1. Arachidonic acid metabolites (derivatives) are well known inflammation mediators. What enzyme will release arachidonic acid from cell membrane lipids?
+Phospholipase
Cyclooxygenase
Lipoxygenase
Adenylate cyclase
Myeloperoxidase
2. There’s only one hormone among the neurohormones which is referred to the derivatives of amino acids according classification. Point out it:
+Melatonin
Thyroliberin
Vasopressin
Oxytocin
Somatotropin
3. 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:
+Glycerol
Diacylglycerol
Inositol-3,4,5-triphosphate
CAMP
Ca2+
4. Hypocalciemia can be caused by the violation of one hormone secretion. Point out this hormone:
+Parathyroid hormone
STH
ACTH
Thyroxin
Aldosterone
5. A 44-year-old woman complains of common weakness, heart pain, considerable increase of body weight. Objectively: moon-like face, hirsutism, AP- 165/100 mm Hg, height - 164 cm, weight - 103 kg; fat is mostly accumulated in the region of neck, upper shoulder girdle, stomach. What is the main pathogenetic mechanism of obesity?
Decreased production of glucagon
+Increased production of glucocorticoids
Increased production of mineralocorticoids
Increased production of insulin
Decreased production of thyroidal hormones
6. 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?
Aldosterone
+Catecholamines
Glucocorticoids
Thyroidal hormones
ACTH
7. Kidneys of a man under examination show increased resorbtion of calcium ions and decreased resorbtion of phosphate ions. What hormone causes this phenomenon?
Thyrocalcitonin
Vasopressin
+Hormonal form D3
Aldosterone
Parathormone
8. Secretion of which gastrointestinal hormones is primarily decreased in patient with removed duodenum?
+Cholecystokinin and secretin
Gastrin
Histamine
Gastrin and histamine
Neurotensin

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

10. A 2-year-old child experienced convulsions because of lowering calcium ions concentration in the blood plasma. What organ function is decreased?
+Parathyroid glands
Hyophysis
Adrenal cortex
Pineal gland
Thymus

11. 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 mitochondrial of cells?
+Uncouple oxidation and oxidative phosphorylation
Activates phosphorylation of substance
Stops phosphorylation of substance
Stops respiratory chain
Activates oxidative phosphorylation

12. Arterial hypertension is caused by the stenosis of the renal arteries in the patient. Activation of what system is the main link in the pathogenesis of this form of hypertension?
+Renin-angiotensin
Sympathoadrenal
Parasympathetic
Kallikrein-kinin
Hypothalamic-pituitary

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

14. Patient was on glucocorticoids for a long time, discontinuation of usage caused exacerbation of the illness, decreased BP, weakness. How can you explain it?
+Insufficiency of adrenal glands
Adaptation to the medicine
Sensitization
Hyperproduction of ACTH
15. The person has decreased diuresis, hypernatremia, hypokalemia. Hypersecretion of what hormone can cause such changes?
  +Aldosterone
  Vasopressin
  Auricular sodiumuretic factor
  Adrenalin
  Parathormone

16. Aspirin has antiinflammatory effect due to inhibition of the cyclooxygenase activity. Level of what biological active acids will decrease?
  +Prostaglandins
  Leucotriens
  Catecholamines
  Biogenic amines
  Iodinethyronyns

17. Periodic renal colic attacks are observed in the woman with primary hyperparathyroidism. Ultrasonic examination revealed small stones in the kidneys. What is the cause of the formation of these stones?
  +Hypercalcemia
  Hyperphosphatemia
  Hypercholesterinemia
  Hyperuricemia
  Hyperkalemia

18. A 50-year-old patient complains of thirst, drinking of a lot of water, marked polyuria. Blood glucose is 4.8mmol/L, urine glucose and acetone bodies are absent, urine is colorless, specific gravity is 1.002-1.004. What is the cause of polyuria?
  +Vasopressin insufficiency
  Hypothyroidism
  Insulin insufficiency
  Aldosteronism
  Thyrotoxicosis

19. 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 probable?
  +Steroid diabetes
  Insulin-dependent diabetes mellitus
  Myxoedema
  Type I glycogenesis
  Addison's disease

20. 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?
  Adrenal glands
  Testicle
  Ovaries
  Pancreas
  +Hypophysis

21. A patient with infectious mononucleosis had been taking glucocorticoids for two weeks. He was brought into remission, but he fell ill with acute attack of chronic tonsillitis. What action of glucocorticoids caused this complication?
  Antiallergic
  +Immunosuppressive
  Antitoxic
Antishock
Anti-inflammatory

22. Some diseases reveal symptoms of aldosteronism with hypertension and edema due to sodium retention in the organism. What organ of the internal secretion is affected on aldosteronism?
Hypophysis
Testicle
Ovaries
Pancreas
+Adrenal glands

23. A 46 year-old patient has complained of headache, fatigue, thirst, pains in the spine and joints for the last 2 years. Clinically observed disproportional enlargement of hands, feet, nose, superciliary arches. He notes that he needed to buy bigger shoes three times. What is the main reason of such disproportional enlargement of different parts of the body?
Increased sensitivity of the tissues to growth hormone
Joints dystrophy development
Joints chronic inflammation development
Increased sensitivity of the tissues to insulin
+Cartilaginous tissue proliferation under growth hormone influence

24. A man after 1.5 liter blood loss has suddenly reduced diuresis. The increased secretion of what hormone caused such diuresis alteration?
+Vasopressin
Corticotropin
Cortisol
Parathormone
Natriuretic

There is only one hormone among the neurohormones which refers to the derivatives of amino acids according to classification. Point it out:

25. A 52 year-old patient with bronchial asthma was treated with glucocorticoids. Fever reaction appeared as a result of abscess formation after injection. The patient had subfebrile temperature, which didn’t correspond to latitude and severity of inflammatory process. Why it was such low fever reaction?
+Inhibited endogen pyrogens production
Thermoregulation center inhibition
Violation of heat loss through lungs
Inflammatory barrier formation in injection place
Violation of heat-producing mechanisms

26. 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 messenger:
Diacylglycerol
+CAMP
Inositol-3,4,5-triphosphate
Ca2+
Glycerol

27. 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?
Ovaries
*Adrenal glands
Testicle
Pancreas
Hypophysis
28. Intake of oral contraceptives containing sex hormones inhibits secretion of the hypophysal hormones. Secretion of which of the indicated hormones is inhibited while taking oral contraceptives with sex hormones?
   Thyrotropic
   *Follicle-stimulating
   Somatotropic
   Oxytocin
   Vasopressin

29. Thyrotoxicosis leads to increased production of thyroid hormones T3 and T4, weight loss, tachycardia, psychical excitement and so on. How do thyroid hormones affect energy metabolism in the mitochondria of cells?
   Activate oxidative phosphorylation
   +Disconnect oxidation and oxidative phosphorylation
   Stop substrate phosphorylation
   Activate substrate phosphorylation
   Stop respiratory chain

30. Testosterone and its analogs increase the mass of skeletal muscles that allows using them for treatment of dystrophy. Due to interaction of the hormone with what cell substrate is this action caused?
   Membrane receptors
   Ribosomes
   *Nuclear receptors
   Proteins-activators of transcription
   Chromatin

31. The regulation of the water balance in organism is a function of:
   *Hypothalamus
   Thalamus
   Cerebellum
   Medulla oblongata
   Limbic system

32. Leukotrienes are a group of active substances derived from arachidonic acid by way of the lipoxygenase pathway in inflammation. Which is an INCORRECT in the following classic action of leukotriens?
   Vasodilatation
   Mediation of increased capillary permeability
   *Vasoconstriction
   Chemotaxis
   Bronchoconstriction

33. In addition to growth hormone, acromegaly is associated with an increased serum concentration of:
   *Insulin-like growth factor – 1 (IGF-1), somatomedin C
   ACTH
   FSH
   Prolactin
   TSH

34. Hypothyroidism is caused by all of the following EXCEPT:
   Thyroid adenoma
   Autoimmune causes
   Surgery, radiation therapy, or both
   Hereditary or developmental abnormalities
   *Iodine deficiency

