrosis, which was accompanied by the release of active pancreatic proteinases into the bloodstream and tissues and breakdown of tissue proteins. Which protective factors can inhibit such processes?
A) Ceruloplasmin, transferrin
B) Hemopexin, haptoglobin
C) Cryoglobulin, interferon
D) Immunoglobulin
E) α2-Macroglobulin, α1-antitrypsin

A patient with diabetes mellitus has a diabetic coma due to an acid-base balance disorder. Which kind of acid-base balance disorders occurs in this case?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) No changes in acid-base balance

A patient with diabetes mellitus has hyperglycemia, ketonuria, glucosuria, hypersthenuria, and polyuria. Which form of acid-base balance disorders occurs in this situation?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis
E) Excretory alkalosis

A patient with diabetes mellitus was hospitalized in a severe precomatous state. Metabolic acidosis was found. What is the primary mechanism for the identified acidbase balance disorder?
A) Impaired use of O2 in cells
B) Formation of underoxidized products
C) Abnormal blood buffer systems
D) Excretion of alkaline components in the urine
E) A decrease in CO2 excretion

A patient with hypochromic anemia has splitting hair and loss of hair, increased nail bottling and taste alteration. What is the mechanism of the development of these symptoms?
A) Deficiency of vitamin B12
B) Decreased production of thyroid hormones
C) Deficiency of vitamin A
D) Decreased production of parathyrin
E) Deficiency of iron-containing enzymes

A patient, hospitalized to the pulmonological department, was diagnosed with pulmonary emphysema, which resulted from the destruction of interalveolar septa by tissue trypsin. Which protein congenital insufficiency can cause the development of this disease?
A) Transferrin
B) α2-Macroglobulin
C) Cryoglobulin
D) α1-Proteinase inhibitor
E) Haptoglobin

A person suffers from diabetes mellitus, which is accompanied by fasting hyperglycemia (more than 7.2 mmol/L). Which plasma protein level allows assessing the level of glycemia retrospectively (for 4-8 weeks before the examination)?
A) Glycosylated hemoglobin
B) C-Reactive protein
C) Fibrinogen
D) Ceruloplasmin
E) Albumin

A significant increase in the activity of creatine phosphokinase MB and LDH1 was revealed in the patient's blood. What is the possible pathology?
A) Myocardial infarction
B) Hepatitis
C) Rheumatism
D) Pancreatitis
E) Cholecystitis

A worker has decreased buffer capacity of blood due to exhausting muscular work. What acidic substance that came to blood caused this phenomenon?
A) 3-phosphoglycerate
B) 1,3-bisphosphoglycerate
C) Lactate
D) α-ketoglutarate
E) Pyruvate

According to clinical data, a patient was diagnosed with acute pancreatitis. Which biochemical test can confirm this diagnosis?
A) Acidic phosphatase activity in the blood
B) Activity of alkaline phosphatase in the blood
C) Blood amylase activity
D) Aminotransferase activity in the blood
E) Blood creatinine level

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

After repairing the car in the garage, the driver was hospitalized with symptoms of poisoning with exhaust fumes. Which blood hemoglobin type will be increased in the blood?
A) Carboxyhemoglobin
B) Methemoglobin
C) Carbhemoglobin
D) Oxyhemoglobin
E) Glycosylated hemoglobin

After the accident in the chemical plant, the environment was polluted with nitro compounds. People living in that area experienced weakness, headache, shortness of breath, dizziness. What was the cause of hypoxia?
A) Inhibition of dehydrogenases
B) Formation of carboxyhemoglobin
C) Reduced function of flavin-dependent enzymes
D) Formation of methemoglobin
E) Inactivation of cytochrome oxidase

All of blood plasma proteins are transporters EXCEPT one in this list. Choose it:
A) Transferrin
B) Albumin
C) Ceruloplasmin
D) Fibrinogen
E) VLDL

All of the following are required for normal clot formation except:
A) Vitamin K
B) Calcium
C) Plasmin
D) Thrombin
E) Proteolysis

Along with the normal types of hemoglobin in adults, there are also pathological ones. Select one of them.
A) HbA1
B) HbS
C) HbA2
D) HbF
E) HbO2

An increase in the concentration of carbon monoxide in the air can lead to poisoning. It affects the oxygen transport by hemoglobin from lungs to tissues. Which hemoglobin derivative is formed in this case?
A) Oxyhemoglobin
B) Methemoglobin
C) Carboxyhemoglobin
D) Carbhemoglobin
E) Hemochromogen

Analysis of blood serum of a patient revealed the increase of alanine aminotransferase and aspartate aminotransferase levels. What cytological changes can cause such a situation?
A) Disturbance of genetic apparatus of cells
B) Cellular breakdown
C) Disorder of enzyme systems of cells
D) Disturbance of cellular interrelations
E) Disturbed energy supply of cells

Apparatus of artificial ventilation of lungs has been attached to a patient with severe trauma. Determination of acid-base balance indices show a decrease in the content of blood carbon dioxide and an increase in its removal. These changes are typical for:
A) Respiratory alkalosis
B) Respiratory acidosis
C) Metabolic alkalosis
D) Metabolic acidosis

Approximately 20% of the world population have a decrease in the activity of glucose-6-phosphate dehydrogenase in erythrocytes. Such people have a higher risk of hemolysis due to the impairment of:

A) Hemoglobin synthesis
B) Glycolysis in erythrocytes
C) Activities of calcium-magnesium-ATPase
D) Activity of sodium-potassium-ATPase
E) Antioxidant system of erythrocytes

At rest a man makes himself to breathe frequently and deeply within 3-4 minutes. How it affects the acid-base balance of an organism?
A) There is metabolic alkalosis.
B) There is respiratory acidosis
C) There is respiratory alkalosis
D) There is metabolic acidosis
E) Acid-base balance is not affected

Biochemical analysis of an infant`s erythrocytes revealed evident glutathione peroxidase deficiency and low concentration of reduced glutathione. What pathological condition can develop in this infant?
A) Hemolytic anemia
B) Megaloblastic anemia
C) Siclemia
D) Iron-deficiency anemia
E) Pernicous anemia

Biochemical analysis of the baby's erythrocytes reaveled a marked glutathione peroxidase deficiency and low levels of reduced glutathion~Which pathological condition can develop?
A) Pernicious anemia
B) Megaloblastic anemia
C) Sickle cell anemia
D) Hemolytic anemia
E) Iron deficiency anemia

Blood analysis revealed a decrease in hemoglobin. Which blood function was affected?
A) Provision of immunity
B) Transport of hormones
C) Transport of nutrients
D) Transport of medicines
E) Transport of gases

Blood analysis revealed azotemia. The percentage of urea nitrogen in the (rest) residual blood nitrogen is significantly reduced. Which organ is affected?
A) Stomach
B) Liver
C) Kidney
D) Intestine
E) Heart

Blood is the tissue needed for the transport of all absorbed products in the gut after digestion processes. Name the function of the blood described above:
A) Body temperature regulatory function
B) Transport of hormones
C) Nutrition function
D) The maintenance of acid-base balance in the organism
E) Protection against microbial agents

Blood pH is 7,3 in a patient with diabetes mellitus. Which buffer system components are used for diagnostics of acid-base balance disturbances?
A) Phosphate
B) Bicarbonate
C) Oxyhemoglobin
D) Hemoglobin
E) Protein

Blood sampling for bulk analysis is recommended to be performed on an empty stomach and in the morning. What changes in blood composition can occur if to perform blood sampling after food intake?
A) Reduced contents of erythrocytes
B) Increased contents of erythrocytes
C) Increased contents of leukocytes
D) Increased plasma proteins
E) Reduced contents of thrombocytes

C-reactive protein is revealed in blood serum:
A) After physical loading
B) In remission phase of disease
C) In lipid metabolism disturbances
D) In acute phase of inflammatory diseases
E) In diabetes mellitus

Choose the anticoagulant normally present in the blood plasma:
A) Vitamin K
B) Heparin
C) Hyaluronidase
D) Dicumarol
E) None of the above

Choose the blood plasma index that is used in screening of newborn for phenylketonuria estimation:
A) Phenylalanine
B) Dihydroxyphenylalanine
C) Acetone
D) Acetoacetate
E) Pyruvate

Choose the location of most plasma protein synthesis:
A) Liver
B) Lungs
C) Small intestine
D) Kidney
E) Skin

Complement can combine:
A) IgM and IgG
B) IgA
C) IgD
D) IgE
E) Nothing from above mentioned

Considerable disturbances of blood circulation in response to shock provide the development of:
A) Metabolic acidosis
B) Respiratory acidosis
C) Respiratory alkalosis
D) Metabolic alkalosis

Considerable losses of gastric juice in prolonged vomiting provide the development:
A) Respiratory acidosis
B) Metabolic alkalosis
C) Respiratory alkalosis
D) Metabolic acidosis

Considerable losses of gastric juice in prolonged vomiting provide the development of:
A) Respiratory acidosis
B) Metabolic alkalosis
C) Respiratory alkalosis
D) Metabolic acidosis

Continue the statement: "Estimation of glycosylated hemoglobin in the blood helps to know the ____".
A) Time duration of untreated diabetes mellitus
B) Rate of ketoacidosis
C) Rate of glucose utilization in tissues
D) The rate of oxygen saturation by hemoglobin
E) Reason of diabetes mellitus development

Conversion of prothrombin to thrombin requires one or more factors from the following list: Choose them:
A) Factor X and Ca2+only
B) Factor V and Ca2+only
C) Factors X, V, Ca2+, acidic phospholipids
D) Factors XI, VI, Ca2+, acidic phospholipids
E) Factors X, V and Mn2+

Creatine level is much higher then normal, creatinine level is lower then normal in the blood plasma of patient. Choose the probable diagnosis for this patient:
A) Myocardium infarction
B) Cholestasis
C) Viral hepatitis
D) Phenylketonuria
E) Muscular dystrophy

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

Edema rapidly develops in a patient. Which protein is reduced in blood serum in edema?
A) α1-Globulins
B) α2-Globulins
C) Albumins
D) β-Globulins
E) Fibrinogen

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

Embolism of respiratory tract by phlegm is observed in a patient. Which disorder of acid-base balance may be found in blood?
A) Respiratory acidosis
B) Metabolic acidosis
C) Acid-base balance is normal
D) Respiratory alkalosis
E) Metabolic alkalosis

Erythema and vesicular rash on the skin appeared in a child under the action of sunlight. The child complains of itching. Blood tests revealed a decrease in blood serum iron content, as well as an increase in urinary excretion of uroporphyrinogen I. The most likely hereditary pathology is:
A) Methemoglobinemia
B) Hepatic porphyria
C) Erythropoietic porphyria
D) Coproporphyria
E) Intermittent porphyria

Erythrocytes are sickle-shaped in a patient with severe forms of hemolytic anemi~What is the molecular cause of this disease?
A) Replacement of glutamate with valine
B) Abnormal porphyrin synthesis
C) Disorders of hemoglobin alpha chain synthesis
D) Abnoral synthesis of hemoglobin beta-chain
E) Impaired heme synthesis

Examination of 27-year-old patient revealed pathological changes in liver and brain. Blood plasma analysis revealed an abrupt decrease in the copper concentration, urine analysis revealed an increased copper, concentration. The patient was diagnosed with Wilson's degeneration. To confirm the diagnosis it is necessary to study the activity of the following enzyme in blood serum:
A) Leucine aminopeptidase
B) Xanthine oxidase
C) Alcohol dehydrogenase

D) Ceruloplasmin
E) Carbonic anhydrase

Examination of a 56-year-old female patient 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) Decrease in the concentration of amino acids in blood
C) Albuminosis
D) Increase in the oncotic pressure in the blood plasma
E) Increase in low-density lipoprotein level

Examination of a patient revealed hyperglycemia, glycosuria, hyperketonemia and ketonuria, polyuria. Which type of acid-base balance disorder is observed in this case?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Metabolic alkalosis
D) Respiratory acidosis
E) Acid-base balance is not affected

Factors of nonspecific immunity are:
A) Complement system
B) Interferon
C) Lysozyme
D) All above mentioned
E) Nothing from above mentioned

Heme synthesis is regulated by feedback mechanism at the stage of:
A) Incorporation of iron ion into protoporphyrin
B) Formation of δ-aminolevulinic acid
C) Condensation of porphobilinogen molecules
D) Formation of protoporphyrin III
E) Synthesis of porphobilinogen

Hemoglobin of adultsis a protein-tetramer consisting of two α- and two β-peptide chains. What is the structure of this protein?
A) Tertiary
B) Secondary
C) Quartenary
D) Primary
E) -

Hereditary defects in heme synthesis enzymes are associated with the increased sensitivity of patients' skin to sunlight. Urine is red. Which hemoglobin metabolites are accumulated causing such symptoms?
A) Mesobilinogens
B) Stercobilinogens
C) Urobilinogens
D) Porphyrinogens
E) Bilirubin

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

IgA takes part in the following reactions:
A) Local immunity
B) Bacteria neutralizing
C) Comlement binding
D) Local immunity and bacteria neutralizing
E) All the above mentioned

IgE takes part in following reactions:
A) Local immunity
B) Allergy reactions
C) Comlement binding
D) Primary immune responce
E) All the above mentioned

Immune reactions of organism are provided by high-specific interaction "antigen-antibody". Such specificity of immunoglobulins depends on their molecular structure. Immunoglobulins are:
A) Lipoproteins
B) Metalloproteins
C) Chromoproteins
D) Glycoproteins
E) Nucleoproteins

Immune system by means of cellular and humoral mechanisms provides the distinguishing, binding and destroying of antigens. The main classes of blood immunoglobulines, which realize humoral immune response, are:
A) Ig A and Ig E
B) Ig G and Ig M
C) Ig D and Ig A
D) Ig A and Ig M
E) Ig E and Ig D

Immunoglobulins are synthesized by:
A) T-lymphocytes
B) Neutrophyls
C) Plasmacytes
D) Macrophages
E) All the above mentioned

In a number of hemoglobinopathies, amino acid substitutions occur in the α- and β- chains of hemoglobin. Which of them is typical for HbS (sickle cell anemia)?
A) Aspartate-lysine
B) Alanine-serine
C) Methionine-histidine