35. Hypersecretion of ADH is associated with all of the following EXCEPT:
Diabetes insipidus
Water retention
* Dilution hyponatremia
Inability to dilute urine
An increased blood output
36. All of the following characteristics are associated with somatotropic adenoma EXCEPT:
* Inappropriate water retention
Gigantism
Hyperglycemia
Hypertension
Acromegaly
37. If a 19-year-old female was suffering from tachycardia in rest condition, weight loss, excessive sweating, exophtalmos and irritability, which hormone would you expect to found elevated in her serum?
* Thyroxine
Cortisol
Mineralocorticoids
ACTH
Insulin
38. Primary adrenocortical deficiency (Addison disease) is most frequently caused by:
* Autoimmune mechanism
Histoplasmosis
Tuberculosis
Amyloidosis
Metastatic tumor
39. A benign tumor of adrenal glands causes hypersecretion of aldosterone is:
* Conn’s disease
Addison’s disease
Cushing disease
Tetany
Hypertension
40. Which of the following is a characteristic of steroid hormones?
Activation of adenylate cyclase
Activation of protein kinases
Plasma membrane receptors
* Stimulation of cellular protein synthesis
Termination of effects by phosphodiesterase
41. Patient with diabetes mellitus type I has made himself a dose of prolonged insulin intravenous infusion in order to decrease high glucose blood level. Hypoglycemic coma has developed. Choose the mechanism of hypoglycemia development?
* Tissues glucose increased consumption
increased glucose excretion from organism by urine
glucagon secretion inhibition
glucose interaction with insulin
inhibition of gluconeogenesis and ketogenesis in liver
42. At the patient 27 years old after the carried sepsis the bronze color of skin is appeared, which is typical for Addison's disease. Which hormone secretion is on the mechanism of hiperpigmentation?
* Melanocute stimulating hormone
Somatotropic
Gonadotropic
B-lipotropic
Thyrotropic
43. For a woman 46 years old after an operation on a thyroid gland a fibrillar twitchings of 
muscles of hands, feet and face of person appeared soon. These violations can be removed by 
introduction of 
The triiodothyronine 
*Parathyroid hormone 
Thyrotropin 
Thyroxin 
Thyrotropin releasing hormone 
44. The patient with diabetes mellitus was delivered to a hospital in the state of 
unconsciousness. Kussmaul’s breathing, arterial pressure 80/50 mm HG, with the smell of 
acetone from a mouth. The accumulation of what matters in the organism can explain the 
origin of these disorders? 
Lactic acid 
Modified lipoproteines 
*ketone bodies 
Carbonic acid 
Complex carbohydrates 
45. For a patient the adenoma found out which takes a place from the cells of glomerular zone 
of adrenal cortex. A primary hyperaldosteronism or Conn’s disease developed as a result of it. 
On the exchange of which ion does this hormone influence an? 
Iron 
Chlorine 
Magnesium 
Calcium 
*Sodium 
46. Chronic insufficiency of adrenal cortex takes place for a patient (Addison’s disease or 
bronze disease). Insufficiency of what hormone does take a place on this pathological process? 
*Àldosterone 
Insulin 
Adrenalin (Epinephrine) 
Thyroxin 
Vasopressin 
47. In 1 – 2 days after a deletion of parathyroid gland on the dog is observed: a languor, thirst, 
sharp increase of nerve-muscular excitability with development of tetany. What violation of 
electrolytes exchange does take a place here? 
Hypercalcemia 
*Hypocalcemia 
Hypomagniemia 
Hypermagniemia 
Hyposodiumemia 
48. A sick person 44 years old complain of a common weakness, increase of body mass, 
growth of hair on face, stop of menstruation, arterial pressure of 165/100 mm HG. What will 
help to differentiate Cushing’s disease from the Cushing’s syndrome? 
A contents of 17 – ixi absentee in urine 
A level of cortisol in plasma 
*A level of corticotropin in blood plasma 
Roentgenenography (radiography) of the skull 
An amount of eosinophil in blood 
49. An obesity, hirsutism, "moon" face, purple scars on thigh skin were found in patient. 
Arterial pressure 180/110 mm HG, blood glucose -17,2] mmol/l. What are changes in adrenal 
gland hormones production such picture is posible?
Hypoproduction of mineralocorticoids
Hypoproduction of glucocorticoids
Hyperproduction of mineralocorticoids
*Hyperproduction of glucocorticoids
Hypoproduction of epinephrine

50. A sick person K., 35 years old complain on constant thirst, decreased appetite. The amount of dranked liquid is about 9 litres. A daily diuresis is increased; urine is bleached, relative density - 1005. The main possible reason of this pathology development in patient is damaging:
Basal membrane of glomerular capillary
Epithelium of kidney canaliculus
*Anterior pituitary
Epiphysis
Hypothalamus nucleiues

51. A sick person, 46 years old, the nonproportional increasing in size of hands, feets, nose, ears, superciliary arcs and malar bones. In blood - hyperglycemia, desorder in glucose tolerance test. The main posible reason of this pathology development is:
*Hypersecretion of somatotropic hormone
Hypersecretion of all hormones of adenohypophis
Hyposecretion of insulin
Hyposecretion of vasopressin
Hypersecretion of glucocorticoids

For a 6 years old child the hyperergic form of inflammation of top respiratory tracts developed. The threat of serious violation of breathing appeared, and that is why there was a necessity to apply antinflammation hormones. Among hormones a antiinflammation effect shows:

52. A 27 years old man appealed to the physician. At a examination was found out the increase of hand, feets and lower jaw. In addition there was deformation of joints (kiphosis), hormonal violations (impotence, atrophy of testicles). The functions of what gland is violate?
Corpus Pineale
Adrenal cortex
*Anterior hypophysis
Thyroid gland
Parathyroid glands

53. As a result of injuring for a patient the parathyroid gland was deleted, that was accompanied: by a weakness, thirst, sharp increase of nervo-muscular excitability. With what matter exchange violation is it related:
Molybdenum
Manganese
Chlorine
*Calcium
Zinc

54. A patient stings on enhanceable irritability, periodic subfebrile temperature. Frequency of pulse - 120 per minute. The amount of T3 and T4 hormones in blood is scaled-up. What endocrine pathology most logically suspected?
*Hypothyroidism
Adrenal insufficiency
Hypoparathyroidism
Hyperparathyroidism
Hyperthyroidism

55. With the purpose to suppress the autoimmune reactions after transplantation of organs obligatory is a course of hormonotherapy. What hormones have to be applied from this purpose?
*Glucocorticoids
Mineralocorticoids
Sex hormones
Adrenalin (Epinephrine)
Somatotropic hormone
56. For a patient with pneumonia there was a fever. What directly does cause the change of adjusting point of temperature in the neurons of hypothalamus of this patient?
Endotoksin
*Prostaglandins PGÅ1, PGÅ2
Exotoxin
Interleykin-2
Thrombocyte growth factor
57. In laboratory animal by the intravenous injection of alloxone the experimental diabetes mellitus was evoked. What is the mechanism of this substance action?
Formation of antibodies to insulin
Binding of Zinc
*The ?-cells of pancreatic islands damaging
Activation of insulinase
Activation of contrinsulin hormones formation
58. A 53 years old woman has a 163 sm height, a bodyweight is 92 kg, deposition of fat is even, a person face is puffy, not mobile and apathetical. There is a fossula at pressure of skin of leg. What gland parafunction is the cause of illness?
Gonads
Hypophysis
Adrenal gland
*Thyroid
Parathyroid
59. A patient on the early stage of diabetes mellitus has polyuria. What is the cause of it?
*Hyperglycemia
Ketonemia
Hypocholesterolemia
Hypercholesterolemia
Hyperkalemia
60. A patient 48 years old has a hypertension, head pain, muscular weakness, convulsions. In blood the concentration of K+ is decreased and the concentration of Na+ is increased, which is the result of hypersecretion of:
Adrenalin
*Aldosterone
Parathyroid hormone
Cortisol
Dihydrocholesterol
61. At the simulation of inflammation of lower extremity in animal the temperature of body rise, the content of antibodies and leucocytes was increased in blood. What matters did stimulate development of these common reactions of organism at inflammation?
Leukotrienes
Glyucocorticoids
Mineralocorticoids
*Interleukins
Somatomedins
62. For a woman with primary hyperparathyreoidism periodically the attacks of nephrocolic repeat. An ultrasound inspection rotined the presence of small stones in kidney. What is the most probable reason of its formation?
Hyperkalemia
Hyperphosphatemia
Hypercholesterolemia
Hyperurikemia
*Hypercalcemia

63. A 38 years old woman grumbles about a general weakness, pain in the heart area, increase of appetite, absence of menstruations. Objectively: height is about 166 sm, bodyweight 108 kg, a “moon like” face, deposition of subcutaneous adipose tissue mainly in the high limb area, trunk; on the skin of thighs, stomach bloody- red stripes, pulse of 62 per minute, AP-160/105 mm HG. All this states are most characteristic for:
Myxoedema
Alimentary obesity
*Cushing’s disease
Insulinoma
Babinskiy-Frelikh syndrome

64. A 26 years old woman complaint about a present general weakness, loss of body mass on 18 kg, absence of menstruations, is ill already 1 year, after confinement; she had a difficult confinement, accompanied by bleeding. Objectively: 168 sm height, bodyweight 53 kg, hypoplasia of mammary glands. The syndrome of Shikhena is diagnosed. What is the basic mechanism of loss of weight for a woman?
Hypothyroidism
Decline of gonads function
Decline of adrenal cortex function
*Decreased production of adenohypophysis hormones
hypoparathyroidism

65. In patient under investigation revealed hirsutism, "moon like”face, on the skin of thighs, stomach bloody- red stripes. Arterial blood pressure is 190/100 mm HG, glucosemia - 17,6 mmol/l. In what of indicated pathology types this picture appears?
*Hyperfunction of adrenal cortex
Hyperthyroidism
Hypothyroidism
Hypofunction of gonads
Hyperfunction of insulin

66. In patient determined presence of hyperglicemia,polyuria, hyperstenuria and glucoseuria. For what form of metabolism pathology this combination typical?
Kidney diabetes
*Diabetes mellitus
Diabetes insipidus
Glycogenosis
Diencefalon obesity