D) Glycine-serine
E) Glutamate valine

In diabetes mellitus the activation of fatty acid oxidation leads to ketosis. Which disorders of acid-base balance can lead to excessive accumulation of ketone bodies in the blood?
A) Metabolic alkalosis
B) There will be no changes
C) Metabolic acidosis
D) Respiratory acidosis
E) Respiratory alkalosis

In erythrocytes, an additional intermediate metabolite of glycolysis is formed in a significant amount, which plays the role in allosteric regulation of hemoglobin function. Choose this metabolite.
A) 3-Phosphoglycerate
B) 1,3-Bisphosphoglycerate
C) C.2.3-Bisphosphoglycerate
D) 2-Phosphoglycerate
E) Phosphoenolpyruvate

In fever development the increase of “acute phase” proteins (ceruloplasmin, fibrinogen, C-reactive protein) is characteristic. Which mechanism of this is possible?
A) Proliferate action of IL-2 to T-lymphocytes
B) Damage action of temperature to organism cells
C) Degranulation of tissue basophils
D) Stimulating influence of IL-1 to hepatocytes

In patients with erythropoietic porphyria (Gunther's disease), teeth are fluoresced in the ultraviolet with a bright red color, the skin is sensitive to light, urine is re~Which enzyme insufficiency is observed?
A) Delta-aminolevulinate synthase
B) Uroporphyrinogen decarboxylase
C) Uroporphyrinogen I synthase
D) Ferrochelatase
E) Uroporphyrinogen III cosyntase

Inflammatory processes in the body are associated with the synthesis of acute phase proteins. Their synthesis is stimulated by:
A) Interleukin-1
B) Immunoglobulins
C) Interferons
D) Biogenic amines
E) Angiotensins

Inhibition of respiratory center in the brain by narcotic drugs results in:
A) Respiratory acidosis
B) Metabolic acidosis
C) Hyperglycemia
D) Respiratory alkalosis
E) Metabolic alkalosis

It has been known that the pentose phosphate pathway actively functions in erythrocytes. What is the main function of this metabolic pathway in erythrocytes?
A) Prevention of lipid peroxidation
B) Detoxication of xenobiotics
C) Oxidation of glucose into lactate
D) Activation of microsomal oxidation
E) Enhancement of lipid peroxidation

Laboratory investigation of the blood respiratory function showed the worsened CO2 transport. Which enzyme is deficient in the red blood cells?
A) 2,3-Diphosphoglycerate
B) Adenylate cyclases
C) Carbonic anhydrase
D) Protein kinases
E) Phosphorylases

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

Mature RBC contains all except one from the following list. Point out it:
A) Enzymes of HMP shunt pathway
B) Enzymes of TCA cycle
C) Glycolytic enzymes
D) Pyridine nucleotides
E) Hemoglobin

Metabolic acidosis is observed in patient` organism due to the accumulation of:
A) Sodium ions
B) Glucose
C) Pyruvate
D) Fructose
E) Glycerol

Molecular analysis of the hemoglobin in a patient with anemia revealed a 6Glu substitution for 6Val in β-chain. What is the molecular mechanism of the pathology?
A) Chromosomal mutation
B) Genomic mutation
C) Gene mutation
D) Gene amplification
E) Gene transduction

Most affinity of blood plasma iron ion is seen with one compound listed below. Choose it:
A) Transferrin
B) Ferritin
C) Hemoglobin

D) Ceruloplasmin
E) Albumin

Name the blood plasma protein used as inhibitor of some proteolytic enzymes:
A) Albumin
B) Immunoglobulin G
C) C-reactive protein
D) Alpha1-antitrypsin
E) Ceruloplasmin

Name the enzyme which is the indicator of myocardium damage if its activity will be increased in the blood plasma in 10 times or more:
A) Alkaline phosphatase
B) Malate dehydrogenase
C) Glutamate dehydrogenase
D) Guanine transaminase
E) Aspartate transaminase

Name the excretory enzyme of the blood plasma:
A) Alkaline phosphatase
B) Malate dehydrogenase
C) Glutamate dehydrogenase
D) Alanine transaminase
E) Aspartate transaminase

Name the factor of blood coagulation system needed for fibrin formation from fibrinogen:
A) Plasmin
B) Heparin
C) Thrombin
D) Prothrombin
E) Lysine

Name the index of blood plasma which helps to recognize the change in biliary system function at cholestasis state:
A) Fibrinogen
B) Conjugated bilirubin
C) Uric acid
D) Urea
E) Creatine

Name the indexes of blood plasma whose content may be higher at insulin-dependent diabetes mellitus:
A) Glucose
B) Cholesterol
C) Pyruvate
D) Ketone bodies
E) All the indexes named above

Name the method used now as modern technique for the separation and determination of the content of some proteins in the blood plasma at the same time:
A) Dialysis
B) Immunoelectrophoresis
C) Spectrophotometry method
D) X-ray radiation method
E) Densitometry method

Name the process that can be considered in the blood, only:
A) Synthesis of proteins
B) Destruction of hormones
C) Thrombosis
D) β-Oxidation of fatty acids
E) High fatty acid synthesis

Neurological abnormalities, skin jaundice, the increase of blood serum unconjugated bilirubin level were revealed in sick 10-years-old child. Which enzyme disturbed synthesis leads to development of Gilbert's disease?
A) UDP-dehydrogenase
B) UDP-glucuronyltransferase
C) Glycerol kinase
D) Galactose-1-phosphate uridyltransferase

One of the major complications of diabetes mellitus is the development of ketoacidosis due to the accumulation of ketone bodies in the blood serum. Which form of acid-base balance disorders occurs in this case?
A) Respiratory alkalosis
B) Metabolic acidosis
C) Respiratory acidosis
D) Metabolic alkalosis

Osmolality of blood plasma is:
A) Osmolarity per kg of solvent
B) Osmolarity per liter of solvent
C) Osmoles of solute per kg of solvent
D) Number of osmoles of solute per liter of solution
E) A liter of solvent per 1 mole

Paraproteins are proteins of the γ-globulin fraction that appear in the blood plasma of people with leukemia, myeloma, lymphosarcoma. Which of the following proteins is a paraprotein capable of forming a gelatinous precipitate when the temperature decreases?
A) C-Reactive protein
B) α1-Glycoprotein
C) Fibronectin
D) Cryoglobulin
E) Ceruloplasmin

Patient has high photosensitivity, lesions of skin, abdominal pain, neuropsychiatric disturbances. Urine becomes of red color when leaving for some period of time. Which diagnosis is the most probable?
A) Hemolytic jaundice
B) Pellagra
C) Alkaptonuria
D) Porphyria
E) Albinism

Plasmacytes are formed from:
A) B-lymphocytes

B) T-lymphocytes
C) Macrophages
D) Fibroblasts
E) Nothing from above mentioned

Point out a blood buffer system, which is the most important in the regulation of acid-base balance:
A) Phosphate
B) Hemoglobin
C) System of blood plasma proteins
D) Bicarbonate

Point out normal region of blood pH:
A) 6.85-7.0
B) 7.05-7.2
C) 7.77-8.0
D) 7.38-7.4
E) 7.45-7.6

Point out the blood microelement:
A) Sodium
B) Copper
C) Calcium
D) Potassium
E) Magnesium

Point out the component of blood, which belongs to nitrogen-free compounds:
A) ATP
B) Thiamin
C) Ascorbic acid
D) Creatine
E) Glutamine

Point out the main blood plasma protein, participating in the blood oncotic pressure maintaining:
A) Globulin
B) Lipoprotein
C) Ceruloplasmin
D) Hemoglobin
E) Albumin

Point out the major transport form of triacylglycerols from the intestine to the liver and other tissues:
A) Chylomicrons
B) LDL
C) VLDL
D) IDL
E) HDL

Point out the most important compensatory mechanism in metabolic acidosis:
A) Hyperventilation
B) Increased NH3 excretion by kidneys
C) Increased filtration of phosphates
D) Increased HCO3- production
E) Urea production in the liver

Point out the most mobile and important buffer in extracellular fluid:
A) Hemoglobin
B) Phosphate
C) Protein
D) H2CO3/HCO3-
E) Na+/K+

Point out the most powerful buffer system of the blood:
A) The bicarbonate buffer system
B) The phosphate buffer system
C) The protein buffer system
D) Haemoglobin buffer system
E) The acetate buffer system

Point out the most probable location of the plasma proteins synthesis:
A) Kidneys
B) Muscle tissue
C) Nervous tissue
D) Liver
E) Lungs

Point out the non-protein nitrogenous component of the blood plasma that is in a level about 50% of total non-protein nitrogen:
A) Uric acid
B) Creatine
C) Creatinine
D) Amino acids
E) Urea

Point out the permissible range of the pH fluctuation in the blood:
A) 8.0-8.61
B) 7.36-7.44
C) 7.81-7.94
D) 6.2-6.84
E) 6.85-7.0

Point out the protease of blood that helps to solvate the fibrin clot:
A) Plasminogen
B) Plasmin
C) Thromboplastin
D) Antifibrinolysinogen
E) Lysokinase

Point out the protease of blood that helps to solvate the fibrin clot:
A) Plasminogen
B) Lysolipase
C) Plasmin
D) Antifibrinogen
E) Tromboplastin

Point out the protein of blood plasma which provides the processes of coagulation hemostasis?

A) Albumin
B) Haptoglobin
C) LDL
D) Ceruloplasmin
E) Fibrinogen

Point out the protein, which is not observed in the blood serum of healthy people:
A) Cryoglobulin
B) Albumin
C) Transferin
D) Haptoglobin
E) Alpha2-macroglobulin

RBCs don't contain mitochondria. What is the major pathway of ATP synthesis in them?
A) Creatine kinase reaction
B) Adenylate kinase reaction
C) Oxidative phosphorylation
D) Aerobic glycolysis
E) Anaerobic glycolysis

RBCs require energy in the form of ATP. Which process provides these cells with the necessary amount of ATP?
A) Pentose phosphate pathway
B) Beta-oxidation of fatty acids
C) Anaerobic glycolysis
D) Aerobic glucose oxidation
E) Tricarboxylic acid cycle

Renal insufficiency was proposed to look at patient due to the change of the ratio [Urea]/Residual nitrogen (80%). Name the index of the blood plasma whose content will prove this diagnosis:
A) High levels of sodium ion
B) Low levels of copper ion
C) High levels of glucose
D) High levels of creatinine
E) High levels of creatine

Rest (residual) nitrogen and urea were determined in the patient's blood. The proportion of urea in the residual nitrogen is significantly reduced. Which organ is affected?
A) Stomach
B) Liver
C) Kidney
D) Intestine
E) Heart

Rest (residual) nitrogen in the patient's blood was 48 mmol/L, urea - 15.3 mmol/L. Which organ is affected?
A) Stomach
B) Liver
C) Kidney
D) Intestine
E) Spleen

Severe form of hypoxia (shortness of breath, cyanosis) developed in a 3-month-old child. Which process of hemoglobin formation is affected?
A) Replacement of hemoglobin F to hemoglobin M
B) Replacement of hemoglobin F to hemoglobin S
C) Replacement of hemoglobin F to glycosylated hemoglobin
D) Replacement of hemoglobin F to methemoglobin
E) E. Replacement of hemoglobin F to hemoglobin A

Sickle cell anemia is common in some areas of South Africa. In this case, erythrocytes have the shape of a sickle due to the replacement of the amino acid glutamate with valine in the molecule of hemoglobin. What causes this disease?
A) Genomic mutation
B) Crossingover
C) Gene mutation
D) Impaired mechanisms for the implementation of genetic information
E) Transduction

Skin, scleras and mucosa are of yellow color in patient. Urine has the color of dark beer, feces are acholi~The increased level of both direct and indirect bilirubin, the enhanced AlAT, LDH4 and LDH5 activities are revealed in bloo~Bilirubin is found in the urine. Which is the type of jaundice?
A) Inherited
B) Hemolytic
C) Obstructive
D) Hepatic
E) Neonatal physiologic jaundice

Substrates for the synthesis of pyrrol rings of porphyrin are:
A) Acetyl-CoA and glycine
B) Acetoacetyl-CoA and serine
C) Succinyl-CoA and serine
D) Succinyl-CoA and glycine
E) Malonyl-CoA and serine

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A) Acetyl-CoA and glycine
B) Acetoacetyl-CoA and serine
C) Succinyl-CoA and serine
D) Succinyl-CoA and glycine
E) Malonyl-CoA and serine

Symptoms of liver cirrhosis with ascites and edema of lower extremities appeared in a patient who had hepatitis C and constantly consumed alcohol. Which changes in blood composition underlied edema development?
A) Hypoglobulinemia
B) Hypoalbulinemia
C) Hypokaliemia
D) Hypoglycemia

E) Hypocholesterolemia

The activation of the inflammatory process, some autoimmune and infectious diseases leads to a sharp increase in the level of acute phase proteins in the blood plasm~Which of the following proteins can form a gel when the serum is cooled?
A) Haptoglobin
B) Cryoglobulin
C) C-reactive protein
D) α2-Macroglobulin
E) Ceruloplasmin

The activities of lactate dehydrogenase (LDH1, LDH2), aspartate aminotransferase, creatine kinase in the blood plasma of patient are increased. In which of the following organs (tissues) is the pathological process probably developing?
A) In the myocardium
B) In the skeletal muscles
C) In adrenal glands
D) In the connective tissue of cartilages
E) In the liver

The activities of lactate dehydrogenase (LDH4, LDH5), alanine aminotransferase, carbamoyl phosphate ornithine transferase are increased in the blood plasma of patient. What organ (tissue) is the pathological process developing in?
A) Skeletal muscles
B) Myocardium
C) Liver
D) Kidneys
E) Bones

The amount of plasma proteins changed in a person after physical exercise under high temperature. What is the cause of such changes?
A) Absolute hyperproteinemia
B) Dysproteinemia
C) Absolute hypoproteinemia
D) Relative hyperproteinemia
E) Paraproteinemia