67. Patient 18 years old, after the carried rubeola (german measles) began to lose of weight, constantly felt dryness in a mouth, thirst, appetite is increased, frequent urination began. Objectively: dayly amount of urine - 6 litres, glucosemia - 17 mmol/l, glucose and acetone are found in urine. What disease did arise up for a patient?
Secondary diabetes mellitus
Symptomatic diabetes mellitus
*²insulin depended diabetes mellitus
²nsulin independent diabetes mellitus
Steroid diabetes

68. The woman 23 years old entered to hospital with a diagnosis acute pneumonia. She fall ill sharply, 2 days back, when a chill with a fever to 39°С, weakness, dry cough appeared. What from the enumerated neurohumors of inflammation has endogenous pyrogen characteristics?
Serotonin
69. Woman 55 years old, which lives in mountain locality, an endemic goitre is diagnosed. Objectively: a bit enhanceable wellnourishment, slow down, apathetical, increase of thyroid gland size. The deficiency of what element can cause it?
- Sodium
- Fluorine
- Manganese
- Molybdenum
- *Iodine

70. An endemic goiter is diagnosed in boy. What is the basic mechanism of hypothyroidism development at boy?
- *Decreased production of thyroxine and triiodothyronine
- Decline production of thyrotropin
- Decline sensitivity of tissues receptors to thyroxine and triiodothyronine
- Increased metabolism of thyroxine and triiodothyronine
- Violation of thyroxine and triiodothyronine transport

71. A man 46 years old, who suffered on diffuse toxic goitre, an operation of thyroid gland resection was conducted. After an operation an absence of appetite, dyspepsia, increased neuromuscular excitability are marked. Mass of body was not increased. The temperature of body is normal. What from transferred below the state of man is conditioned?
- Decline production of thyroxine
- *Decline production of parathormone
- Increased production of calcitonine
- Increased production of thyroliberin
- Violation of thyroxine production

72. Man of 42 years old, which suffers on an top type obesity (high limb area, a “moon like” face), AP is 160/95mm HG, glucose of blood - 8.0 mmol/l. The level of cortisol contents in blood is enhanced, but adrenocorticotropic level is reduced. What most reliable cause of hypercorticoidism development?
- Diminishing of statins production
- Hormonprodusing tumour of anterior pituitary
- *Hormonprodusing tumour of adrenal cortex
- Increase of corticoliberin production
- Diminishing of sex hormones production

73. For a patient with diabetes mellitus the processes of regeneration are reduced, wounds do not heal over long. With what changes in the metabolism is this related?
- Diminishing of glucose entering to the cells
- By the accumulation of ketone bodies
- Acidosis
- *Depression of proteins synthesis
- Violation of lipids metabolism

74. With the purpose of prevention of seizure of transplanted organ after transplantation obligatory course of endocrinotherapy is conducted with the purpose of immunosuppression. What hormones can be used?
- Thyroid
- Mineralocorticoids
- Sex hormones
- Catecholamines
- *Glucocorticoids
75. By the method of nondirect calorimetry it was identified, that basic metabolism of the person is on 40% below to necessary. Violation of what gland activity can be assumed?
*Thyroid glands
Thymus
Pancreas
Epiphysis
Parathyroid gland

76. At 50 years old person after the carried infectious disease of cerebrum a diuresis was significantly increased to 12 l/day. At a blood test a glucose level was 4,1 mmol/l. What hormone deficiency is the cause of it?
Glucagon
*Vasopressin
Insulin
Cortisol
Aldosterone

77. Clinically was observed, what under pregnancy the gravity of rheumatoid arthritis symptoms sharply decreased. Acceleration of what hormones secretion with antiinflammatory action can be present on this case?
Thyroid gland hormones
Estrogens
*Glucocorticoids
Catecholamines
Gonadotropins

78. A woman 29 years old grumbles about a general weakness, loss of body mass on 22 kg, amenorrhea. It is ill after births. Objectively: growth - 162 sm, body mass - 46 kg, hypoplasia of mammary glands. A hypophisial cachexy is diagnosed. What hormone production diminishing was most substantial in get thin?
Melanotropin
Adrenocorticotropicin
Thyreotropin
*Somatotropin
Prolaktotropin

79. In the emergency department a unconscious patient is delivered with the smell of acetone from an oral cavity. The methods of express-analysis expose glucose in blood - 17,3 mmol/l. The increase of what matters maintenance did result in the loss of consciousness?
Glucose
Lactic acid
*ketone bodies
Fat acids
Urea

80. For a patient it is set stable fervescence, excess heart beating, emotional lability, tremor. With what hormon production changing is this state connected?
Aldosterone
Vasopressin
Testosteron
*Thyroxiine
Insulin

81. One of dangerous moments in pathogenesis of myocardium necrosis there is subsequent growth of necrosis areas, dystrophy and ischemia. A important rolehere is in belongs to the increase of oxygen consumption by myocardium. What matters are assist in this process?
*Catecholamines
Acetylcholin
Adenozin
Cholesterol
Chlorine ions
82. The woman 44 years old grumbles about a general weakness, pain in the area of heart, considerable increase of body mass. Objectively: a person í”́ë³ñòë³ãîä³áíå|, ã³ðñóòèçì|, AP is 165/100 mm HG, growth is 164 mm, weight is 103 kg, mainly accumulation of fat on a neck, high limb area, stomach. What is the basic pathogenic mechanism of obesity for a woman?
Increase of insulin products
Decline of thuroid gland hormones production
*Increased glucocorticoids production
Decline of glucogon production
Increase of mineralocorticoids production
83. A patient with the lungs inflammation has a high temperature. What bioactive matter does play a leading role in the origin of this display?
Serotonin
Gistamin
Bradykinin
*Interleukin-I
Leukotrienes
84. After a stroke (cerebral thrombosis) with the defeat of hypothalamus nucleuses a patient had diabetes insipidus. What did become reason of increased urine formation for this patient?
Acceleration of glomerular filtration
Diminishing of sodium reabsorption
Decline of arterial pressure
Hyperglycaemia
*Diminishing of water reabsorption
85. For a patient with the inflammatory process of skin and hypoderm with chronic course found out predominance of proliferation processes. The deficiency of what hormone can result it?
*Cortison
Aldosterone
Insulin
Somatotropic hormone
Thyroxin
86. A patient 50 years old grumbles about thirst, drinks much water, polyuria is expressed. Blood glucose - 4,8 mmol/l, in urine glucose and acetone ar absent, urine is colourless, relative gravity 1,002-1,004. What reason of polyuria?
Hypopthuroidism
*Deficiency ADH
Insulin insufficiency
Aldosteronizm
Thyrotoxicosis
87. At patient 39 years old ovary concerning malignant tumours were removed. In 2 years later a hirsutism appeared, voice is coarsen, a physigue build get masculine (male) signs. What from hormonal changes is underlay on given pathology?
Strengthening of prolactin production
Absence of progesteron
*Decrease of estrogens
Decline of androgens production
Hypofunction of adrenal cortex
88. For a patient with cirrhosis of liver a hypertension, muscular weakness, periodic cramps appeared. In blood – Na⁺ content is increased and K⁺ content is decreased. What from diminished types of endocrine violations underlay this symptomocomplex?
Hyperpituitarism
Hypopituitarism
Primary aldosteronism
*Secondary aldosteronism
Hypoaldosteronism

89. For mise with the inherited obesity a hyperglycemia and lowering of insulin receptors amount in lipocytes is established. What pathogenic mechanism is primary in strengthening of lipogenesis for these animals?
*Hyperinsulinemia
Hypoinsulinism
Hypertrophy of lipocytes
A decline tolerance to glucose
Increase deposition of fats

90. Patient a 16 years old, who suffer on Cushing’s disease, was consulted about excess body weigh. At questioning elucidated, that energetic value of consumed food is 1700-1900 kkal/day. What is the primary reason of obesity in this case?
Deficiency of insulin
Excess glucocorticoids production
*Excess of insulin
Deficiency of glucocorticoids
Hypodinamia

91. A hypertension for a patient is dependent on stenosis of kidney arteries. Activation of what system is a main link in pathogenesis of this form of hypertension?
Parasympathic system
Sympato-adrenal system
*Renin-angiotensin system
Hypothalamo-hypophyseal
Calicrein-kinin system

92. A patient with chronic heart insufficiency have edemata of lower extremities. Extra activation of what system is the main link of this pathology?
Parasympathic
Hypothalamo-hypophyseal
Sympatho-adrenalal
*Renin-angiotensin-aldosterone system
Calicrein-kinin system

93. For a patient what receive the prolonged course of glucocorticoids treatment, found out ulcers in a stomach. What mechanism is main in their development?
Decline of parasympathic nervous system tone
A decline of Histamin in the mucus shell of stomach
Increase of sympathetic nervous system tone
Increase of prostaglandin E1, E2 production
*Increase of secretion and acidity of gastric juice

94. For a patient with a hemorrhage in the posterior hypophysis there was polyuria and diminishing of vasopressin level in blood. What is the main mechanism of polyuria development in this case?
*Diminish of water reabsorption in kidney canaliculus
An increase of water filtration in glomerulis
An increase of sodium reabsorption in canaliculus
Diminishing of sodium reabsorption in canaliculus
Increase of potassium excretion