The content of residual (rest) nitrogen in patient's blood is 48 mmol/L; urea level reaches 15.3 mmol/L. Which organ disease may be the cause of such changes:
A) Spleen
B) Liver
C) Stomach
D) Kidney
E) Pancreas

The content of total protein in blood plasma is normal. Which of the below - mentioned parameters corresponds to physiological norms?
A) 33-45 g/L
B) 50-60 g/L
C) 55-70 g/L
D) 65-85 g/L
E) 85-95 g/L

The content of total protein in blood plasma is normal. Which of the below mentioned parameters (g/L) corresponds to physiological norm?
A) 33-45
B) 50-60
C) 55-70
D) 65-85
E) 85-95

The examination of several classes of immunoglobulins in newborns can be used as diagnostic test to verify the fetal infection. Which class of immunoglobulins can pass through placenta?
A) Ig M
B) Ig A
C) Ig G
D) Ig E
E) Ig D

The excessive accumulation of iron in tissues is observed in a 42-year-old woman. The accumulation occurs due to transferrin deficiency. Each of the following statements about transferrin is correct except:
A) Transferrin is a protein that binds iron and is secreted by neutrophiles
B) Transferrin is a glycoprotein secreted by parenchymatous cells of liver
C) Iron binding by transferrin is the mechanism of protection from iron toxicity
D) Iron and transferrin amounts are proportional in blood
E) Transferrin directs a flow of iron to cells which actively synthesize hemoglobin

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

The hypoproteinemia (30-40 g/l) is indicated at nephritis syndrome, and it causes an edema. Point out the protein of the blood plasma, whose content is decreased in this case:
A) Fibrinogen
B) Albumin
C) LDL
D) Interferon
E) Transferrin

The prolonged action of a number of antibiotics and sulfonamides is caused by the fact that they circulate in the blood for a long time in a complex with:
A) Hemoglobin
B) Albumin
C) Haptoglobin
D) Transferrin
E) Hemopexin

The synthesis of heme is regulated by feed-back mechanism on the stage:
A) Incorporation of iron ion into protoporphyrin
B) Formation of δ-aminolevulinic acid
C) Condensation of porphobilinogen molecules
D) Formation of protoporphyrin III
E) Synthesis of porphobilinogen

The toxic damage to the liver cells with their impaired functions led to the development of edema. Which changes in the blood plasma composition are the main causes of edema in this case?
A) An increase in the content of globulins
B) Reduction of fibrinogen content
C) An increase in albumin content
D) Reduction of the content of globulins
E) Reduction of albumin content

The toxic damage to the liver leads to the impairment of its protein-synthesizing function. Which kind of dysproteinemia is observed in this case?
A) Absolute hyperproteinemia
B) Relative hypoproteinemia
C) Absolute hypoproteinemia
D) Relative hyperproteinemia
E) Paraproteinemia

There are several dozens of proteins in blood plasma of healthy individuals. New proteins may appear in blood during various diseases, in particular "acute phase proteins." One of the following proteins belongs to this group:
A) Immunoglobulin A
B) C-Reactive protein
C) Prothrombin
D) Immunoglobulin G
E) Transcobalamin

There is an abnomal formation of a metalloprotein, which is the source of iron for heme synthesis, in the liver of a patient with iron deficiency anemi~How is this protein called?
A) Ceruloplasmin
B) Ferritin
C) Hemosiderin
D) Myoglobin
E) Cytochrome c

To prevent the long-term consequences of four-day malaria, a patient was prescribed with primaquin. Abdominal and heart pain, dyspepsia, general cyanosis, hemoglobinuria appeared on the third day after the beginning of treatment with therapeutic doses of the drug. What was the reason for the development of the side effects?
A) Potentiation of action by other drugs
B) A decrease in activity of microsomal liver enzymes
C) Genetic insufficiency of glucose-6-phosphate dehydrogenase
D) Low urinary excretion of the drug
E) Cumulation of the drug

To study blood serum proteins, it is possible to use different physical and physicochemical methods. In particular, blood serum albumins and globulins can be separated using the method of:
A) Polarography
B) Dialysis
C) Spectrography
D) Electrophoresis
E) Refractometry

Under the action of oxidizing agents (hydrogen peroxide, nitric oxide, etc.), hemoglobin that contains Fe^{2+} is converted to a compound containing Fe^{3+} that is unable to carry oxygen. What is the name of this compound?
A) Methemoglobin
B) Carboxyhemoglobin
C) Carbhemoglobin
D) Oxyhemoglobin
E) Glycosylated hemoglobin

What is the action of bradykinin on vessels?
A) Vasodilation
B) Vasoconstriction
C) An increase in blood pressure
D) An increase in blood clotting
E) A decrease in vascular permeability

What is the cause of metabolic acidosis development?
A) Increased production and decreased oxidation of ketone bodies
B) Increased production and decreased oxidation of lactate
C) Loss of basic equivalents
D) Ineffective hydrogen ions secretion, retention of acids
E) All options mentioned above are correct

What is the cause of metabolic alkalosis development?
A) Uncompensated loss of hydrogen ions
B) Loss of potassium
C) Retention of alkalis
D) Intake of alkalis
E) All options mentioned above are correct

What of the following enzymatic actions is in need for vitamin K use?
A) Activation of factor X of blood coagulation system
B) Regulation of blood calcium levels
C) Conversion of fibrinogen to fibrin
D) Synthesis of prothrombin
E) Transcriptional control of fibrinogen synthesis

Which blood plasma protein binds and transports copper?
A) Transferrin
B) Bradykinin
C) C–reactive protein
D) Kallikrein
E) Ceruloplasmin

Which buffer system plays an important role in supporting pH of urine?
A) Phosphate
B) Hemoglobin
C) Bicarbonate
D) Protein

Which components of blood residual (rest) nitrogen fraction prevail in productive azotemia?
A) Ketone bodies
B) Lipids, carbohydrates
C) Amino acids, urea
D) Porphyrins, bilirubin

Which fraction of blood globulins provides humoral immunity performing a function of antibodies?
A) α1-Globulins
B) β-Globulins
C) γ-Globulins
D) Cryoglobulins
E) α1-Macroglobulins

Which is the action of bradykinin on vessels?
A) Vasodilation
B) Vasoconstriction
C) The increase of blood pressure
D) Increasing blood clotting
E) The decrease of vessel wall permeability

Which level of residual (rest) nitrogen is normal for adults?
A) 14.3-25 mmol/L
B) 25-38 mmol/L
C) 42.8-71.4 mmol/L
D) 70-90 mmol/L

Which level of residual nitrogen is normal for adults?
A) 14,3-25 mmol/L
B) 25-38 mmol/lL
C) 42,8-71,4 mmol/lL
D) 70-90 mmol/L

Which mechanisms provide blood pH stability?
A) CO_2 removal by lungs
B) Buffer systems
C) Hydrogen ion secretion by kidney
D) Metabolism of substances
E) All options mentioned above are correct

Which mechanisms provide the pH stability of blood?
A) CO_2 removal by lungs
B) Buffer systems
C) Hydrogen ion secretion by kidney
D) Sodium reabsorption by kidney
E) All the above mentioned

Which of the below mentioned pH values corresponds to normal pH in blood?
A) 7.25 - 7.31
B) 7.40 - 7.55
C) 7.35 - 7.45
D) 6.59 - 7.0
E) 4.8 - 5.7

Which of the following statements about porphyrias is not correct?
A) Genetic disturbance of heme synthesis
B) They are divided into erythropoietic and hepatic
C) They are accompanied by the increased excretion of bile pigments in urine and feces
D) They manifest by dermatitis and neuropsychiatric disorders E. Some symptoms are similar to those caused by lead poisoning

Which of the following statements about porphyrias is uncorrect?
A) Genetic disturbance of heme synthesis
B) They are divided into erythropoietic and hepatic
C) They are accompanied by the increased excretion of bile pigments with urine and feces
D) They are manifested by dermatitis and neuropsychiatric disturbances
E) Some symptoms are similar to produce by light

Which of the pH values mentioned below corresponds to normal blood pH?
A) 7.25-7.31
B) 7.40-7.55
C) 7.35-7.45
D) 6.59-7.0
E) 4.8-5.7

Which physical and chemical properties of blood are provided by electrolytes?
A) Oncotic pressure
B) Erythrocyte sedimentation rate
C) Osmotic pressure
D) Viscosity

Which physical and chemical property of protein is the base of the method of electrochemical determination of blood protein spectrum?
A) Viscosity
B) Presence of charge
C) Ability to be denaturated
D) Hydrophility and ability to swell
E) Optical activity

Which physico-chemical property of protein is the base of the method of electrochemical determination of blood protein spectrum?
A) Viscosity
B) Presence of charge
C) Ability to denaturation
D) Hydrophility and ability to swelling
E) Optical activity

Which protein binds to hemoglobin in order to transport it to the reticuloendothelial system of the liver?
A) Haptoglobin
B) Albumin
C) Ferritin
D) Transferrin
E) Ceruloplasmin

Wilson disease (hepatocerebral dystrophy) is accompanied by low ceruloplasmin levels. What is the consequence of this transport protein insufficiency?
A) Breakdown of tissue proteins
B) Complex formation of amino acids with copper
C) Decarboxylation of amino acids
D) Urea synthesis
E) Transamination of amino acids

Wilson disease is associated with a decrease in the plasma content of the protein that transports copper ions. Select this protein.
A) Ceruloplasmin
B) Transferrin
C) Haptoglobin
D) Fibronectin
E) C-Reactive protein

Situational Tasks:

1. A diabetic patient has hyperglycemia, ketonuria, glucosuria, hyperstenuria and polyuria.
a) What form of acid-base disturbance occurs in this situation?
b) How does the pH, pCO2 and blood bicarbonate content change under these conditions?
c) What compensatory mechanisms arise under these conditions?

2. The patient has an increase in serum activity of tartrate-resistant acid phosphatase activity.
a) The lesion of which organ is most likely in the patient.
b) Which group of blood enzymes does it belong to?
c) The activity of which other enzymes increases in the serum when this organ is damaged?

3. In the analysis of blood for patient the rest nitrogen was – 48 mmol/l, urea – 15.3 mmol/l.
a) What its mean "rest nitrogen"? Name its components.
b) Describe the results of analysis. What is the pathological condition? The impression of which organ is most likely.
c) What other component of residual nitrogen will be increased under these conditions?

4. In the analysis of blood in a patient with burn disease, rest nitrogen was 40 mmol/l, urea – 9.5 mmol/l.
a) Describe the results of analysis. What is the pathological condition?
b) Specify the cause of its occurrence. How will the level of amino acids in the serum change under these conditions?
c) How will the oncotic blood pressure change under these conditions? What are the consequences of this for the body?

5. In the patient of 27 years revealed the pathological changes of a liver and a brain. Diagnosed with Wilson's disease.

a) What protein deficiency is observed in the patient? Which class of globulins does it belong to?
b) Specify the biological role of this protein.
c) Which trace element is disturbed under these conditions and how will its content in blood and urine plasma change?

6. In the laboratory examination of blood serum it is established that the activity of ALT is 0.45 mmol/(h*l), AST – 0.95 mmol/(h*l).
a) Describe the results of analysis.
b) The pathology of which organ is most likely.
c) Which group of blood enzymes do they belong to?

7. The content of C-reactive protein is increased in the patient's blood.
a) Name the pathological process in the patient.
b) To which group does this protein belong? Specify the biological role of this protein group.
c) What other proteins will grow under these conditions?

8. The patient has impaired airway patency at the level of small and medium bronchi.
a) What form of acid-base disturbance occurs in this situation?
b) How does the pH, pCO2 and blood bicarbonate content change under these conditions?
c) What compensatory mechanisms arise under these conditions?

9. The patient undergoes an operation using artificial ventilation. He obtained the following parameters of laboratory studies: pH – 7.49, pCO2 – 25 mmHg, bicarbonate content – 24 mmol/l.
a) Describe the results of analysis.
b) What is the form of acid-base disturbance that occurs in this situation?
c) What compensatory mechanisms arise under these conditions?

10. A patient with severe vomiting in the laboratory study obtained the following parameters: pH – 7.50, pCO2 – 36 mmHg, bicarbonate content – 30 mmol/l.
a) Describe the results of analysis.
b) What is the form of acid-base disturbance that occurs in this situation?
c) What compensatory mechanisms arise under these conditions?

11. The patient has a concussion, accompanied by vomiting and shortness of breath. In the laboratory, the following parameters were obtained: pH – 7.50, pCO2 – 29 mmHg, bicarbonate content – 32 mmol/l.
a) Describe the results of analysis.
b) What is the form of acid-base disturbance that occurs in this situation?
c) What compensatory mechanisms arise under these conditions?

12. A patient of 20 years complains of general weakness of dizziness, rapid fatigue. The examination revealed: hemoglobin of blood 80 g/l, microscopically – erythrocytes sickle-shaped.
a) What disease can be suspected?
b) What is the molecular basis of its development?

c) What types of hemoglobin can be detected in this patient?

13. Environmental pollution caused by nitrogen compounds after a chemical industry accident. People living in the area experience severe weakness, headache, shortness of breath, dizziness.
a) What is the cause of hypoxia? What substance accumulates in red blood cells under these conditions?
b) Name the erythrocyte enzyme that counteracts the accumulation of this substance.
c) What treatment measures should be carried out under these conditions?

14. The patient has increased sensitivity to light, anemia, red color of urine. Defective uroporphyrinogen III cosyntase was found in additional studies.
a) What is the name of this pathology?
b) What is the molecular basis of its development?
c) Specify the cause of photodermatitis in these conditions.

15. A patient with kidney disease in the laboratory examination of serum found: total protein content – 50 g/l, albumin – 30 g/l.
a) Describe the results of analysis. What is the pathological condition? Specify the reason for its occurrence.
b) What is the main clinical symptom of this condition? Specify the reason for its occurrence.
c) How does the duration and toxicity of aspirin under these conditions change if it binds to albumin in the blood?

16. 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?

17. 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?

18. 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?

19. 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?

20. 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.

21. In order to diagnose liver damage (hepatitis, cirrhosis) in the serum determine the activity of LDH and ALT.
a) Give the full names of these enzymes.
b) To which classes (according to the International Classification of Enzymes) do they belong?
c) Which of them has isoenzyme forms? Which isoform activity increases in hepatitis?

22. In order to diagnose myocardial infarction in the serum determine the activity of CPK and AST.
a) Give the full names of these enzymes.
b) To which classes do they belong according to the International Classification of Enzymes.
c) Which of them has isoenzyme forms? Which isoform activity increases during a heart attack?

23. In order to diagnose myocardial infarction in the serum determine the activity of LDH.
a) Give the full name of the enzyme and the class (according to International Classification of Enzymes to which it belongs?).
b) Explain the structure of LDH isoenzymes
c) Name the localization of LDH isoenzymes.

24. Indirect anticoagulants (dicoumarins) disrupt the synthesis of prothrombin and other blood clotting proteins in the liver.
a) Structural analogues of which vitamin are they?
b) The activity of which enzyme is inhibited by dicoumarins?
c) What type of inhibition occurs?

25. 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?

Chapter IV. Biochemistry of liver. Xenobiotics and detoxification processes. Biochemistry of kidneys and urine. Water-mineral metabolism.

List of the exam questions:

1. Functions of the liver. The biological role of the liver in nitrogen metabolism and biosynthesis of specialized proteins.
2. The biological role of the liver in carbohydrate and lipid metabolism.
3. The biological role of the liver in metabolism of vitamins. Digestion, storage and excretion of different metabolites.
4. Hemoglobin metabolism, its breakdown. Bile formation.
5. Biochemistry of jaundice (hemolytic, hepatic and obstructive): causes, clinical symptoms, differential diagnostics. Hereditary jaundice: Crigler-Nayar, Gilbert, Dabin-Johnson syndromes. Neonatal physiological jaundice.
6. Biotransformation of xenobiotics and endogenous toxins. Microsomal oxidation. Ethanol toxicity and its metabolism.
7. Functions of the kidneys. Filtration, secretion, reabsorption, excretion. The mechanism of urine formation. Renal clearance.
8. The role of the kidneys in the regulation of osmotic pressure and acid-base balance. Endocrine renal function.
9. Physical and chemical properties of urine. Composition of urine under normal and pathological conditions.
10. The biological role of water. The distribution of water and electrolytes in the body, its regulation. Osmotic pressure. Disorders of water metabolism (dehydration, hyperhydration): types, causes, clinical symptoms.
11. The biological role of sodium, potassium and chlorine, regulation and disorders of their metabolism. The biological role of calcium, magnesium and phosphorus, regulation and disorders of their metabolism.
12. The biological role of microelements (Fe, Cu, Zn, F, I, S, Se, Cr, Mn, Co, Mo). Dyselementoses: causes, clinical symptoms.

Multiple Choice Questions:

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

A boy (of 10 years) complains of general weakness, dizziness, and tiredness. A mental retardation is observed. A concentration of valine, leucine, isoleucine is high in blood and urine. Urine has a specific odour. Name the probable diagnosis:
A) Maple syrup urine disease
B) Phenylketonuria
C) Histidinemia
D) Tyrosinemia
E) Hartnup disease

A female patient with an acute attack of hepatic colic was hospitalized to the gastroenterological department. Body temperature is 38ºC, sclera, mucous membranes and skin are icteric, urine is dark, feces are lightly colored. The

patient complains of itching. What is the cause of jaundice in this patient?
A) Hepatocyte destruction
B) Enhanced destruction of erythrocytes
C) Obstruction of the bile duct
D) Impaired lipid metabolism
E) Prolonged use of carotene - containing products

A female was hospitalized with complaints of weakness, irritability, sleep disturbance. The skin and sclera are yellow. An elevated level of direct bilirubin is found. Feces are acholic. Dark color (bile pigments) of urine is observed. Which type of jaundice should be diagnosed?
A) Hemolytic
B) Mechanical
C) Parenchymal
D) Gilbert syndrome
E) Crigler-Najjar syndrome

A male complains of nausea, vomiting, pain in the right hypochondrium. The patient has skin and sclera jaundice, increased body temperature, enlarged liver, dark urine, hypocholic feces, hyperbilirubinemia (due to direct and indirect bilirubin), bilirubinuria, urobilinuria, hypoproteinemia, decreased blood clotting. Which of the conditions mentioned below are characterized by such changes?
A) Hemolytic jaundice
B) Cellular parenchymal jaundice
C) Acute pancreatitis
D) Pedicular jaundice
E) Acute cholecystitis

A male with yellow skin has anemia, splenomegaly, hyperbilirubinemia (indirect bilirubin), urobilinuria, dark-yellow feces. These changes are the most typical for:
A) Hemolytic jaundice
B) Obstructive jaundice
C) Hepatocellular jaundice
D) Gilbert's syndrome
E) Liver insufficiency

A newborn has physiological jaundice. The level of free bilirubin in the blood significantly exceeds the normal values. Which enzyme deficiency is observed?
A) Transaminases
B) Xanthine oxidases
C) Adenosine deaminases
D) Hemoxygenase
E) UDP-glucuronyl transferase

A newborn has signs of jaundice. The administration of small doses of phenobarbital, which induces the synthesis of UDP-glucuronyl transferase, has contributed to the improvement of the child's health. Which of the following processes is activated in this case?
A) Conjugation
B) Microsomal oxidation
C) Tissue respiration
D) Gluconeogenesis
E) Glycogen synthesis

A patient complains about dyspnea provoked by the physical activity. Clinical examination revealed anaemia and presence of the para-protein in the zone of gamma-globulins. To confirm the myeloma diagnosis it is necessary to determine the following index in the patient's urine:
A) Ceruplasmin
B) Bilirubin
C) Antitrypsin
D) Bence Jones protein
E) Haemoglobin

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

A patient has been suffering from pain in the right hypochondrium for several days after eating fatty food. The jaundice of the sclera and skin is visually noted. Acholic feces are observed. Urine has a "color of beer." Which substance is present in the urine and causes a dark color of urine?
A) Ketone bodies
B) Indirect bilirubin
C) Stercobilin
D) Bilirubin glucuronides
E) Direct bilirubin

A patient has immune hemolytic anemia. Which parameter is increased in the serum at most?
A) Indirect bilirubin
B) Direct bilirubin
C) Protoporphyrin
D) Mesobilinogen
E) Stercobilinogen

A patient suffers from hepatic cirrhosis. Examination of which of the following substances excreted by urine can characterize the state of antitoxic function of liver?
A) Uric acid
B) Creatinine
C) Ammonium salts
D) Hippuric acid
E) Amino acids

A patient was hospitalized with complaints of general weakness, abdominal pain, and bad appetite. Symptoms of jaundice were observed. Blood serum total bilirubin

content was 77.3 μmol/L; conjugated bilirubin level was 70.76 μmol/L. Which diagnosis is the most possible?
A) Obstructive jaundice
B) Acute hepatitis
C) Cirrhosis of liver
D) Hepatic jaundice
E) Hemolytic jaundice

A patient with encephalopathy was admitted to the neurological in patient department. There was revealed a correlation between increasing of encephalopathy and substances absorbed by the bloodstream from the intestines. What substances that are formed in the intestines can cause endotoxemia?
A) Indole
B) Ornithine
C) Acetacetate
D) Butyrate
E) Biotin

A patient with jaundice has the increased content of direct bilirubin and bile acids in blood. There is no sterocilinogen in the urine. Which type of jaundice can be diagnosed?
A) Parenchymal
B) Hepatic
C) Hemolytic
D) Posthepatic
E) Mechanical

A patient with signs of jaundice due to viral hepatitis was hospitalized to the infectious department. Which of the following parameters is strictly specific, distinguishing parenchymal jaundice from the other types?
A) Cholechemia
B) Hyperbilirubinemia
C) Bilirubinuria
D) Increased activity of ALT, ASAT
E) Urobilinuria

A patient with symptoms of acute alcohol poisoning was brought to the hospital. What carbohydrates metabolism changes are typical for this condition?
A) The anaerobic glucose metabolism predominates in muscles
B) The gluconeogenesis is increased in the liver
C) The breakage of glycogen is increased in the liver
D) The gluconeogenesis velocity in the liver is decreased
E) The anaerobic breakage of glucose is increased in muscles

A premature newborn on the second day of life has yellow coloration of the skin and mucous membranes. Which enzyme temporary deficiency is the cause of this condition?
A) UDP-glucuronyltransferase
B) Aminolevulinate synthase
C) Hemoxygenases
D) Heme synthase
E) Biliverdin reductase

A young male has a hereditary UDP-glucuronyl transferase deficiency. Laboratory tests allowed determining hyperbilirubinemia, mainly due to the increase in blood concentrations of:
A) Direct bilirubin
B) Urolilinogen
C) Indirect bilirubin
D) Sterkobilinogen
E) Biliverdin

All of the following may have a physiological antioxidant role except
A) Beta-carotene
B) Vitamin C
C) Selenium
D) Iron
E) Vitamin E

Ammonia content in urine is important index of acid-base balance of organism. Ammonia amount increases both under respiratory and metabolic acidoses. It is connected with following enzymes stimulation in the renal epithelial cells under acidosis:
A) Glutaminase
B) Krebs cycle
C) Carboanhydrase
D) ATP-ase
E) Hyaluronidase

Appearance of albumins in the urine of diseased person may be at:
A) Acute nephritis
B) Chronical nephritis
C) Severe form of diabetes mellitus
D) Pyelonephritis
E) All that is placed above

Arthritis occur in
A) Alkaptonuria
B) Cystinosis
C) Maple syrup diseases
D) Homocystinuria
E) Addison’s disease

As a result of the transfusion of Rh antigen incompatible blood, hemolytic jaundice developed in a patient. Which laboratory blood parameter can confirm this type of jaundice?
A) Accumulation of urobilinogen
B) A decrease in the content of unconjugated bilirubin
C) Accumulation of unconjugated bilirubin
D) Reduction of the content of sterbilin
E) Reduction of the content of conjugated bilirubin

Barbiturates activate UDP-glucuronyl transferase synthesis in the liver, which causes the formation of:
A) Direct bilirubin
B) Indirect bilirubin
C) Biliverdin
D) Protoprophyrine
E) Heme

Benzoic acid causes the toxic effect at its accumulation in the liver. Choose the main conjugative agent to detoxify it:
A) Glycine
B) PAPS
C) S-adenosyl methionine
D) Glutathione
E) Acetyl-CoA

Benzoic acid has the formula C6H5-COOH and causes the toxic effect at its accumulation in the liver. Choose the main conjugative agent for this substance:
A) Glycine
B) PAPS
C) S-adenosyl methionine
D) Glutathione
E) Urea

Bilirubin content (indirect bilirubin) in a newborn is increased; feces are intensively colored (the enhanced level of stercobilin). Bilirubin is not found in urine. Which type of jaundice may be diagnosed?
A) Hepatocellular
B) Hemolytic
C) Obstructive
D) Inherited
E) Neonatal physiologic jaundice

Choose metabolites of methanol which may be produced in the liver:
A) Acetaldehyde + Acetic acid
B) Formaldehyde + Formic acid
C) Pyruvate + Pyruvic acid
D) Fumarate + Fumeric acid
E) Glyceroaldehyde + Glycerol

Choose normal amount of proteins excreted in urine/24 hours.
A) Less than 150 mg
B) 200 mg - 225 mg
C) 450 mg – 500 mg
D) More than 800 mg
E) 150 mg – 250 mg

Choose one wrong continuation of a phrase: Oxidation of ethanol…:
A) Occurs, basically, in a liver
B) Is catalyzed by alcohol dehydrogenase
C) Is slowed down at increase NADH/NAD+ in a cell
D) Can proceed under microsomal system action
E) Results in the formation of an intermediate product of Pentose phosphate cycle

Choose one wrong continuation of a phrase: Phase I of xenobiotics transformation:
A) Is carried out by enzymes of endoplasmic reticulum
B) Demands presence of NADPH
C) Results in increase of polarity of a substance
D) Occurs in anaerobic conditions
E) Proceeds at participation of cytochrome P450

Choose the correct statement about hepatic monooxygenases linked with cytochrome P450 enzyme.
A) Located mainly in smooth EPR
B) Catalyzes oxidation, reduction and hydrolysis reactions at the same time
C) Certain drug inactivate and certain drug enhance their reactions
D) Positions A, C are correct
E) Their action always causes the detoxification of xenobiotics

Choose the exogenous factor (the drug) that can induce the UDP-glucuronosyltransferase gene expression in the liver:
A) Calcitriol
B) Thyroxine
C) Riboxin
D) Phenobarbital
E) Thiamine diphosphate

Choose the form of the bile pigment, which is the normal urine component:
A) Uroporphyrin
B) Unconjugated bilirubin
C) Conjugated bilirubin
D) Mesobilinogen
E) Stercobilinogen

Choose the main biochemical tests for diagnostics of kidney diseases:
A) Urea content in the blood plasma and in the urine
B) Creatinine content in the blood and urine
C) Sodium ions content in the blood and urine
D) N-acetyl-beta-D-glucosaminidase activity (blood serum, urine)
E) All that is placed above

Choose the process that is not placed in the liver:
A) Urea synthesis
B) Bile acid synthesis
C) Detoxification of xenobiotics
D) Cortisol synthesis
E) Deposition of fat soluble vitamins

Choose the right continuation of the statement: “In mammalian bile, the bile acids are normally present____”.