95. The prolonged use of mineralocorticoids resulted in appearance of muscular weakness in the patient. What is underlay on pathogenesis of this phenomenon?
*Hyperkalemia
Hypokalemia
Hypernatremia
Hyponatremia
Hypervolemia

96. A patient appealed to the physician with complaints on pain in a head, changes in extremities, increase of hands and feet size. Objective: massive superciliary arcs, lips. At surplus of what hormone such symptoms appear.
Thyroid hormone
Adrenocorticotropic hormone
*Somatotropic hormone
Glucocorticoids
Adrenalin

97. Patient K., 45 years old enter to endocrinologycal department with complications on pain in a head, thirst, nikturia, periodical attack of cramps, increase of arterial pressure. About 6 months ago the diagnosis of primary aldosteronism was delivered (Conn’s disease).
Hyperfunction of what hormones cause this pathology?
Adrenocorticotropic hormone
Catecholamines
Glucocorticoids
*Aldosteron
Thuroid gland hormones

98. Patient Í., 25 years old, after carried infection a diabetes insipidus developed. Deficiency of what hormone lead to this patology formation?
Vasopressin
Aldosteron
Cortisol
Renin
*Insulin

99. Patient D., 50 has a diagnosis “Myxedema”. Disorder of what hormones formation can lead to this pathology development?
Cortisol and aldosterone
*Tyroxine and triiodothyronin
ACTH and STH
Oxitocin and vasopressin
Insulin and glucogon

100. For a girl an adrenogenital syndrome is diagnosed (pseudohermafroditism). Surplus secretion of what hormone of adrenal cortex did stipulate this pathology?
Adrenalin
Estrogen
Aldosterone
Cortisol
*Androgens

1. Patient with carcinoma has the insufficiency of vitamin B5, serotonin concentration at blood is extremally increased. What is the reason of this state?
Infringement of serotonin metabolism in organism
+Tryptophan mainly turns in serotonin
Alimentary deficiency of vitamin PP
Increased use of vitamin PP
Serotonin promotes reduction of vitamin PP in an organism

2. After epileptic attack the baby was examined by the pediatrist, baby is given artificial meal. Dermatitis was also diagnosed. After laboratory tests the decrease of alanin - and aspartataminotransferase level activity of erythrocytes was detected. What vitamin insufficiency can be detected?
   Cobalamin
   Ackorbinic acid
   +Pyridoxine
   Riboflavin
   Calcipherol

3. During obstructive jaundice deficiency of protrombin is often registered. Deficiency of what vitamin is it connected with?
   E
   B6
   A
   D
   +K

4. The symptoms of rickets at child (4 month). Digestion disturbance are not registered. The child spends much time outdoors(sun bathes). During 2 months the child received vitamin D3, however rickets symptoms have not decreased. What is the possible explain of rickets development at this child?
   Infringement of calcitryol synthesis
   Infringement of calcitonin synthesis
   +Infringement of parathormon synthesis
   Infringement of thyroxin synthesis
   Infringement of insulin synthesis

5. Treatment of some infectious diseases which are caused by bacterias is based on, sulfanilamide medicines, these medicines block synthesis of the growth factor of bacteria. Choose the mechanism of sulfanilamide’s medicines:
   Inhibition of absorption of folic acid
   +these drugs are antivitamins of paraaminobenzoic acid
   inhibitor of same enzymes
   these drugs take part in oxide-redactions reactions
   these drugs are allosteric enzymes of paraaminobenzoic acid

6. On reception to the doctor the patient with symmetric dermatitis of open sites of skin has come. From patient’s story it is established that he eats, basically, sereals and few meat, milk and eggs. Deficiency of which vitamin is principally detected?
   Folic acid
   Calciferol
   +Nikotinamide
   Biotin
   Tokoferol

7. Carrot, pumpkin and other red vegetables contain carotin. Defficiency of what vitamin is supplied with these vegetative pigments?
   Tokoferol
8. Avitaminosis of what vitamin can significantly decrease the aminotransferesis activity in blood serum?
B9, folic acid
B1 thiamin
B2 riboflavin
B5 nicotinic acid
B6 pyridoxine

9. At woman for a long time is on a diet with cleared rice, polyneuritis (illness beriberi) was diagnosed. What vitamin insufficiency at food leads to development of this disease?
Thiamin
Ackorbinic acid
Pyridoxine
Folic acid
Riboflavin

10. Patient has disturbance in calcium absorption processes in intestine after removal of gold bladder. What vitamin will stimulate this process?
PP
D3
C
B12
K

11. The symptoms of beriberi are present at the patient. Activity of what enzyme is broken at the patient?
Malate dehydrogenase
Citrate sintatese
Pyruvate dehydrogenase
Suktsinate dehydrogenase
Fumarase

12. At the patient with frequent bleedings from an internal organs and mucous membrane, proline and lysine as a part of collagen’s fibers are found out. What vitamin absence causes hydroxylation of proline and lysine?
Thymine
B1
A
C
E

13. At the patient, which accepts anticoagulants of indirect action, decrease of prothrombin level from 0, 15 g/l to 0, 05 g/l is detected. Prothrombin takes part in the second phase of blood clotting - formations of thrombin. It has taken place as a result of:
Decrease of quantity of globulin of blood
Deficiency of vitamin B12
Deficiency of vitamin C
Decrease of concentration of Ca ++  
+Deficiency of vitamin K

14. Increased concentration of pyruvate is detected at the patient’s blood and urine. What avitaminosis is observed at the patient?
+Avitaminosis B1  
Avitaminosis E  
Avitaminosis B3  
Avitaminosis B6  
Avitaminosis B2

15. Anticoagulant pelentan was prescribed to the patient with thromboembolitic illness. What vitamin antagonist is this compound?
Vitamin C  
Vitamin E  
Vitamin A  
Vitamin D  
+Vitamin K

16. At patient a night blindness ( nyctalopia) is detected. What of the low listed substances will have medical effect?
Karnitin  
Keratin  
Kreatin  
+b Carotene  
Karnozin

17. The patient complains on general weakness and bleeding from gums. What vitamin lack can cause such state?
Vitamin A  
Vitamin E  
+Vitamin C  
Vitamin H  
Vitamina D

18. During child (age of 11 months) examination by pediatrist, bended bones of the low limbs and retardment of bones mineralization of skull were found. What vitamin lack leads to the pathology?
Thiamin  
+Cholecalciferol  
Pantothenic acid  
Bioflavonoid  
Riboflavin

19. During treatment of inflammatory process (Infectious process) by antibiotics, infringement of blood clotting at patient emerged, as a result of suppression of intestines microflora. Insufficiency of what vitamin is detected at the patient?
+K  
B1  
D  
C  
B12
20. The patient has symptoms of diarrhoea, dementia and dermatitis as a result of wrong diet. Lack what of vitamin causes these state?
Vitamin B1
+Vitamin pp
Vitamin B2
Vitamin C
Vitamin B12

21. The patient suffers from pernicious anemia. The patient eats normally. One month ago he had operation on a stomach. What is reason of the anaemia?
Deficiency of folic acid in food
Deficiency of vitamin C
Deficiency of vitamin PP in food
Deficiency of proteins in food
+Deficiency intrinsic factor Castle

22. During routine inspection of a child the retardment of a bones mineralization was revealed. What vitamin lack could serve the reason of this?
Folic acid
Riboflavin
Tocopherol
+Calciferol
Cyanocobalamin

23. Hydroxyproline is the important amino acid in the structure of collagen. Which vitamin does help in formation of this amino acid by hydroxylation of proline?
B2
D
B1
+C
B6

24. During enterobyosis structural analogue of vitamin B2- acrachine is used. What enzymes synthesis infringement at microorganisms causes this medicines?
Peptidase
Cytochrome oxidase
+FAD- dependent dehydrogenase
NAD - dependent dehydrogenase
Aminotransferase

25. The 10 year-girl is often affected respiratory infections. After respiratory infections plural hemorrhage dot in places of a friction of clothes are observed. Specify what hypovitaminosis has taken place at the girl.
B6
+c
B1
And
B2

26. Vitamin therapy was prescribed to the pregnant woman who had some spontaneous abortions in the anamnesis. Specify vitamin, which promotes carrying of a pregnancy.
Folic acid
+@-tocopherol
Cyanocobalamine
Pyridoxin
Rutin

27. At the child (6 month) frequent and strong hypodermic bleedings were observed. An appointment of synthetic analogue of vitamin K (vicasol) has given positive effect. This vitamin takes part in carboxylation of glutamate in molecules of blood factor (coagulation proteins). Specify this protein?
Antihemophilic globulin, factor VIII
fibrinogen
The factor of Hageman
+Prothrombin, factor II
Rosenthal’s factor

28. At patients, with obturation of the general bile duct, hemorrhages arise, which are connected with bad absorption of vitamin:
E
+k
K
D
F

29. Patient suffers from diarrhoea, dementia and dermatitis. At the anamnesis is known that the basic foodstuff of the patient is corn. These infringements are connected with bad mastering of vitamin:
Vitamin B1
+Vitamin pp
vitamin B2
vitamin B9
vitamin B8

30. The oculist has found out increase of adaptation time of an eye to the darkness at patient. What vitamin insufficiency can cause such symptoms?
Vitamin C
Vitamin E
+Vitamin A
Vitamin K
Vitamin D

31. The patient complained on the general weakness and bleeding from gums. What vitamin insufficiency can it be at patient?
Vitamin B1
Vitamin E
Vitamin PP
Vitamin D
+Vitamin C

32. During examination of the patient diarrhoea, dementia and dermatitis are diagnosed. Specify absence of what vitamin is the cause of this state.
Ascorbic acid
33. The megaloblastic anemia is diagnosed at the patient. Specify the substance which insufficientcy can cause the development of this illness.