A) In their free form
B) As cholesterol esters
C) As conjugated with glycine or taurine
D) As conjugated with beta-glucuronic acid
E) As conjugated with bilirubin

Choose the specific gravity region (g/ml) for urine of healthy person:
A) 1.005-1.015
B) 1.030-1.040
C) 1.015-1.020
D) 1.030-1.040
E) Less then 1.010

Choose the urine component, whose concentration increases at consuming a lot of meat food:
A) Glucose
B) Protein
C) Uric acid
D) Ketone bodies
E) Fructose

Choose the urine index that is used to estimate detoxification function of the liver:
A) Citric acid
B) Acetyl-CoA
C) Pyruvate
D) Hippuric acid
E) Uric acid

Confirmation of elevation of alkaline phosphatase of hepatic origin is by
A) SGOT (Serum glutamic oxaloacetic transaminase)
B) SGPT (Serum glutamic pyruvic transaminase)
C) GGT (Gamma-glutamyl transferase)
D) LDH (Lactate dehydrogenase)
E) Acid phosphatase

Creatinine levels in the urine and blood are used to test kidney function. Creatinine is useful for this test because it is not significantly reabsorbed nor secreted by kidney, and metabolically it is:
A) Produced at a constant rate
B) Produced only in kidney
C) A storage form of energy
D) An acceptor of protons in renal tubules
E) A precursor for phosphocreatine

Daily water requirement for adults is:
A) 30-50 ml/kg
B) 75-100 ml/kg
C) 75-80 ml/kg
D) 100-120 ml/kg

Desulfiram is widely used in medical practice to prevent alcoholism, it inhibits aldehyde dehydrogenas~Increased level of what metabolite causes aversion to alcohol?
A) Acetaldehyde
B) Ethanol
C) Malonyl aldehyde
D) Propionic aldehyde
E) Methanol

Examination of a 43 y.o. anephric patient revealed anemia symptoms. What is the cause of these symptoms?
A) Folic acid deficit
B) Vitamin B12 deficit
C) Reduced synthesis of erythropoietins
D) Enhanced destruction of erythrocytes
E) Iron deficit

Fat dystrophy of liver is examined in the patient. The disturbance of which substance synthesis can lead to such pathology?
A) Cholic acid
B) Urea
C) Phosphatidic acid
D) Tristearylglycerin
E) Phosphatidylcholine

Find out the enzyme name which is specific for liver tissue, only:
A) Succinate dehydrogenase
B) Arginase
C) Alanine amino transferase
D) Aspartate amino transferase
E) Isocitrate dehydrogenase

Find out the enzyme of liver tissue participating in the detoxification of cyanides:
A) NADH - dehydrogenase
B) Cytochrome b
C) Thiosulfate transferase
D) Cytochrome c
E) Cytochrome P450

Find the correct definition of the term "xenobiotic":
A) A substance that is an obligatory component of food products
B) A substance that is unnatural for humans
C) A substance that is synthesized in small quantities in humans
D) A substance that regulates metabolism in organism
E) A substance that is a terminal product of metabolism

Find the enzyme participating in the function of the microsomal monooxygenase chain:
A) NADP - dehydrogenase
B) Cytochrome b
C) Cytochrome c1
D) Cytochrome c
E) Cytochrome P450

Find the protein name that is synthesized in the liver, only:
A) Albumin of blood plasma

B) Alpha2-macroglobulin
C) Alpha1-antitrypsin
D) Ceruloplasmin
E) All the names above are right answers

Glucose-6-Phosphate is the key metabolite of carbohydrate metabolism. Point out the pathway of its utilization which is present in liver:
A) Glycogenesis
B) Gluconeogenesis
C) Glycolysis
D) Hexose Monophosphate Shunt
E) All of the above

Goiter is a disease which is widely spread in some biogeochemical areas of the earth. Which element deficiency causes this disease?
A) Iron
B) Iodine
C) Zinc
D) Copper
E) Cobalt

In a patient the development of acute pancreatitis is accompanied by the obstruction of common bile duct. What can develop as a result?
A) Hepatic coma
B) Portal hypertension
C) Mechanical jaundice
D) Haemolytic jaundice
E) Parenchymal jaundice

In a patient with a pronounced yellowness of the skin, sclera, mucous membranes, urine became of color of dark beer, feces were lightly colored. The content of direct bilirubin is elevated, bilirubin is found in urine. Which type of jaundice is observed?
A) Obstructive
B) Parenchymal
C) Hemolytic
D) Conjugative
E) Excretory

In course of metabolic process active forms of oxygen including superoxide anion radical are formed in the human body. By means of what enzyme is this anion inactivated?
A) Catalase
B) Glutathione reductase
C) Peroxidase
D) Superoxide dismutase
E) Glutathione peroxidase

In patients with a genetic enzymatic disease (Gilbert's disease), conjugation of bilirubin in the liver is impaired. Which enzyme is blocked in this case?
A) UDP-glucosopyrophosphorylase
B) UDP-glycogentransferase
C) Ornithine carbamoyltransferase
D) UDP-glucuronyl transferase
E) Phosphoribosyl pyrophosphate amidotransferase

In the patient the average daily output of water is lower than its intake. Which disease can lead to that state?
A) Renal disease
B) Hepatitis
C) Pancreatitis
D) Infectious diseases
E) Myocardial infarction

It was found in 1970s that the cause of severe neonatal jaundice was abnormal bilirubin conjugation in hepatocytes. Which substance is used to form the conjugate?
A) Uric acid
B) Sulfuric acid
C) Lactic acid
D) Glucuronic acid
E) Pyruvic acid

Jaundice of the skin and mucous membranes developed in a patient after the blood transfusion. Blood levels of total and indirect bilirubin are high. Urobilin is found in the urine. Stercobilin is found in the urine. Which kind of jaundice can be suspected?
A) Hereditary
B) Obturative
C) Parenchymal
D) Jaundice of newborns
E) Hemolytic

Kidney insufficiency development will cause the infringements in those processes:
A) Erythropoietin synthesis and secretion
B) Calcitriol synthesis
C) Mineralization of bone tissue
D) Creatine synthesis
E) All that is placed above

Kidney insufficiency in patient is accompanied with:
A) Excess levels of urea in the blood plasma
B) Excess levels of potassium ions in the blood plasma
C) Disturbed clearance
D) Disturbed filtration and reabsorption processes
E) All that is placed above

Kidneys make all functions excepting:
A) Excretion of final products of metabolism
B) Regulation of water-salt metabolism
C) Keeping osmotic pressure
D) Regulation of blood pressure
E) Breakdown of urea to CO2 and H2O

Liver cirrhosis in patient is accompanied with:
A) Disturbed production of urea
B) Accumulation of bililrubin total in the blood

C) Hypoproteinemia
D) Disturbed function of coagulation system of the blood
E) All that is placed above

Liver does not produce one compound from the following list. Point out it:
A) Albumin
B) Gamma-globulin
C) Fibrinogen
D) Prothrombin
E) Haptoglobin

Liver synthesizes all the compounds from the following list EXCEPT:
A) Clotting factor II
B) Clotting factor XII
C) Urea
D) Stercobilin
E) Cholesterol

Monooxygenase and reductase chains of EPR (smooth part) are necessary for:
A) Saturated HFA synthesis
B) Structure modification of endogenous substrates only
C) Structure modification of xenobiotics and endogenous substrates
D) Structure modification of xenobiotics only
E) Energy reception at the oxidation of xenobiotics

Name organic compound which is terminal for humans and not reabsorbed in renal tubules:
A) Globulins
B) Glucose
C) Albumin
D) Creatinine
E) Bilirubin

Name the compound metabolized in the liver across conjugation reaction like xenobiotics:
A) Bilirubin
B) Cholesterol
C) Urea
D) Acetylcholine
E) Uric acid

Neurologic abnormalities, yellow skin, an increase in blood serum unconjugated bilirubin levels were found in an ill 10-year-old child. Which enzyme abnormal synthesis leads to the development of Gilbert's syndrome?
A) UDP dehydrogenase
B) UDP-glucuronyl transferase
C) Glycerol kinase
D) Galactose-1-phosphate uridyltransferase

One of liver functions is maintenance of glucose concentration in the blood. Point out the carbohydrate metabolic pathway in the liver that provides realization of this function at exception of diet carbohydrates:
A) Aerobic oxidation of glucose
B) Anaerobic oxidation of glucose
C) Gluconeogenesis
D) Pentose phosphate cycle
E) Glycogenesis

One way of acid-base balance maintenance in organism by means of kidney is ammonia salts formation. Point out the enzyme in kidney that takes part in this process:
A) Monooxygenase
B) Arginase
C) Carbamoyl phosphate synthetase
D) Glutaminase
E) Alanine amino transferase

Organ specific enzyme for kidneys is:
A) Lactate dehydrogenase
B) Succinate dehydrogenase
C) Aspartate aminotransferase
D) Transamidinase
E) Creatinephosphokinase

Point out the chemical nature of prosthetic group of cytochrome P450:
A) Nucleotide
B) Fe3+
C) Fe2+
D) Phosphate
E) Heme

Point out a major source of ammonia in kidney tissue:
A) Urea
B) Aspartate
C) Glutamine
D) Glutamate
E) Uric acid

Point out the amino acid that is conjugative agent at Quick`s test:
A) Lactic acid
B) Glycine
C) Valine
D) Leucine
E) Histidine

Point out the blood serum enzyme elevated in alcoholic cirrhosis of liver:
A) Alcohol dehydrogenase
B) Creatine kinase
C) Acidic phosphatase
D) Gamma-glutamyl transpeptidase
E) Aspartate transaminase

Point out the conjugation agent that is conjugative agent at the detoxification of heterocyclic alcohols in the liver:
A) Glutathione

B) Glycine
C) Valine
D) PAPS
E) Histidine

Point out the conjugation agent that is in need to detoxify heterocyclic alcohols in the liver:
A) Glutathione
B) Glycine
C) Valine
D) PAPS
E) Histidine

Point out the conjugation agent used for conjugated bilirubin formation in the liver cell:
A) Glycine
B) Cysteine
C) UDP-glucuronic acid
D) PAPS
E) Acetyl-CoA

Point out the donor of sulfate group in the conjugation phase of xenobiotics transformation:
A) Glutathione
B) UDP-glucuronic acid
C) Adenosine 3́-phosphate-5́-phosphosulfate
D) Acetyl-CoA
E) S-adenosylmethionine

Point out the enzyme located in the cytoplasm of hepatocytes and participating in the modification of a xenobiotic:
A) Glutamine synthetase
B) Alcohol dehydrogenase
C) Alanine amino transferase
D) Carbomoyl phosphate transferase
E) Glutamate dehydrogenase

Point out the enzyme of monooxygenase chain as a final electron acceptor from NADPH:
A) Cytochrome b5
B) Cytochrome b
C) Cytochrome P450
D) Cytochrome c1
E) Cytochrome aa3

Point out the enzyme whose activity is decreased in the blood plasma at liver cirrhosis in patient:
A) Glutamine synthetase
B) Glutamate dehydrogenase
C) Alanine amino transferase
D) Choline esterase
E) UDP - glucoronyl transferase

Point out the enzyme whose activity is determined in the blood plasma of patients to estimate the liver parenchyma damage:
A) Lactate dehydrogenase
B) Palmitate synthase complex
C) Alanine amino transferase
D) Cytochrome c1
E) Adenylate cyclase

Point out the lipid mainly synthesized in the liver:
A) Ganglyoside
B) Phospatidyl ethanol amine
C) Cholesterol
D) Phosphatidyl choline
E) Phosphatidyl inositol

Point out the liver enzyme participating in the neutralization of xenobiotics, their metabolites and harmful endogenous products:
A) Glutamine synthetase
B) Glutamate dehydrogenase
C) Alanine amino transferase
D) Carbomoyl phosphate synthetase
E) UDP - glucoronyl transferase

Point out the liver enzyme participating in the neutralization of xenobiotics, their metabolites and harmful endogenous products:
A) Glutamine synthetase
B) Glutamate dehydrogenase
C) Alanine amino transferase
D) Carbomoyl phosphate synthetase
E) UDP-glucuronyl transferase

Point out the liver enzyme participating in the neutralization of ammonia:
A) Glutamine synthetase
B) Glutamate dehydrogenase
C) Carbomoyl phosphate synthetase
D) Alanine amino transferase
E) All the enzymes in A, B, C positions

Point out the main enzyme in monooxygenase system of EPR responsible for modification of xenobiotics:
A) Glucuronyl transferase
B) Glutathione S-transferase
C) NADPH reductase
D) Cytochrome P450
E) Cytochrome C oxidase

Point out the main place for the location of microsomal oxidation in a cell:
A) Nucleus
B) Cytoplasm
C) EPR, smooth part
D) EPR, rough part
E) Lysosomes

Point out the normal component of urine:
A) Coniugated bilirubin
B) Glucose
C) Ketone bodies

D) Uric acid
E) Albumins

Point out the pathological component of urine:
A) Haemoglobin
B) Urea
C) Uric acid
D) Creatinine
E) Amino acids

Point out the pathological urine component that appears in the urine during nephritis, some cardiac diseases, some forms of idiopathic hypertension and pregnancy pathology. Test with sulphosalicylic acid for that component is the most sensitive reaction:
A) Amino acids
B) Urea
C) Uric acid
D) Hippuric acid
E) Protein

Point out the pathways placed mainly in the liver:
A) 25-hydroxycholecalciferol synthesis
B) Taurine synthesis
C) Cholic acid synthesis
D) Sex hormone binding protein synthesis
E) All of the above

Point out the peptide participating in the conjugation of some harmful products in the liver:
A) Glutathione
B) Methionine
C) Trialanine
D) Oxytocin
E) Prolylproline

Point out the peptide participating in the conjugation of some harmful sulfur containing products in the liver:
A) Glutathione
B) Methionine
C) Trialanine
D) Oxytocin
E) Prolylproline

Point out the process of carbohydrate metabolism which is occurred only in liver:
A) Glycogenolysis
B) Glycogenesis
C) Heparin synthesis
D) Pentose phosphate pathway
E) Aerobic glycolysis

Point out the qualitative reaction to prove the presence of blood pigments in urine:
A) Heller's test
B) Benzidine test
C) Lugol's test
D) Trommer's reaction
E) Rozine's reaction

Point out the qualitative reaction to prove the presence of proteins in urine:
A) Heller's test
B) Benzidine test
C) Lugol's test
D) Trommer's reaction
E) Rozine's reaction

Point out the substance that appears in the urine in a case of alkaptonuria:
A) Fructose
B) Protein
C) Homogentisic acid
D) Glucose
E) Tryptophan

Pyruvate concentration in the patient’s urine is increased 10 times than the normal level. Choose the vitamin, the deficiency of which in the organism can be the reason of this change:
A) Vitamin B1
B) Vitamin K
C) Vitamin A
D) Vitamin C
E) Vitamin B2

Study of conversion of a food colouring agent revealed that utilization of this xenobiotic takes place only in one phase – microsomal oxidation (modification phase). Name an enzyme of this phase:
A) Cytochrome aa3
B) Cytochrome C oxidase
C) Cytochrome P-450
D) Cytochrome C1
E) Cytochrome b

Tabun, zarin, fluorodiisopropyl phosphate (phosphororganic substances) are poisons of neuro-paralytic action. Which of the mentioned enzymes is inhibited by phosphororganic substances?
A) Cytochrome P450
B) Phospholipase A2
C) Angiotensin converting enzyme
D) Tyrosine aminotransferase
E) Acetylcholine esterase

The activity of UDP-glucuronyl transferase is reduced at Gilbert Syndrome. What metabolite concentration will raise in the blood at these patients?
A) Direct bilirubin
B) Indirect bilirubin
C) Mesobilirubinogen
D) Stercobilinogen
E) Mesobilinogen

The concentration of what urine component will decrease in a case of viral hepatitis:
A) Glucose
B) Protein
C) Urea
D) Lipids
E) Carbohydrates

The decrease of blood residual nitrogen level was revealed in the patient with liver insufficiency. The diminishing blood nonprotein nitrogen is due to:
A) Urea
B) Ammonium
C) Amino acids
D) Bilirubin
E) Uric acid

The detoxification of natural metabolites and xenobiotics is disturbed in the patient's liver. The decrease of which chromoprotein activity can be reason of this?
A) Cytochrome b
B) Hemoglobin
C) Cytochrome oxidase
D) Cytochrome P450
E) Cytochrome c1

The development of Addison-Biermer's disease (pernicious hyperchromic anemia) is due to a deficiency of vitamin B12. Choose metal which is included to composition of this vitamin:
A) Zink
B) Cobalt
C) Molybdenum
D) Magnesium
E) Iron

The diuresis in healthy adults is about:
A) 400-700 ml
B) 1000-2000 ml
C) 2000-3000 ml
D) 700-900 ml
E) 3000-4000 ml

The patient complains of thirst and polyuri~The urine analysis revealed: daily diuresis - 10 L; urine density - 1.001 (normal – 1.012-1.024). Which disease causes the indexes?
A) Diabetes mellitus
B) Steroid diabetes
C) Thyrotoxicosis
D) Acromegaly
E) Diabetes insipidus

The patient has an acute attack of cholelithiasis. What will be changed in laboratory tests?
A) Positive reaction for stercobilin in feces
B) The presence of connective tissue in feces
C) Fibers in feces
D) Negative reaction for stercobilin in feces
E) The presence of starch granules in feces

The rate of high fatty acids synthesis in the liver is high. Point out the precursor for this process and its intracellular location:
A) Acetyl CoA, Matrix
B) Acetyl CoA, Cytoplasm
C) Glucose, Matrix
D) Amino acids, Cytoplasm
E) Amino acids, Matrix

The violation of the hormone secretion is followed by polyuri~Choose this hormone:
A) Adrenalin
B) Insulin
C) Testosterone
D) Vasopressin
E) Oxytocin

There is yellowness of the skin at newborn. The content of bilirubin in the blood is moderately increased due to indirect bilirubin. The fecal level of stercobilinogen is raised, bilirubin is not present in the urin~What type of a jaundice take place:
A) Prehepatic jaundice
B) Hepatic jaundice
C) Posthepatic jaundice
D) Crigler-Najjar syndrome
E) Gilbert syndrome

This lipoprotein class is synthesized in the liver, and is in need for the transport of triacylglycerols and cholesterol from the liver to tissues. Name it:
A) IDL
B) HDL
C) LDL
D) VLDL
E) Chylomicrons

What is the urine color when intestinal rotting processes are intensified:
A) Brown
B) Straw-yellow
C) Red
D) Green or blue
E) Beer like color

What organic compounds accumulate in final urine at severe form of diabetes mellitus?
A) Albumins
B) Glucose
C) Ketone bodies
D) Bilirubin conjugated
E) All that is placed in positions A, B, C

What process is stimulated in the liver at starvation:
A) Glycogenolysis

B) Gluconeogenesis
C) Non-oxidative phase of HMP
D) Ketogenesis
E) All of the above

Which following cytochrome participates in drug metabolism?
A) Cytochrome aa3
B) Cytochrome C1
C) Cytochrome C
D) Cytochrome P450
E) Cytochrome b

Which hormone influences the blood sodium and potassium levels?
A) Calcitonin
B) Histamine
C) Aldosterone
D) Thyroxine
E) Parathyroid hormone

Which is a physiological constituent of urine
A) Globulins
B) Glucose
C) Albumin
D) Creatinine
E) Bilirubin

Which is the normal blood calcium level (in mmol/L)?
A) 1.50-1.75
B) 1.75-2.00
C) 2.25-2.75
D) 3.0-4.5
E) 0.65-1.60

Which of the following substances is not excreted in the urine?
A) Conjugated bilirubin
B) Unconjugated bilirubin
C) Urobilinogen
D) Stercobilinogen

Wilson's disease (hepatolenticular degeneration) is accompanied by the decrease of:
A) Fibrinogen
B) Transferrin
C) Albumin
D) C-reactive protein
E) Ceruloplasmin

Situational Tasks:

1. Jaundice has developed after the bite of a poisonous snake in humans. Total plasma bilirubin is 80 μmol / l, indirect bilirubin is 72 μmol / l, urine and feces are intensely colored.
a) Describe the results of analysis.
b) Name the type of jaundice.
c) What is the cause of intense stool and urine staining?

2. In the laboratory analysis of the serum of a patient with hepatitis established: the content of total protein - 55 g / l, albumin - 30 g / l.
a) Describe the results of analysis.
b) Destroy of which liver function is registered in the patient?
c) What are the consequences for the body of this disorder?

3. In the laboratory analysis of the serum of a patient with hepatitis established: urea content - 2.0 mmol / l, ammonia - 75 mmol / l.
a) Describe the results of analysis.
b) Destroy of which liver function is registered in the patient?
c) What are the consequences for the body of this disorder?

4. A patient with a sleep disorder is assigned a drug from the group of barbiturates that did not cause a hypnotic effect at the usual therapeutic dose. From the anamnesis it is established that the patient misuses alcohol.
a) What phenomenon is observed under these conditions?

b) Specify the cause of its occurrence.
c) What is the clinical significance of this phenomenon for doctors?

5. In the process of dealkylation of codeine, a much stronger narcotic analgesic of morphine is formed.
a) What phase of biotransformation takes place under these conditions?
b) Name the enzymes and coenzymes that provide this conversion. In which organelle cells it passes.
c) What is the significance of the dealkylation process?

6. The anti-tuberculosis drug isoniazid in the human body is subject to acetylation processes.
a) What phase of biotransformation takes place under these conditions?
b) How are people divided by the rate of acetylation? What is the clinical significance?
c) How is isoniazid toxicity altered in people with different acetylation rates?

7. Long-term alcohol intake causes toxic damage to the liver.
a) Which ethanol metabolite is the most toxic to cells?
b) In what reactions is it formed and with which enzymes?
c) Specify the mechanism of its toxic action?

8. A woman suffering from gallstone disease has a yellowing of the skin, sclera. Urine of color of "dark beer", cal - gray-white. Total plasma bilirubin - 180 μmol / l, Florence sample (urinary uroline) – negative.
a) Describe the results of analysis. Name the type of jaundice.
b) What are the causes of discoloration of urine and feces?
c) Name the blood plasma enzymes - indicators of cholestasis (bile flow outflow).

9. The patient is diagnosed with viral hepatitis A (Botkin's disease). The content of indirect bilirubin in blood plasma is 48 μmol / l, direct bilirubin is 95 μmol / l, urine is dark beer.
a) Describe the results of analysis.
b) Name the type of jaundice.
c) Name the enzymes of blood plasma - indicators of cytolysis of hepatocytes.

10. Jaundice has emerged in a 16-year-old boy after the use of the antimalarial drug primachin. The content of indirect bilirubin in the blood plasma is 76 μmol / l, direct bilirubin - 4.5 μmol / l, urine and cal - dark color, hemoglobin (hemoglobinuria) is detected in the urine.
a) Describe the results of analysis.
b) Name the type of jaundice.
c) Specify the cause of jaundice.

11. A young man with Gilbert's disease is marked with yellowness of the sclera, the content of total bilirubin in the blood plasma - 48 μmol / l, indirect bilirubin - 37 μmol / l, feces and urine - normal color.
a) Describe the results of analysis.

b) Specify the cause of jaundice.
c) Specify a drug that can reduce these disorders.

12. A newborn baby has a progressive increase in jaundice, CNS lesions. The content of indirect bilirubin in blood plasma is 340 μmol / l, direct bilirubin is 0 (absent), hemolysis of erythrocytes is not detected. The introduction of phenobarbital did not reduce the signs of jaundice.
a) Describe the results of analysis.
b) Name the type of jaundice.
c) Specify the mechanism of neurotoxic effect of indirect bilirubin.

13. After the donor blood transfusion, the patient's body temperature increased, lumbar pain occurred, and yellowing of the skin developed. The content of indirect bilirubin is 100 μmol / l, direct - 4.0 μmol / l, urine and feces are intensely colored.
a) Describe the results of analysis.
b) Name the type of jaundice and its cause.
c) Compare the properties of direct and indirect bilirubin.

14. In the laboratory analysis of blood serum it is established that the activity of ALT is 1.05 mmol / (h ^ l), AST - 0.40 mmol / (h ^ l).
a) Describe the results of analysis.
b) The pathology of which organ is most likely.
c) Research on the activity of which enzymes will confirm the diagnosis?

15. The patient has pain in the right hypochondrium. Laboratory analysis revealed an increase in the activity of alkaline phosphatase and GGTP in serum.
a) What is the pathological condition of the patient?
b) How can total serum bilirubin and its fractions be changed under these conditions?
c) Hypovitaminosis what vitamins should expect?

16. The patient was admitted to the infectious hospital with complaints of rampant vomiting.
a) What the defection of water-mineral metabolism is observed under these conditions?
b) What clinical symptoms are characteristic of this disorder?
c) What are the other causes for the development of such defection of water-mineral metabolism?

17. The patient with renal pathology found: in the serum, urea content - 5.5 mmol / l, creatinine - 75 μmol / l, glucose - 4.8 mmol / l; in urine glucose - 2.5%.
a) Describe the results of analysis.
b) Which kidney function is destroyed?
c) In which nephron part do the abnormalities occur?

18. The patient has a tumor of the medulla oblongata, accompanied by pronounced hypersalivation (6-7l per day).
a) What the defection of water-mineral metabolism is observed under these conditions?

b) What clinical symptoms are characteristic of this disorder?
c) What are the other causes for the development of such defection of water-mineral metabolism?

19. During the analysis of the electrolyte composition of the serum, it was found that the sodium content was 175 mmol / l, potassium - 4.0 mmol / l, calcium - 2.5 mmol / l.
a) Describe the results of analysis.
b) Under these conditions, how does the osmotic blood pressure change? Specify its regulatory metrics.
c) What clinical symptoms are characteristic of this disorder?

20. After prolonged administration of diuretic, the patient has tachycardia and cardiac arrhythmias.
a) What disturbance of electrolyte metabolism is observed under these conditions?
b) What is the reason for the development of these defection?
c) Name the hormone that regulates the level of this electrolyte in the blood.

21. A patient with a syndrome of prolonged muscle contraction developed bradycardia and after some time cardiac arrest in diastole was registered.
a) What disturbance of electrolyte metabolism is observed under these conditions?
b) What is the reason for the development of these defection?
c) What is the biological role of this electrolyte?

22. In women with chronic kidney disease, there is an increase in blood pressure, with a high renin content in the blood.
a) Specify the reason for the increase in renin content under these conditions.
b) Which regulatory system activation causes blood pressure to rise? Which metabolite of this system is a potent vasoconstrictor?
c) How does serum potassium and sodium content change under these conditions?

23. A patient with kidney disease complains of bone fragility. The serum content of calcium is 1.75 mmol / l.
a) Describe the results of analysis.
b) Specify the cause of the pathological condition.
c) What hormone is involved in the regulation of calcium metabolism in the kidneys? What is its biological role?

24. In a patient with renal pathology diuresis - 400 ml, in serum: urea content - 10.3 mmol / l, creatinine - 200 μmol / l.
a) Describe the results of analysis.
b) Which kidney function is destroyed?
c) What other indicator is used to evaluate this kidney function?

25. During the analysis of the specific gravity in different portions of daily urine it was found that this indicator ranges from 1,004-1,007 g / ml.

a) Describe the results of analysis.
b) Which kidney function is destroyed?
c) At what pathological condition do such changes occur?

26. 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?

27. 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 convulsions?

28. 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.

29. Captopril is an antihypertensive drug that is a competitive inhibitor of angiotensin-converting enzyme (ACE). ACE is a carboxydipeptidyl peptidase that converts the angiotensin I proenzyme to the angiotensin II enzyme.
a) Name the mechanism of activation of angiotensin I in angiotensin II.
b) What type of chemical bonds are hydrolyzed by peptidases? What kind of specificity of their action?
c) To which class of enzymes do peptidases belong?

30. A patient with suspected acute pancreatitis was brought to the emergency clinic.
a) Increased activity of which enzymes in the blood and urine will confirm the diagnosis?
b) The activity of which of the enzymes of the pancreas in the urine is determined by the method of Wolgemut?
c) Indicate the normal values of the activity of this enzyme in the urine.

Chapter V. Biochemistry of muscle, connective tissue, and nervous system.