Cholecalciferol
Glycine
Copper
+Cyanocobalamine
Magnesium

34. At patient, with frequent bleedings in to visceral organs and mucous membranes, in the structure of collagen fibers proline and lysine were found out. Absence of what vitamin causes such infringement of hydroxylation of this amino acid?

Vitamin E
+Vitamin C
Vitamin K
Vitamin A
Vitamin D

35. According with clinical symptoms pyridoxalphosphate was prescribed to the patient. For what processes correction this medicine is recommended?

+Transamination and decarboxylation of amino acids
Oxidative decarboxylation of keto acid
Deamination of amino acids
Synthesis purine and pyrimidine bases
Synthesis of proteins

36. Dermatitis has appeared at patient after eating raw (unboiled) eggs. What avitaminosis has emerged?

Avitaminosis of folic acid
+Avitaminosis of biotin
Avitaminosis of pantothenik acid
Avitaminosis of paraaminobenzoic acid
Avitaminosis of inositol

37. A pyruvate concentration is increased at the patient’s blood. The much pyruvate is excreted via urine. What avitaminosis is observed at the patient?

avitaminosis of vitamin B6
avitaminosis of vitamin E
avitaminosis of vitamin B3
+avitaminosis of vitamin B1
avitaminosis of vitamin B2

38. The patient has symptoms of pellagra. During interrogation it became known that throughout long time he ate mainly corn and little meat. What became the cause of pellagra?

Deficiency proline in corn
Deficiency tyrosin in corn
+Deficiency tryptophan in corn
Deficiency alanine in corn
Deficiency hystidine in corn

39. During various diseases level of active forms of oxygen increases extremly that leads to destruction of cellular membranes. For prevention of it antioxidants are used. Strong natural antioxidant is:
   Glucose
   +@-tocopherol
   Vitamin D
   Fatty acids
   Glycerine

40. The newborn child has symptoms of hemorrhagic illnesses which connected with vitamin K hypovitaminosis. This disease is caused by inhibition of the vitamin K biological role, which:
   inhibits synthesis of heparin
   Is cofactor of prothrombin, factor II
   Is specific inhibitor of antithrombin
   Influences on proteolytic activity of thrombin
   +Is cofactor @-glutamat - carboxylase

41. Morbidity along large nervous trunks and the raised pyruvate level in blood is found out at the patient. What vitamin insufficiency can cause such changes?
   PP
   B2
   +b1
   Pantothenic acid
   Biotin

42. Most participants of Magellan expedition to America died from avitominosis. This disease debuted with general weakness, subcutaneous hemmorhages, falling of teeth, gingival hemmorhages. What is the name of this avitiminosis?
   Biermer's anemia
   Pellagra
   Rachitis
   Polyneuritis (beriberi)
   +Scurvy

43. While examining the child, doctor found symmetric cheeks roughness, diarrhea and disfunction of the nervous system. Lack of what food components caused it?
   Threonine, pantothenic acid
   Methionine, lipoic acid
   Lysine, ascorbic acid
   +Nicotinic acid, tryptophane
   Phenylalanine, pangamic acid

44. It is known that the collagen molecule contains amino acids (oxyproline, oxylysine). Which one of the listed low substances takes part in hydroxylation of proline and lysine during synthesis?
   Asparaginic acid
   Folic acid
   Pantothenic acid
   Glutamic acid
45. At the newborn spasms are registered, they've disappeared after appointment of vitamin B6. This effect is most possibly caused by the fact that vitamin B6 takes part in formation of:
- histamine
- non-essential amino acids
- heme
- γ-aminobutyric acid (GABA)
- Nicotinamide

46. At the young man 20 years old macrocytic anaemia has emerged, increased level of methyl malonic acid is registered in urine. It is first of all caused by deficiency of:
- Pantothenic acid
- Nicotinic acid
- Cyanocobalamin
- Ascorbic acid
- Biotin

47. The gerontology institute advises to old people to use a complex of vitamins which contains vitamin E. What main function does it carry out?
- Antiscorbutic function
- Antihemorrhagic function
- Antioxidant function
- Antineuritic function
- Antidermatitic function

48. After a course of therapy the doctor offers to the patient with an ulcer of a duodenum to use cabbage and potato juices. What substances in this food promotes preventive maintenance and healing of ulcers?
- Pantothenic acid
- Vitamin U
- Vitamin C
- Vitamin B1
- Vitamin K

49. The doctor advises to use half-cooked liver in ratio of the patient during treatment of pernicious anemia. What vitamin presence in this product will have medical effect?
- Vitamin b12
- Vitamin B1
- Vitamin B2
- Vitamin C
- Vitamin H

50. At the man who did not received fats with meal for a long time, but received enough of carbohydrates and proteins, dermatitis, bad healing of wounds, sight deterioration are found out. What is the cause of metabolism infringement?
- A lack of palmitic acid
- A lack of linoleic acid, vitamins A, D, E, K
- A lack of vitamins PP, H
- Low caloric content of diet
- A lack of oleic acid
51. People, who suffers from alcoholism, receive main part of calories with alcohoholic beverages. They can have a characteristic insufficiency of thiamine (a syndrome of Wernicke), which causes a nervous system functions infringement, psychoses, memory loss. With what enzyme activity inhibition is it connected?
Transaminase
Alcohol dehydrogenase
+Pyruvate dehydrogenase
Aldolase
Hexokinase

52. Treatment of the child who suffers from rickets with vitamin D did not give positive results. What is the most plausible reason of treatment inefficiency?
Raised use of vitamin D by microflora of intestines
Insufficiency of lipids in meal
Infringement of vitamin D inclusion to enzyme
+Infringement of vitamin D hydroxylation
Infringement of vitamin D transport by blood proteins

53. At person who suffers from alcoholism, hypovitaminosis B1 is often observed, which is the reson of diet infringements. Symptoms of B1 hypovitaminosis are the nervous system frustration, psychoses, memory loss. Why cells of a nervous tissue are especially sensitive to vitamin B1 deficiency?
Decreases intensity of glycolysis
Amplifies lipolysis in adipose tissue
Oxidation of fatty acids is broken
Intensity of glycolysis is raises
+Infringement of glucose aerobic oxidation

54. After treatment with antibiotics as a result - fringement of intestine microflora is possible with development of hypovitaminosis:
D
C
A
p
+b12

55. For treatment of malignant tumours methotrexate (structural analogue of Folic acid) is prescribed which is the competitive inhibitor of dehydrofolatreductase and consequently suppresses synthesis of:
Glycerophosphates
Monosaccharides
Fatty acids
+Nucleotides
Glycogen

56. Vitamin A in a complex with specific cytoreceptors penetrates through a nuclear membrane and induces transcription processes, which stimulate the growth and differentiation of cells. This biological function is realised through the following form of vitamin A:
Retinol
Tranc-retinal
Cis-retinal
+Trans-retinoic acid
57. Malignant macrocytic anaemia – Birmer disease – is a result of vitamin B12 lack. What microelement is a part of this vitamin?
Zinc
Molybdenum
+Cobalt
Iron
Magnesium

58. During parodontosis treatment an antioxidant of a natural and artificial origin is used. Specify, what of natural compounds is used as antioxidant?
Gluconate
Thiamine
+Tocopherol
Pyridoxine
Choline

59. At patients, with impassability of bile-excreting ducts, infringement of blood coagulation bleedings emerge which are the consequence of wrong metabolism of vitamin:
A
K
D
+k
Carotene

60. At the patient such changes are registered: sight infringement in dark, dryness of conjunctiva and cornea. Such infringements can emerge because of deficiency of:
Vitamin B
+Vitamin A
Vitamin C
Vitamin D
Vitamin B12

61. After resection of 2/3 of stomach erythrocytes quantity has decreased in blood, erythrocytes volume has increased, haemoglobin level has decreased. Deficiency of what vitamin leads to such changes in blood?
P
C
P
B6
+b12

62. At what hypovitaminosis simultaneous infringement of reproductive function and a dystrophy of skeletal muscles are observed?
+Vitamin e
Vitamin A
Vitamin K
Vitamin D
Vitamin B1
63. At the patient of 37 years after a long application of antibiotics, raised hemorrhagic bleeding from small damages is observed. At blood – decrease in activity of blood coagulation factors II, VII, X, lengthening of blood coagulation time. Deficiency of what vitamin has caused such changes?
Vitamin C
Vitamin A
+Vitamin K
Vitamin D
Vitamin E

64. At the patient of 36 years old who suffers from chronic alcoholism, accumulation of pyruvate is registered in blood, in erythrocytes – transketolase activity is decreased. What coenzymes form of the vitamin which insufficiency causes noted changes?
Pyridoxal phosphate
Carboxybiotin
Methyl cobalamin
+Thiamine pyrophosphate
Tetrahydrofolate

65. At the 43-years-old patient the megaloblastic hyperchromic anaemia is observed, atrophic chronic gastritis. MethyImalonyl in urine is raising. Insufficiency of what vitamin has caused occurrence of these symptoms?
+Vitamin b12
Vitamin B2
Vitamin B3
Vitamin B5
Vitamin B1

66. For diagnostics of some diseases, aminotransferase activity is researched in blood. What vitamin is a coenzyme of these enzymes?
+Vitamin B6
B2
B1
B9
B5

67. At the child of 2 years after a long antibiotic therapy the dysbacteriosis has developed: almost total absence of Escherichia coli. Insufficiency of which group vitamins can emerge in connection with a dysbacteriosis?
B
b+
C
E
D

68. At the patient frequent bleedings from internal organs and mucous membranes are observed. The analysis has defined insufficiency of hydroxyproline and hydroxylysine as a part of collagenic fibres. Lack of what vitamin does bring disturbance in the process of hydroxylation of these aminoacids?
Vitamin K
Vitamin A
Vitamin H
69. The oxidative decarboxylation of \( \alpha \)-ketoglutarate is broken because of vitamin B1 deficiency. Synthesis of what coenzyme is broken?
- Nicotinamide adenine dinucleotide (NAD)
- Thiamine pyrophosphate (TPP)
- Flavine adenine dinucleotide (FAD)
- Lipoic acid (LA)
- E.Coenzyme A

70. According to clinical symptoms, pyridoxalphosphate was prescribed to the patient. For correction of what processes this medicine is recommended?
- Deamination of purine nucleotides
- Oxidative decarboxylation of keto-acid
- Transamination and decarboxylation of amino acids
- Synthesis of purine and pyrimidine nucleotides
- Synthesis of proteins

71. Hypovitaminosis of vitamine C leads to reduction of organic matrix formation, to infringement of collagen synthesis because this vitamin takes part in processes of:
- Proline carboxylation
- Proline hydroxylation
- Lysine carboxylation
- Arginine hydroxylation
- Tryptophan hydroxylation.

72. Gingival hemorrhage has sharply emerged to the patient. What vitamins should be prescribed to this patient?
- C, K
- B1, B2
- C;K
- B12
- Biotin, pantothenic acid

73. The peripheral blood smear of a severely anemic patient reveals oval macrocytes (color index = 1,5) hypersegmented neutrophils and decreased platelets. Simultaneously he had severe lifelong achylic gastritis. The most likely anemia is:
- Megaloblastic B12- folate deficiency anemia
- Aplastic anemia
- Iron deficiency
- Thalassemia major
- Sickle cell anemia

74. If there is insufficiency of thiamine - vitamin B1, bery-bery desiase (polyneuritis) and carbohydrate metabolism disorder occure. What metabolite accumulates in blood during these processes?
- Malate
- Lactate
- Succinate
- Citrate
- Pyruvate
75. Patient with hypochromic anemia has splitting hair and loss of hair, increased nail brittling and taste alteration. What is the mechanism of these symptoms development?
Deficiency of iron-containing enzymes
Deficiency of vitamin B12
Decreased production of parathyroid hormones
Deficiency of vitamin A
Decreased production of thyroid hormones.

76. Increased vessels, enamel and dentine destruction at scurvy patients are caused by disorder of collagen maturing. What stage of procollagen modification is damaged during this avitaminosis?
+Hydroxylation of proline
Formation of polypeptide chains
Glycosylation of hydroxylysine residues
Removal of C-ended peptide from procollagen
Detaching of N-ended peptide.

77. 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?
+Avitaminosis b1
Avitaminosis E
Avitaminosis B3
Avitaminosis B6
Avitaminosis B2

78. There is an inhibited coagulation in the patients with bile ducts obstruction, bleeding due to the low level of absorbtion of a vitamin. What vitamin is in deficiency?
K
+k
D
A
Carotene

79. Pyruvate concentration in the patient’s urine has increased 10 times from normal amount. What vitamin deficiency can be the reason of this change:
Vitamin B6
Vitamin A
Vitamin E
Vitamin C
+Vitamin B1

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

81. A 2-year-old child has got intestinal dysbacteriosis, which results in hemorrhagic syndrome. What is the most likely cause of hemorrhage of the child?
Activation of tissue thromboplastin
PP hypovitaminosis
Fibrinogen deficiency
+Vitamin K insufficiency
Hypocalcemia.

82. In case of enterobiosis acrihine - the structural analogue of vitamin B2 - is administered. What enzymes synthesis disorder does this medicine cause in microorganisms?
NAD-dependet dehydrogenases
Cytochrome oxidases
+FAD-dependent dehydrogenases
Peptidases
Aminotransferases.

83. Patients with bile ducts obstruction suffer from inhibition of blood coagulation, bleedings as a result of low level of vitamin assimilation. What vitamin is in deficiency?
D
Carotene
K
+k
E

84. 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?
Ergocalciferol
Thiamine chloride
+Tocopherol acetate
Folic acid
Riboflavin

85. The role of the majority of water-soluble vitamins is due to their ability to form a cofactor of enzyme. Name the vitamin that is unable to carry out this function:
+Ascorbic acid
Nicotinamide
Riboflavin
Biotin
Adenosine triphosphate

86. Name the enzyme class, whose structure often contains vitamin PP (its derivatives NAD or NADP):
+Oxidoreductases
Hydrolases
Ligases
Isomerases
Lyases

87. There is the osteoporosis in the patient with chronic renal failure. What vitamin’s metabolism infringement promotes this disorder?
+Vitamin D
Vitamin E
Vitamin A
Vitamin K

1. Decreased concentration of the glucose leads to the increased secretion of:
   Serotonin
   Acetylcholine
   Histamine
   +Adrenalin
   Dopamine

2. The utilization of glucose by cells is promoted by…
   Glucagon
   +Insulin
   Adrenalin
   Thyroxin
   Somatotropin

3. The patient with the symptoms of acute alcoholic poisoning was brought in clinic. Which changes of carbohydrates metabolism are typical for this condition?
   The anaerobic breakage of glucose is increased in muscles
   The gluconeogenesis is increased in liver
   The breakage of glycogen is increased in liver
   The anaerobic glucose metabolism predominates in muscles
   +The speed of gluconeogenesis in liver is decreased

4. A 7-year-old girl has signs of anemia. Laboratory examination revealed pyruvate kinase deficiency in erythrocytes. What process disturbance plays the main role in anemia development?
   +Peroxide decomposition
   Anaerobic glycolysis
   Tissue respiration
   Aminoacids deamination
   Oxidative phosphorylation

5. The loss of consciousness and cramp occur with the patient who suffers on diabetes mellitus after the insulin injection. What result can give a biochemical blood test on sugar maintenance?
   5,5 mmol/l
   8,0 mmol/l
   10,0 mmol/l
   3,3 mmol/l
   +1,5 mmol/l

6. 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:
   High fatty acids
   Monosaccharides
   Amino acids
   +Ketone bodies
   Cholesterol esters

7. Buffer capacity of blood was decreased in the worker due to exhausting muscular work. Entry of what acid substances to the blood can explained this state?
Pyruvate
1,3-bisphosphoglycerate
+Lactate
Alpha-ketoglutarate
3-phosphoglycerate

8. A patient with the symptoms of acute alcoholic poisoning was brought to the hospital. What carbohydrates metabolism changes are typical for this condition?
The gluconeogenesis is increased in liver
The anaerobic glucose metabolism predominates in muscles
+ The gluconeogenesis velocity in liver is decreased
The breakage of glycogen is increased in liver
The anaerobic breakage of glucose is increased in muscles

9. Galactosemia has been revealed in a child. Concentration of glucose in the blood has not considerably changed. What enzyme deficiency caused this illness?
Galactokinase
Phosphoglucomutase
+Galactose-1-phosphate uridyltransferase
Hexokinase
Amylo-1,6-glucosidase

10. The gluconeogenesis is activated in the liver after intensive physical trainings. What substance is utilized in gluconeogenesis first of all in this case:
Glutamate
Lactate
Alanine
Glucose
+Pyruvate

11. A worker has decreased buffer capacity of blood due to exhausting muscular work. The influx of what acid substance in the blood can cause this symptom?
3-phosphoglycerate
1,3-bisphosphoglycerate
+Lactate
alfa-ketoglutarate
Pyruvate

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

13. Microsomal oxidation is the universal biological system of the oxidation of the non-polar compounds (many drugs, toxic compounds), steroid hormones, and cholesterol. Indicate name of cytochrome, which takes part in the microsomal oxidation.
Cytochrome aa3
+Cytochrome P 450
14. A 30-year-old woman was diagnosed with insufficiency of exocrine function of pancreas. Hydrolysis of what nutrients will be disturbed?
Proteins, fats
Proteins, carbohydrates
Fats, carbohydrates
+Proteins, fats, carbohydrates
Proteins