List of the exam questions:

1. Characteristic of biochemical composition of muscle tissue.
2. Specifics of metabolism in muscle tissue.
3. Energy sources for muscular activity.
4. Mechanism of muscle contraction.
5. Specifics of skeletal, cardiac and smooth muscles.
6. Biochemical changes in muscle in pathology conditions.
7. Characteristic and functions of connective tissue.
8. Biochemical composition of extracellular matrix: specific proteins and protein-carbohydrate complexes.
9. Biochemical composition of bones and cartilages.
10. Specifics of metabolism in extracellular matrix.
11. Specifics of metabolism in bones.
12. Biochemical changes in connective tissue and bones in pathology conditions.
13. Characteristic of biochemical composition of nervous tissue.
14. Specifics of metabolism in nervous tissue.
15. Mechanism of synaptic signal transmission. Resting potential and action potential.
16. Biochemistry of neuromediators (neurotransmitters): classification, functions and metabolism, receptors. Disturbances of mediator metabolism.
17. The blood-brain barrier. Cerebrospinal fluid, its composition.
18. Biochemistry mechanism of vision.

Multiple Choice Questions:

A 30 y.o. woman had been ill for a year when she felt pain in the area of joints for the first time, they got swollen, and skin above them became reddene~Provisional diagnosis is rheumatoid arthritis. One of the most probable causes of this disease is a structure alteration of a connective tissue protein:

A) Ovoalbumin
B) Collagen
C) Myosin
D) Troponin
E) Mucin

A 46 year woman complains of progressing Duchenne-type muscular dystrophy. Which enzyme activity changing is diagnostic test in this case?

A) Glutamate dehydrogenase
B) Lactate dehydrogenase
C) Pyruvate dehydrogenase
D) Creatine phosphokinase
E) Adenylyl kinase

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

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

A 53-year-old male patient is diagnosed with Paget's disease. The concentration of oxyproline in daily urine is sharply increased, which primarily means intensified disintegration of:

A) Albumin
B) Hemoglobin
C) Collagen
D) Fibrinogen
E) Keratin

A child is diagnosed with an X-linked recessive

mucopolysaccharidosis that causes heparan sulfate and dermatan sulfate deposition in his bones. Which enzyme deficiency leads to development of this disease?

A) α-L-iduronidase
B) L-iduronosulfate sulfatase
C) N-acetylgalactosamine-6-sulfatase
D) Amylo-1,6-glucosidase
E) Arylsulfatase A

A deficiency of copper affects the formation of normal collagen by reducing the activity of one enzyme from following list. Choose it:

A) Glucosyl transferase
B) Galactosyl transferase
C) Prolyl hydroxylase
D) Lysyl oxidase
E) Collagenase

A five-year old boy was normal at birth, but by the age 18 months he developed characteristic of short stature, mental retardation, limited movements and coarse facial features. He was diagnosed with L-iduronidase deficiency. Which one of the following diseases does he have?

A) Hurler's- Scheie disease
B) Hunter's disease
C) Sanfilippo A disease
D) Morquio's disease
E) Marteaux-Lamy disease

A patient with serious damage of muscular tissue was admitted to the trauma department. What biochemical urine index will be increased in this case?

A) Creatinine
B) Common lipids
C) Uric acid
D) Glucose
E) Mineral salts

A special role in the metabolism of catecholamine mediators is assigned to the enzyme:

A) Glutamate decarboxylase
B) S-adenosylmethionine decarboxylase
C) Acetylcholinesterase
D) Monoamine oxidase
E) Glutamate dehydrogenase

Adenosine triphosphatase (ATPase) activity needed for muscle contraction is a component of:

A) The amino-terminal globular head of myosin
B) The carboxy-terminal tail region of myosin
C) Troponin T
D) Actin
E) Troponin C

Ammonia is a strong poison, and the nervous system is highly susceptible to it. Choose the amino acid that plays a special role in the neutralization of ammonia:

A) Alanine
B) Arginine
C) Valine
D) Methionine
E) Glutamic acid

An unconscious patient was taken by ambulance to the hospital. On objective examination the patient was found to have on 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) Urea
B) Histamine
C) Glutamine
D) Ammonia
E) Bilirubin

Choose a substance that can be the product of enzymatic hydrolysis of elastin , only:

A) Glycine
B) Pepsin
C) Nucleic acid
D) Desmosin
E) Ribose

Choose an enzyme which takes part in ATP resynthesis in the muscle tissue:

A) Glucokinase
B) Creatine kinase
C) Hexokinase
D) Pyruvate kinase
E) Pyruvate carboxylase

Choose the enzyme of the blood plasma, whose activity increases in ten or more times for 3-4 hours after myocardium infarction:

A) Aspartate transaminase
B) Leucine aminopeptidase
C) Alkaline phoshatase
D) Acidic phoshatase
E) Arginase

Choose the mechanism for proline conversion to hydroxyproline:

A) Vitamin C mediated hydroxylation
B) Reverse hydroxylation
C) Vitamin H mediated carboxylation
D) Post translation induction
E) Vitamin K mediated hydroxylation

Choose the neurotransmitter from following list:

A) Serine
B) Glutathione
C) Glutamate
D) Phenylalanine
E) Alanine

Choose the product of guanidoacetate transmethylation from following list:

A) Chlorine
B) Hydroxyproline
C) Creatinine
D) Creatine
E) Glutathione

Collagen occurs in different types, which are usually classified on the basis of the:

A) Type of carbohydrate present
B) Cysteine content
C) Hydroxyproline and hydroxylysine content
D) Types of peptide chains present
E) Glycine content

Correct statements regarding creatinine include all of the following except:

A) Creatinine is formed by the spontaneous cyclization of a constant fraction of muscular creatine phosphate
B) The excretion of creatinine in the urine of adults is very constant from day to day
C) Creatinine is a precurcor of creatine
D) Urinary creatinine levels help to estimate the muscular mass in person
E) Blood level of creatinine is a good indicator of kidney function

Creatine is formed metabolically using one compound listed below. Choose it:

A) Tryptophan
B) Phenylalanine
C) Lysine
D) Valine
E) Leucine

Decarboxylation of glutamate induces production of gamme-aminobutyric acid (GABA) neurotransmitter. After inactivation GABA is converted into a metabolite of the citric acid cycle, that is:

A) Fumarate
B) Succinate
C) Oxaloacetate
D) Malate
E) Citric acid

Depressions and emotional insanities result from the deficit of noradrenalin, serotonin and other biogenic amines in the brain. Their concentration in the synapses can be increased by means of the antidepressants that inhibit the following enzyme:

A) Phenylalanine-4-monooxygenase
B) Monoamine oxidase
C) D-amino-acid oxidase
D) L-amino-acid oxidase
E) Diamine oxidase

Disruption of nerve fiber myelinogenesis causes neurological disorders and mental retardation. These symptoms are typical for hereditary and acquired alterations in the metabolism of:

A) Phosphatidic acid
B) Cholesterol
C) Sphingolipids
D) Neutral fats
E) Higher fatty acids

GABA (γ-aminobutyric acid), which belongs to inhibitory mediators, is he product of glutamate decarboxylation. Which vitamin prescription has the sense in convulsion states due to the decreased formation of GABA?

A) B9
B) B6
C) B1
D) B5
E) B2

Hydroxylation of proline to hydroxyproline in collagen synthesis requires all except one. Point out it.

A) Pyridoxal phosphate
B) Ascorbic acid
C) O2
D) Specific hydroxylase
E) Iron ion

In the brain ammonia is converted to product from following list. Point out it:

A) Aspartate
B) Glutamine
C) Alanine
D) Histidine
E) Urea

Increased fragility of vessels, enamel and dentine destruction resulting from scurvy are caused by disorder of collagen maturation. What stage of procollagen modification is disturbed under this avitaminosis?

A) Hydroxylation of proline
B) Detaching of N-ended peptide
C) Formation of polypeptide chains
D) Glycosylation of hydroxylysine residues
E) Removal of C-ended peptide from procollagen

It is established that creatine synthesis in the liver is in need for three amino acids as substrates in this process. Point out them:

A) Ala, Ser, Glu
B) Arg, Gly, Met
C) Tre, Ile, Val
D) Phe, Trp, Val
E) Ala, Val, Leu

It is established that there is specific system of

energy supply in muscular cell. Point out this system:
A) Renin-angiotensinogen system
B) Creatine phosphate kinase system
C) Adenylate cyclase system
D) Translation system of a cell
E) Palmitate synthetase complex

It's suspected that a child has a progressing muscular dystrophy. What urine component is increased and will confirm the diagnosis:
A) Hippuric acid
B) Creatine
C) Ketone bodies
D) Glucose
E) Urea

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) Serotonin
C) Dopamine
D) Noradrenalin
E) Adrenalin

Name biochemical tests used for diagnostics of muscular dystrophy development:
A) Creatine content in the blood plasma and urine
B) Creatinine content in the blood plasma
C) Ctreatine phosphate kinase activity in the blood plasma
D) Myofibril proteins content in tissue homogenate obtained due to biopsy method
E) All that is placed above

Name the enzyme which produces acetylcholine (neurotransmitter):
A) Acetylcholinesterase
B) Cholinesterase
C) Acetylcholine dehydrogenase
D) Acetylcholine carboxykinase
E) Choline acetyltransferase

Name the metabolic pathway used as the main energy source for myocardium contraction at healthy humans:
A) Anaerobic glycolysis
B) Aerobic glycolysis
C) Glycogen breakdown
D) Oxidation of High Fatty Acids
E) Pentose Phosphate cycle

Name the polysaccharide represented in connective tissue:
A) Collagen
B) Elastin
C) Laminin
D) Hyaluronic acid
E) Fibrillin

Neurotransmitter serotonin is derived from one amino aci~Choose it:
A) Phenylalanine
B) Serine
C) Tryptophan
D) Cysteine
E) Proline

Patient, 36-year old, suffers of collagenosis. Which metabolite increased amount is more possible to be found in the urine?
A) Indican
B) Hydroxyproline
C) Creatinine
D) Urea
E) Urobilinogen

Point biogenic amines which are mediators of inhibition:
A) Dopamine
B) Histamine
C) Serotonin
D) γ-aminobutyric acid
E) Taurine

Point isoforms of LDH, concentration of which increase in blood plasma of patients with myocardial infarction:
A) LDH1 and LDH2
B) LDH3 and LDH4
C) LDH3
D) LDH4 and LDH5
E) LDH5

Point out location of guanidoacetate synthesis and substrates for it.
A) Kidney; Arginine+Glycine
B) Liver; Methionine+Glycine
C) Liver; Cysteine+Arginine
D) Muscle; Citrulline+Aspartate
E) Brain; Methionine+Arginine

Point out the amino acids that are determinated in the structure of collagen, only:
A) Glycine and glutamic acid
B) Proline and lysine
C) Hydroxyproline and hydroxylysine
D) Desmosin and proline
E) Glutamate and aspartate

Point out the amino acids which function as neurotransmitters in CNS:
A) Glutamic acid
B) Aspartic acid
C) Glycine

D) Dihydroxyphenylalanine
E) All the amino acids named above

Point out the enzyme that catalyzes the degradation of some neurotransmitters in the brain:
A) Aldolase
B) Glutamate dehydrogenase
C) Monoamino oxidase
D) Hexokinase
E) Malate dehydrogenase

Point out the factors whose levels in the intracellular space of muscular cell influence the rate of muscular contraction:
A) ATP levels
B) Calcium ions content
C) Magnesium ions content
D) Stroma proteins content
E) All the factors above are in need

Point out the lipid which hardly synthesized in brain of adults:
A) Sphingomyelin
B) Cerebroside
C) Ganglyoside
D) Sulfatide
E) Cholesterol

Point out the main catabolic pathway for glucose in the brain tissue:
A) Aerobic oxidation up to carbon dioxide and water
B) Anaerobic glycolysis
C) Pentose Phosphate Cycle
D) Glycogenesis
E) Gluconeogenesis

Point out the main energy source substrate for the brain:
A) Glucose
B) Fatty acids
C) Phospholipids
D) Ketone bodies
E) Amino acids

Point out the main pathways of catabolism in brain:
A) Glycolysis and Citric Acid Cycle
B) Glycogenolysis and Glycogenesis
C) Glycogenolysis and Citric Acid Cycle
D) Embden-Meyerhof pathway and HMP shunt
E) Oxidation of fatty acids and ketogenesis

Point out the major fuel for the brain after several weeks of starvation:
A) Glucose
B) Fatty acid
C) Beta hydroxyl butyrate
D) Tyrosine
E) Phenylalanine

Point out the neurotransmitter that is isolated from preganglionar neuron synapses of the sympathetic nervous system, mainly:
A) Epinephrine
B) Dopamine
C) Acetylcholine
D) Glycine
E) Serotonin

Point out the substance whose level in the blood plasma correlates with the volume of physical loading of skeletal muscular tissue:
A) Ammonia
B) Urea
C) Creatine
D) Creatinine
E) Uric acid

Psycho-pharmacologic drugs with antidepressive action inhibit oxidative deamination of noradrenaline and serotonin in mitochondria of brain by means of inhibition of:
A) Monoamine oxidase
B) Cytochrome oxidase
C) Pyruvate dehydrogenase
D) Aldolase
E) Succinate dehydrogenase

Simple and conjugated proteins are in the composition of nervous tissu~Point out the simple proteins of this tissue type:
A) Albumins, globulins
B) Prolamins, glutelins
C) Phosphoproteins
D) Nucleoproteins
E) Lipoproteins

Specific diagnostic sign of muscular dystrophy is increased excretion with urine of
A) Creatinine
B) Creatine
C) Proteins
D) Indican
E) Bilirubin

The application of drug atropine is based on its ability to block the muscarinic receptors. Name a neurotransmitter that takes place in the transmission of impulses binding with this type receptor in the autonomic nervous system:
A) Acetylcholine
B) Nor-epinephrine
C) Dopamine
D) Serotonin
E) Glycine

The brain contains relatively high amounts of all

compounds from the following list except one. Point out it:

A) Glutamine
B) N-Acetylaspartate
C) Gamma-aminobutyric acid (GABA)
D) Glycogen
E) Proteolipid

The cardiac muscle utilizes all of the following compounds from the blood except one. Point out it:

A) Glucose
B) Acetone
C) Fatty acids
D) Acetoacetic acid
E) Alanine

The content of certain acidic proteins is characteristic for the nervous tissu~Point out such protein:

A) Histon
B) Protein S-100
C) Globin
D) Actin
E) Tubuline

The content of certain substance is sharply decreased in a striate of a brain at Parcinson disease. Point out it:

A) Dopamine
B) Acetylcholine
C) GABA
D) Histamine
E) Nor-epinephrine

The early signs of rickets have been examined in the child. Which blood index from below mentioned is the evidence of vitamin D deficiency.