15. Analysis of the blood and urine of patient with diabetes mellitus confirmed the hyperglycemia and glucosuria. What available value of glucose concentration in the blood plasma in the patient:
2,54 mmol/l
3,88 mmol/l
4,89 mmol/l
6,55 mmol/l
+9,32 mmol/l

16. Glucose may be transformed into glucose-6-phosphate due to the action of various enzymes in human tissues. Indicate the liver enzyme for this conversion:
Galactokinase
Hexokinase
Fructokinase
+Glucokinase
Phosphofructokinase

17. The glucose-1-phosphate molecules are successfully formed during the process of glycogenolysis in the muscular tissue. Indicate the energy effect (per 1 mol of glucose-1-phosphate) of its further transformation into lactate:
2 ATP
+3 ATP
36 ATP
38 ATP
22 ATP

18. The second stage of aerobic oxidation of glucose in a cell is the oxidative decarboxylation of pyruvate. Name the main product of this process:
Citrate
Glutamate
+Acetyl-CoA
Oxaloacetate
Succinyl-CoA

19. A patient who has been strictly keeping to a certain diet for 10 days went through examination of respiratory coefficient. It was determined that it was 1. What diet have the patient been keeping to?
Mixed
With domination of proteins and carbohydrates
With domination of proteins and fat
20. Avidin is the strong specific inhibitor of biotine-depended enzymes. What from the stated below reactions will be blocked under avidin adding?

Glucose – Pyruvate
+Pyruvate – Oxaloacetate
Oxaloacetate – Glucose
Glucose – riboso-5-phosphate
Lactate – Pyruvate

21. A patient is in the hypoglycemic coma state. Indicate the overdose of what hormone can result such situation.

Corticotropin
Progesteron
Cortisol
Somatotropin
+Insulin

22. For a sick woman with a low arterial blood pressure after parenteral hormone introduction the increase of arterial blood pressure happens and also the level of glucose and lipids was rised in the blood. What hormone was introduced?

Insulin
Glucagon
+Adrenalin
Progesteron
Folliculin

23. At the lack of blood circulation in the period of intensive muscular work in a muscle as a result of anaerobic glycolysis the lactic acid is accumulated. What is subsequent fate of it?

Utillized by tissues for the ketone bodies synthesis
Excreted through kidneys with urine
Used for the glucose synthesis in a muscle
+Included in a gluconeogenesis in a liver
Used in tissues for the fatty acids synthesis

24. Under blood analysis for a patient the expressed hypoglucosemia is discovered on an empty stomach. It appeared at liver biopsy investigation, that there is any glycogen synthesis in the liver cells. Insufficiency of what enzyme is the reason of this disease?

Phosphorylase
+Glycogen synthase
Fructosodiphosphotase
Pyruvatecarboxylase
Aldolase

25. Complete oxidation of glucose molecule and it’s coupling with phosphorylation is equivalent to the following total amount of ATP molecules formation:

52
8
12
+38
58
26. An one-year child falls behind in mental development from the yearlings. In the morning: vomiting, cramps, loss of consciousness. In blood – hypoglycemia on an empty stomach. With what enzyme defect is it related to?
Phosphorylase +Glycogensynthase
Arginase
Sucrase
Lactase

27. As a result of exhausting muscular work for a worker the buffer capacity of blood significantly diminished. What compound entering to the blood is it possible to explain this phenomenon?
1,3- biphosphoglycerate
Pyruvate +Lactate
alfa- ketoglutarate
3- phosphoglycerate

28. Sick X. a first-aid brought. The state is heavy, consciousness absent, absence of movement. Skin covers are dry, hollow eyes. Cyanosis of person. Tachycardia. A smell of acetone is from a mouth. Results of analyses: blood glucose - 20,1 mmol/l (N= 3,3-5,5 mmol/l), in urine 3,5% (in N=0). What is conceivable diagnosis?
Hypoglycemic coma
+Hyperglycemic coma
Acute cardiac insufficiency
Sharp alcoholic poisoning
Anaphylactic shock

29. A glycogen which entered with a meal is hydrolyzed in gastrointestinal tract. What final product did appear as a result of this process?
Galactase
Lactate
Lactase +Glucose
Fructose

30. For a patient with diabetes mellitus after the injection of insulin the loss of consciousness, cramp came. What result can give a biochemical blood test on sugar maintenance?
10,0 mmol/l
8,0 mmol/l
+1,5 mmol/l
3,3 mmol/l
5,5 mmol/l

31. At a sprint the untrained man has a muscular hypoxia. What metabolite accumulation it leads in muscles?
Oxaloacetate
Ketone bodies
Acetyl-CoA
Glucose-6-phosphate +Lactate
32. Plenty of glucose oxidation metabolites are situated in the cytoplasm of myocytes. Name one of them that directly converted into lactate. 
Glucose-6-phosphate 
Oxaloacetate 
Glycerophosphate 
+Pyruvate 
Fruktose-6-phosphate

33. At a long-distance race the skeletal musculature of the trained man utilizes glucose with the purpose of receipt of ATP energy for muscular contraction. Indicate the basic process of glucose utilization in these conditions. 
Anaerobic glycolysis 
+Aerobic glycolysis 
Glycogenolysis 
Gluconeogenesis 
Glycogenesis 

34. There is alfa-amilase, capable to cleave nutritive in saliva. What substrates can act on this enzyme? 
Nucleoproteins 
Lipids 
Simple proteins 
+Carbohydrates 
Chromoproteins

35. For a patient with constant hypoglycemia a blood test after introduction of adrenalin did not change substantially. A physician assumed violation in a liver. About what change of liver function can we speak? 
Ketogenic 
Cholesterol formation function 
+Glycogen deposit function 
Glycolytic 
Excretory

36. At glucose transformation in the pentose cycle a phosphates of different monosaccharides synthesized. What from these matters can be used for nucleic acids synthesis? 
Eritroso-4-phosphate 
Ribuloso-5-phosphate 
+Riboso- 5-phosphate 
Sedogeptuloso-7-phosphate 
Eksiluloso-5-phosphate

37. The characteristic sign of glycogen storage disease is pain in muscles during physical work. What enzyme inborn insufficiency is predetermines this pathology? 
Glycogen synthase 
Glucose-6-phosphotase 
+Glycogen phosphorylase 
Amylo-1,6-glycosidase 
Lysosomal glycosidase
38. Sick L., 46 years old, complain of dryness in a mouth, thirst, frequently urination, common weakness. At a biochemical analysis found out a hyperglycaemia, hyperketonemia. In urine - glucose, ketone bodies. On an electrocardiogram - diffuse changes are in myocardium. What diagnosis is possible for a sick?
+Diabetes mellitus
Alimentary hyperglycaemia
Acute pancreatitis
Diabetes insipidus
Ischemic heart trouble

39. After transfer to the mixed nourishment a new-born child had dyspepsia with diarrhea, flatulence, and lag in development. Insufficiency of what substance is biochemical basis of this pathology?
Cellulases
+Lactase and cellobiose
Trypsin and chymotrypsin
Lipasas and kreatinkinase
Saccharase and isomaltase

40. A 3-years-old child with the enhanced temperature of body after the reception of aspirin has increased hemolysis of RBC. What inborn enzyme insufficiency could cause hemolytic anaemia for a child?
Glycogen phosphorylase
Glucose-6-phosphatase
+Glucose-6-phosphate dehydrogenase
Glycerolphosphate dehydrogenase
gama-glutamil transferase

41. In adjustment of enzymes activity an important place belongs to their postsynthetic covalent modification. What from the noted mechanisms is adjusting of glycogen phosphorylase and glycogen synthase activity carried out?
Metylation
+Phosphorylation-dephosphorylation
Adenyle addition
Limited proteolysis
ADP-ribosylation

42. After the intensive physical training for a sportsman a gluconeogenesis is activated. What is the basic substrate for this process?
Serine
Aspartic acid
Glutamic acid
alfa-ketoglutarate
+Lactate

43. For a 6-years-old child physical activity is decreased, there are signs of movement coordination violation. The genetic defect of pyruvate-dehydrogenase complex is detected. What laboratory indexes decided in the ground of diagnosis?
Alanine is higher of norm
Alanine is below of norm
Pyruvate is below of norm
+Pyruvate is higher of norm
Lactate is below of norm

44. A concentration of glucose in plasma of blood of healthy man is in such limits:
   2-4 mmol/l
   +3,5-5,5 mmol /l
   10-25 mmol/l
   6-9,5 mmol/l
   1-2 mmol/l

45. In 8- monthly child there is vomiting and diarrhea after fruit juices reception. Loading fructose resulted in hypoglycemia. Indicate the inherited insufficiency of what enzyme is reason of the state of child.
   Hexokinase
   Fructokinase
   +Fructose -1- phosphate aldolase
   Phosphofructokinase
   Fructose-1,6-diphosphatase

46. For the 34-years-old patient a decreased endurance to the physical trainings takes a place while in skeletal muscles maintenance of glycogen is enhanced. By what enzyme activity decline is it related to?
   Glycogen synthase
   Glucose-6-phosphate dehydrogenase
   Phosphofructokinase
   +Glycogen phosphorylase
   Glucose-6-phosphatase

47. For a child with the point genes mutation absence of glucose-6-phosphatase, hypoglycemia and hepatomegalyia found out. Define the type of pathology which these signs are characteristic for.
   Cori’s disease
   +Von Gierke’s diasese
   Addison’s diasese
   Parkinson’s diasese
   Me-Ardl’s diasese

48. A patient is delivered to medical establishment in the comatose state. According to accompanying it was find out, that a patient lost consciousness during training on the finishing stage of marathon distance. What type of coma it is more probable to suspect?
   Hepatic
   Hyperclycemic
   Acidosis
   Hypothyroid
   +Hypoglycemic

49. A new-born child after feeding with milk had dyspepsia, vomit. At feeding with glucose solution these phenomenon disappeared. Indicate an enzyme, which takes part in carbohydratess digestion, insufficient activity of which results in these disorders.
   Saccharase
   Amylase
   +Lactase
   Isomaltase
Maltase

50. During at run on short distance the untrained people have muscular pain as a result of lactate accumulation. Indicate, with strengthening of what biochemical process can it be related to.
   - Lipogenesis
   - Gluconeogenesis
   - Pentose phosphate pathway
   - Glycolysis
   - Glycogen formation

1. The activity of which of the following enzymes is directly affected by citrate?
   - Phosphofructokinase I
   - Isocitrate dehydrogenase
   - Fructose-2,6-bisphosphatase
   - Pyruvate carboxylase
   - 6-phosphogluconate dehydrogenase

2. Work of the heart muscle requires energy. Specify which substrate is the main source of energy for running muscles?
   - Amino acids
   - Fatty acids
   - Lactic acid
   - Pyruvate
   - α-ketoglutaric acid

3. It was established that death of 20-year-old women resulted from cyanide poisoning. What process disorder caused the death?
   - Hb synthesis
   - Oxidative phosphorilation
   - Urea synthesis
   + Tissue respiration
   - Oxygen transport by Hb

4. Nucleoside triphosphates belong to high-energy bonds containing compounds. Point out the quantity of high-energy bonds in their structure:
   - 0
   - 1
   + 3
   - 2
   - 4

5. The malate and the salicylic acid (uncoupler) were added to the mitochondrion suspension of rats’ liver that was incubated in aerobic condition at the optimal temperature and pH. Point out the P/O ratio for the malate oxidation in this situation:
   - 3
   + 2
   - 0
   - 1
   - 4

6. Choose the right continuation of the phrase:” Tissue respiration in hypoxia state…”
7. Thyrotoxicosis leads to increased production of thyroidal hormones T3 and T4, weight loss, tachycardia, and psychic excitement and so on. How do thyroidal hormones effect energy metabolism in the mitochondrion of cells?
- Stop respiratory chain
- Activate oxidative phosphorylation
- Stop substrate phosphorylation
- Activate substrate phosphorylation
- Disconnect oxidation and oxidative phosphorylation

8. The experimental animal was given a cytochrome oxidase blocker, which led to its instant death. Which of the given substances can cause these changes?
- Potassium nitrite
- Potassium sulfate
- Potassium cyanide
- Potassium oxalate
- Potassium phosphate

9. The patient with thyroid hyperfunction has high body temperature (fever). What is the main infringement of the energy exchange in rising of temperature during this?
- Increase of the lipolysis
- The increase of glycogen breakdown
- Uncouple of oxidation and oxidative phosphorylation
- Enzymes activation in the Krebs cycle
- Activation of respiratory chain’s enzymes

10. Patients with thyrotoxicosis have the increase of the body temperature due to:
- Increase of uptake of oxygen in the body
- Increases of activity of biological oxidation, disconnecting of processes (uncouple) of oxidation and phosphorylation
- Increase of thermogenesis in the liver
- The constriction of peripheral vessels
- Activation of protein’s catabolism

11. Lipoic acid was excluded from diet of the experimental animals, and during this process the inhibition of their pyruvate dehydrogenase complex was observed. What is lipoic acid for this enzyme?
- Allosteric regulator
- Substrate
- Inhibitor
- Coenzyme
- Product

12. The biological oxidation and deactivation (detoxication) of xenobiotics are realized by hemcontaining enzymes. Which metal is a required component of these enzymes?
- Mg
- Zn
Co  
+Fe  
Mn

13. Patients with the thyrotoxicosis have hyperthermia, bulimia, lose of weight due to the violation of:
- Reactions of α-oxidation of fatty acids
- The breakdown of ATP
- Reactions of synthesis of fat
- Reactions of citric acid cycle
- The coupling of oxidation and phosphorylation

14. Cyanides are extremely powerful cell’s poison which can cause death of the human body. Which enzyme blocking in tissue respiration is basic in this action?
- Catalase
- Superoxide dismutase
- Cytochrome oxidase
- Hemoglobin reductase
- Glucose-6-phosphatdehydrogenase

15. Weight loss and increased body temperature are observed during increasing function of the thyroid gland. What biochemical processes are activating during this?
- Gluconeogenesis
- Anabolism
- Catabolism
- Lipogenesis
- Steroidogenesis

16. Disposal (Deactivation) of pathogenic bacteria and splitting (breakdown) alien bodies in leukocytes are carried out with the help of which type of oxidation reaction:
- Peroxidation reaction
- Oxydase reaction
- Oxygenase reaction
- Peroxidase reaction
- Anaerobic reaction

17. A worker of the chemical company was brought to the hospital with signs of poisoning. Arsenate of the high concentration was found in the hair of the woman, which blocks the lipoic acid. Specify a dysfunction of what process is the main reason of poisoning:
- Deactivation of super oxide ions
- Microsomal oxidation
- reduction of methemoglobin
- reduction of organic peroxides
- Oxidative decarboxylation of pyruvate

18. How does thyroxin influence on the processes of tissue respiration and oxidative phosphorylation of a patient who is ill with thyrotoxicosis?
- Uncouples the process of tissue respiration and oxidative phosphorylation
- Blocks electron transport on the cytochrome’s chain
- Activates hydrolysis of ATP
- Decrease activity of FAD-dehydrogenase
- Decrease activity of NAD-dehydrogenase
19. How many molecules of ATP can be synthesized after full oxidation of acetyl-CoA in Citric acid cycle?
   1
   +12
   5
   8
   3

20. The central intermediate substance of all metabolisms (proteins, lipids, carbohydrates) is:
   Lactate
   Succinil-CoA
   Oxaloacetic acid
   +Acetyl-CoA
   Citrate

21. The process of ATP synthesis, which goes according to the reactions of oxidation with the participation of mitochondrial respiratory enzymes, is called:
   +Oxidative phosphorylation
   Substrate phosphorylation
   Free oxidation
   Photosynthetic phosphorylation
   Peroxidation

22. At necropsy of a 40 year-old woman the legal expert found that death occurred as a result of poisoning with cyanides. Blocking of which process is the most probable with the cyanides in this state?
   +Cytochrome oxidase
   Glycogen phosphorylase
   Pyruvate carboxylase
   Succinate dehydrogenase
   Glucose-6-phosphate dehydrogenase

23. During the pathological processes, accompanied by hypoxia, take place the incomplete reduction of oxygen molecules in respiratory chain and the accumulation of hydrogen peroxide. Specify the enzyme, which catalyze its destruction.
   Aconitase
   Cytochrome oxidase
   Peroxidase
   Ketoglutarate dehydrogenase
   +Catalase

24. Macroergic compounds are necessary for the normal metabolism in the cells. Which of these components belongs to the macroergic compounds?
   Creatinine
   Creatine
   +Phosphocreatine
   Glucose-6-phosphate
   Adenosine monophosphate

25. Potassium cyanide is a poison death of the body comes instantly. Name of the enzyme in mitochondria on which cyanic potassium can influence (affect) is:
Cytochrome b5  
Flavinic enzymes  
+Cytochrome oxidase [aa3]  
NAD - dependent dehydrogenase  
Cytochrome P-450

26. For a woman the symptoms of diabetes are absent 45 years, but on an empty stomach enhanceable maintenance of glucose is determined in blood (7.5 mmol/l). What next test must be conducted?

+ Determination of tolerance is to glucose  
Determination of acetone bodies is in urine  
Determination of remaining nitrogen is in blood  
Determination of glucose of blood on an empty stomach  
Determination of glycoziled haemoglobin

27. In blood of patient content of glucose on an empty stomach was 5.65 mmol/l, in 1 hour after the sugar loading was 8.55 mmol/l, and in 2 hours – 4.95 mmol/l. Such indexes are characteristic for:

+ Healthy man  
Patient with the hidden saccharine diabetes  
Patient with інсулінозалежним saccharine diabetes  
Patient from інсулінонезалежним by saccharine diabetes  
Patient with a thyrotoxicosis

28. Erythrocyte requires energy in ATP. What process does provide necessary quantity of ATP?

+ PPP  
Aerobic of oxidization of glucose  
Anaerobic glicolisis  
Beta-oxidization of fatty acids  
TCA

29. At insufficiency of Thiamin - there is illness of Beri-Beri is occur. Some carbohydrate exchange process is violated. What compound there does accumulate in blood?

Succinate  
Lactate  
+ Pyruvate  
Citrate  
Malate