A) The increase of Ca level
B) The decrease of Ca level
C) The increase of 25-(OH)-D3 level
D) The decrease of 25-(OH)-D3 level
E) The increase of alkaline phosphatase activity

The high levels of creatine phosphokinase (CPK) (MB-isozyme) and lactate dehydrogenase LDH1 activity were revealed. Point out the most probable pathology in the patient:

A) Hepatitis
B) Myocardium infarction
C) Osteoartritis
D) Pancreatitis
E) Cholecystitis

The increased extensibility and elasticity of skin, abnormal joint mobility provide the participation of the patients with Ehlers-Danlos syndrome in circus attraction as “gutta percha boys” and “women-snake”. Which biomolecules hereditary disturbances are observed under this disease?

A) Glycosaminoglycans
B) Collagen
C) Elastin
D) Gangliosides
E) Glycogen.

The main energy source for the brain is:

A) Fatty acids
B) Glucose
C) Ketone bodies
D) Cholesterol
E) Nucleotides

The metabolism disturbance in myocardium in a case of ischemic heart disease is followed by the decrease of ATP and creatine phosphate concentrations. Point out the reason of this event:

A) Glycolysis is activated in myocardium
B) Hypoxia causes the inhibition of all the processes in mitochondria
C) Glucose is not destroyed in myocardium
D) The oxidative phosphorylation is activated in myocardium
E) The accumulation of glucose is in myocardium

The mucopolysaccharidoses signs (dwarfism, hypertrichosis, coarse features, hearing loss) are observed in the child. Which biochemical investigations are necessary to put the final differential diagnosis of mucopolysaccharidoses type?

A) Examination of corresponding GAGs level in urine
B) Examination of corresponding GAGs concentration in blood
C) Examination of corresponding enzymes in blood serum
D) Examination of corresponding enzymes in leukocytes
E) Examination of corresponding enzymes in urine

The myelin substance is a complex of some compounds. What prevailing components are in it?

A) Protein, lipids
B) Carbohydrates, lipids
C) Nucleic acids
D) Adenine-linked nucleotides, creatine phosphate
E) Amino acids, mineral substances

The peptides with opiate-like activity (endorphins and enkephalins) have been shown to be derivatives of:

A) β-Lipotropic hypophyseal hormone
B) Adrenocorticotropic hormone
C) Growth hormone
D) Luteotropic hormone
E) Proinsulin

There are some proteins in muscles: actin, myosin, actomyosin, tropomyosin, troponin. Point out what a specific group of proteins they are related to:

A) Enzymes
B) Sarcoplasmatic proteins
C) Stroma proteins
D) Calcium conjugated proteins
E) Coagulants

There are special supportive proteins in the white matter of nervous tissue. Point out them:
A) Actins
B) Myosins
C) Troponins
D) Albumins
E) Neuroscleroproteins

There is the feature of the chemical composition of neuroglia: one acidic protein has very high concentration. Name it:
A) Protein S-100
B) Myosin
C) Albumin
D) Choline esterase
E) Neuroscleroprotein

Three amino acids take part in creatine synthesis in humans. Point out them:
A) Serine, Aspartate, Glutamate
B) Tyrosine, Phenylalanine, Tryptophan
C) Threonine, Isoleucine, Valine
D) Arginine, Glycine, Methionine
E) Alanine, Valine, Leucine

Three residues (Gly-X-Y-) are repeated many times, and it is the absolute requirement for formation of the triple helix of collagen molecule type 1. What amino acid and its derivative mainly is represented as letters X and Y?
A) Proline
B) Tryptophan
C) Lysine
D) Valine
E) Leucine

Toxicity of ammonia (especially for brain) is due to its capacity to disturb the functioning of Krebs cycle as result of the removal from cycle of:
A) Malate
B) Citrate
C) α-Ketoglutarate
D) Succinate
E) Fumarate

Triple helix is seen in one compound listed bellow. Choose it:
A) Collagen
B) Fibrinogen
C) Histones
D) Serum amylase
E) F-actin

Vitamin C deficiency causes the disorder in collagen synthesis because two enzymes in this synthesis are in need for the use of ascorbic acid. Name one of them:
A) Pyruvate dehydrogenase
B) Acetyl – CoA carboxylase
C) Prolyl hydroxylase
D) Lactate dehydrogenase
E) Phenylalanine hydroxylase

What does cardiac muscle prefer as source of energy?
A) Fatty acids
B) Glucose
C) Ketone bodies
D) Glycogen
E) Fructose

Which is the main process of ammonia detoxification in nervous tissue?
A) Transamination
B) Urea synthesis
C) Formation of dicarbonic acid amides
D) Ammonia salts formation
E) Biogenic amines synthesis

Which myofibril protein performs both structural and enzymatic functions?
A) Actin
B) Myosin
C) Troponin I
D) Troponin T
E) Troponin C

Which of the following is increased in the blood plasma at myocardial infarction?
A) Creatine phosphokinase BB isozyme
B) Lactate dehydrogenase isozyme 5
C) Succinate dehydrogenase
D) Alkaline phosphatase
E) Creatine phosphokinase and aspartate aminotransferase

Which of the following substances belong to as so called “inhibitory amino acids”?
A) Histidine, tyrosine
B) Glutamate, glutathione
C) Aspartate, asparagine
D) Proline, lysine
E) GABA, glycine

Which substance does not cross the blood brain barrier?
A) Insulin
B) Ascorbic acid
C) Bilirubin
D) Glucose
E) Oxygen

Which substance is the reliable marker of hyaline cartilage chondrogenic differentiation?
A) Collagen II type
B) Collagen I type
C) Collagen V type
D) Collagen IX type
E) Collagen XII type

Situational Tasks:

1. In a two-year-old child with mucopolysaccharidosis, there is a delay in physical and neuro-mental development, skeletal deformity and other disorders of the musculoskeletal system.
a) The metabolism of which connective tissue substances are impaired in mucopolysaccharidoses?
b) Deficiency of which enzymes are noted for these diseases? Why these diseases are called lysosomal?
c) The excretion of which substances with urine increases significantly with mucopolysaccharidosis?

2. A diphtheria patient has a decrease in the amount of carnitine in the heart muscle.
a) Specify the class of compounds that are the primary energy source for cardiomyocytes.
b) How does their oxidation change under these conditions? Justify the answer.
c) What process is activated at the same time?

3. In pathological processes in connective tissue (for example, in collagenoses), degradation and formation of collagen fibrillar protein may be enhanced.
a) Name the biochemical markers of collagen destruction.
b) What vitamins and trace elements are required for the formation of collagen fibrils?
c) How glucocorticosteroids affect collagen biosynthesis.

4. In a patient with emphysema, there is a marked catabolism of elastin in the alveolar walls.
a) Specify the biological role of elastin in lung tissue.
b) Which enzyme deficiency is most likely under these conditions?
c) What is the role of this enzyme in the metabolism of elastin?

5. Skeletal muscle pathologies (muscular dystrophies, metabolic myopathies) show an increase in serum creatine (creatinemia) and urine (creatinuria).
a) Explain the cause of creatinemia and creatinuria in this pathology.
b) Research on the activity of which enzymes in the serum is a diagnostic marker of skeletal muscle damage?
c) How does the content of myofibrillar and skeletal muscle stroma proteins change under these conditions?

6. In patients with myocardial infarction, a number of metabolic disorders occur in cardiomyocytes, leading to their damage.
a) What activity of the energy supply process increases in cardiomyocytes under these conditions?
b) List the main biochemical mechanisms of cardiomyocyte damage in this pathology.
c) Increase in the activity of which enzymes and the content of which proteins in the serum is

noted in this case?

7. The patient went to the doctor complaining of excessive bleeding (especially gums), the occurrence of "petechiae" on the skin and mucous membranes, loosening and tooth loss. The survey revealed that the patient consumed little vegetable food for a long time.
a) What pathology does the patient have?
b) Deficiency of which vitamins are the cause of vitamin deficiency
c) Specify the causes of symptoms in the patient.

8. A 1-year-old child in low sunlight has muscle hypotension, skeletal deformities (O-shaped legs, beaded ribs), decreased calcium and phosphorus in the blood, increased alkaline phosphatase activity.
a) Specify the name of the pathological condition. What vitamin deficiency does the patient have?
b) Name the cause of hypovitaminosis.
c) Name the target organs through which the effect of this vitamin on phosphorus-calcium metabolism is realized.

9. A 58-year-old patient was hospitalized with complaints of chest pain, sudden weakness, sweating, fear, dizziness. Preliminary diagnosis is myocardial infarction.
a) The activity of which enzymes should be determined in the patient's blood?
b) Which of them have isoenzyme forms?
c) Which isoenzyme activity is most informative in the first hours of myocardial infarction?

10. Synovial fluid is known to reduce joint surface friction. In rheumatism and arthritis, its viscosity is reduced by depolymerization of a substance.
a) Name this substance.
b) What class of carbohydrates does it belong to? Which components are it made of?
c) What other biological functions does it perform?

11. Proserine, among other drugs, was prescribed to a patient after a stroke to restore muscle mobility.
a) The activity of which enzyme inhibits proserine?
b) What type of inhibitors does it belong to?
c) Which metabolite (neurotransmitter) concentration will increase in the muscles under the action of proserine?

12. Disorders of dopamine metabolism and dopamine receptor functions underlie the development of depressive states, schizophrenia and other pathologies of the nervous system.
a) What type of neurotransmitters (excitatory, inhibitory or mixed) is dopamine?
b) How is its inactivation?
c) Through which type of receptors (metabotropic or ionotropic) and secondary mediator are

the biological effects of dopamine realized?

13. Strychnine alkaloid poisoning causes tetanic seizures due to its ability to block the attachment of glycine to the appropriate receptors.
a) What type of neurotransmitters (excitatory, inhibitory or mixed) is glycine?
b) Through which type of receptors (metabotropic or ionotropic) are the biological effects of glycine realized?
c) Name the biological effects of glycine in the nervous system.

14. In patients with traumatic brain injury and stroke, there are violations of glutamate metabolism and sensitivity of receptors to it.
a) What type of neurotransmitters (excitatory, inhibitory or mixed) is glutamate?
b) Through what type of receptors are the biological effects of glutamate realized?
c) Name the biological effects of glutamate in the nervous system.

15. In patients with depressive states, inactivation of norepinephrine increases and sensitivity of receptors to it decreases.
a) What type of neurotransmitters (excitatory, inhibitory or mixed) is norepinephrine?
b) Through which type of receptors (metabotropic or ionotropic) and which secondary messengers are the biological effects of norepinephrine realized?
c) Which enzyme provides inactivation of this neurotransmitter.

16. For the purpose of differential diagnosis of pathologies of the nervous system, patients undergo lumbar puncture followed by biochemical examination.
a) In which pathologies does the activity of CPK-BB in the cerebrospinal fluid increase?
b) What is the clinical and diagnostic value of determining the glucose content in the cerebrospinal fluid?
c) Indicate the reasons for the increase in protein content in the cerebrospinal fluid.

17. Organophosphorus compounds (OPC) are neuroparalytic poisons used as insecticides and war poisons (sarin).
a) The concentration of which neurotransmitter increases with their action?
b) The activity of which enzyme inhibits OPC? Explain the mechanism.
c) What type of inhibitors do they belong to?

18. The baby has epileptiform seizures caused by vitamin B6 deficiency. The doctor believes that this is caused by a violation of the synthesis in the nervous tissue of the inhibitory mediator.
a) Name this mediator.
b) From which amino acid is it formed?
c) Name the enzyme and coenzyme of this reaction.

19. One of the neurotransmitters formed by successive hydroxylation and decarboxylation reactions is serotonin.
a) From which amino acid is it formed?
b) Describe the successive stages of serotonin production. Name enzymes and coenzymes.
c) Indicate the biological significance of serotonin.

20. The patient has neurological disorders, the content of ammonia in the serum is 120 μmol/l, blood pH - 7.50.
a) Comment on the results of the analysis.
b) What are the possible causes of this pathological condition?
c) Explain the mechanism of development of neurological disorders under these conditions.

21. 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 neutralization of ammonia in brain cells?
c) How does the activity of the Krebs tricarboxylic acid cycle change during the accumulation of ammonia in brain cells?

22. A 50-year-old woman complained to her doctor about high blood pressure, especially after stressful situations. Ultrasound revealed an increase in the right adrenal gland due to brain matter.
a) Violation of the secretion of which hormones is observed in this pathology? Name their chemical nature.
b) Specify the mechanism of action of these hormones.
c) Indicate the effect of these hormones on metabolism.

23. A patient with alcoholism has dysfunction of the nervous and cardiovascular systems, psychosis, memory loss, high levels of pyruvate and lactate in the blood.
a) Specify the name of the pathological condition.
b) What vitamin deficiency does the patient have?
c) Explain the mechanism of development of symptoms in the patient.

24. A newborn child has a progressive increase in jaundice, CNS damage. The content of indirect bilirubin in blood plasma - 340 μmol/l, direct bilirubin - 0 (absent), hemolysis of erythrocytes was not detected. The introduction of phenobarbital did not reduce the symptoms of jaundice.
a) Comment on the results of biochemical studies.
b) Name the type of jaundice.
c) Indicate the mechanism of neurotoxic action of indirect bilirubin.

25. 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.

26. 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?

27. Sleeping pill class is assigned to a patient with insomnia.
a) Name the mitochondrial enzyme for which this drug is an inhibitor.
b) Which coenzyme is a part of it?
c) By what principle are the coenzymes of the respiratory chain?

28. In 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.

29. 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.

30. In order to diagnose myocardial infarction in the serum determine the activity of CPK and AST.
a) Give the full names of these enzymes.
b) To which classes do they belong according to the International Classification of Enzymes.
c) Which of them has isoenzyme forms? Which isoform activity increases during a heart attack?

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