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EXAM QUESTIONS
ON THE DISCIPLINE "HUMAN ANATOMY AND PHYSIOLOGY"
FOR INTERNATIONAL STUDENTS STUDYING IN ENGLISH
IN THE SPECIALTY «PHARMACY»

INTRODUCTION

1. Anatomy as a science that studies the macroscopic structure of the human body and the topography of its organs. Physiology as a science that studies the activity of the healthy human body in inseparable connection with the external environment. The main stages in the development of human anatomy and physiology.
2. The concept of physiological functions, their levels of organization and regulation. Characteristics of the main components of a closed regulatory loop. Positive and negative feedback, their characteristics. Regulation by deviation and by disturbance. Functional system of regulation of physiological functions according to P.K.Anokhin.
3. Epithelial tissues: structural features, classification, types, functions. Glandular epithelium. Concept of secretory products. Types of secretions: protein, mucous, mixed, sebaceous. The role of various cellular organelles in the synthesis of secretion. Cellular mechanisms of secretion: secretory cycle, phases of secretion, types of secretion (apo-, mero-, holocrine).
4. Connective tissues: types, functions, structural features. Bone tissue: cellular composition and extracellular matrix. The role of calcium and phosphates in bone tissue and in the body.

FLUID MEDIA OF THE HUMAN BODY. PHYSIOLOGY OF THE BLOOD SYSTEM

5. The organism as an open system. The concept of the internal environment of the organism. Liquid media of the organism (intercellular fluid, intracellular fluid, blood, lymph, cerebrospinal fluid, etc.), their composition, and volumetric distribution in the body. Water metabolism in the organism and its regulation.
6. The blood system. Composition, quantity, properties, and main functions of blood. Blood plasma. Organic and inorganic components of blood plasma. Main physiological constants of blood characterizing homeostasis.
7. Acid-base status of blood. Physicochemical and physiological mechanisms that maintain the constancy of blood pH. The concept of acidosis and alkalosis.
8. Electrolyte composition of blood plasma. Osmotic pressure of blood, its role in the exchange of water and electrolytes between blood and tissues. Mechanisms regulating blood osmotic pressure.
9. Plasma proteins, their classification, physiological role. Oncotic (colloid-osmotic) pressure of plasma and its role. Blood viscosity and its changes in cases of disturbed body water balance, impact on hemodynamics.
10. Hemopoiesis. Hemocytopoiesis. Properties and functions of the pluripotent hematopoietic stem cell, committed progenitor cells of mature blood cells. Modern model of hemopoiesis. The role of the stem cell microenvironment in hemopoiesis. Stimulators and inhibitors of hemocytopoiesis. Concept of regulation of erythropoiesis, leukopoiesis, thrombocytopoiesis.
11. Formed elements of blood. Erythrocytes. Number of erythrocytes in blood. Structural and functional features of erythrocytes that enable their functions. Color index and its calculation. Hemoglobin, its structure, properties, and functions. Amount of hemoglobin. Types of hemoglobin at different ages. Physiological and pathological compounds of hemoglobin.
12. Leukocytes. Number and types of leukocytes. Structural and functional features that enable their functions. Distribution of leukocytes in the vascular bed, in tissues, its features and physiological significance. Leukocyte formula, shift of the leukocyte formula. Concept of mechanisms of nonspecific and specific resistance of the body.
13. Platelets, their number, structure, functions, lifespan. Primary (vascular-platelet) and secondary (hemocoagulation) hemostasis.

14. Blood group systems. ABO system: antigens (agglutinogens) and antibodies (agglutinins) of blood groups, their characteristics. Formation of agglutinogens and agglutinins of the ABO system. The role of agglutinogens and agglutinins in determining blood group affiliation in the ABO system. Their combinations in the blood of different ABO system groups.
15. Determination of blood group in the ABO system. Standard sera. Monoclonal reagents. Their main characteristics and suitability criteria for use. Sequence of actions when determining blood groups in the ABO system. Criteria for assigning the tested blood to a specific group. Possible errors.
16. Blood group systems. Blood groups of the Rh system, characteristics of antigens and antibodies. Formation of antigens and antibodies to them in ontogenesis, differences between the Rh system and the ABO system. Consequences of transfusing blood incompatible by the Rh system.
17. Main principles of selecting donor blood and its components. Risk factors during transfusion of blood and its preparations. Tests that are mandatory before transfusion of blood and its products. Biological test. Possible consequences of transfusing incompatible blood. Blood substitutes, their classification according to the function performed in the body, and the requirements for them.

ANATOMY AND PHYSIOLOGY OF THE ENDOCRINE SYSTEM. HUMAN REPRODUCTIVE SYSTEM

18. Morphofunctional organization of the endocrine system. Central and peripheral organs of the endocrine system. Contemporary concepts of the functions of endocrine glands, diffuse elements, modes of intercellular communication involving chemical signals (paracrine, autocrine, juxtacrine, endocrine, and neuroendocrine).
19. Molecular (cellular) receptors and their ligands. Classification and properties of ligands. Classification, structure, and functions of membrane and intracellular receptors. Main physiological effects of ligand-receptor interaction at the cellular level.
20. Ligand-receptor interaction. The concept of the main pathways of intracellular signal transduction involving seven-transmembrane receptors. Primary and secondary messengers of signal transmission, their functions. Physiological processes mediated and regulated by seven-transmembrane receptors.
21. One-transmembrane segment receptors, their physiological role. The concept of the main pathways of intracellular signal transmission. Physiological processes mediated (regulated) by single-transmembrane segment receptors.
22. Hormones. General characteristics and classification. Mechanisms of hormone action depending on their chemical structure. Regulation of hormone secretion. Feedback. Mechanisms underlying changes in sensitivity of effector cells to hormone action.
23. Endocrine function of the pituitary gland. Morphological and functional connections of the pituitary with the hypothalamus. Pituitary and hypothalamic hormones, their role in regulating the activity of endocrine and non-endocrine organs. Interaction of neural and humoral mechanisms of function regulation at the hypothalamic level.
24. Thyroid gland. Iodine-containing thyroid hormones: types, synthesis, and regulation of their secretion. Daily requirements for iodine and selenium and sources of their intake into the body. Mechanisms of hormone action and the effects they elicit. The role of thyroid hormones in adaptation processes, their influence on growth and development. Characteristic manifestations of excessive or insufficient hormone secretion.
25. Adrenal glands. Hormones of the adrenal cortex and medulla. Mechanisms of hormone action and the effects they elicit. Regulation of hormone secretion. Characteristic manifestations of excessive or insufficient hormone secretion.
26. Sex hormones. Gonads and other sources of their production. Mechanisms of hormone action and the effects they elicit. Mechanisms of regulation of hormone secretion. Characteristic manifestations of excessive or insufficient hormone secretion.
27. Endocrine function of the pancreas. The role of pancreatic hormones in regulation of carbohydrate, fat, and protein metabolism. Regulation of hormone secretion. The concept of normoglycemia, hypoglycemia, and hyperglycemia and their causes.
28. Regulation of calcium and phosphorus homeostasis in the body. The effect of calcitonin, parathyroid hormone, and vitamin D3 on calcium and phosphorus metabolism. Daily calcium requirements and sources of calcium intake into the body.
29. Hormonal mechanisms of maintaining water-electrolyte balance in the body (antidiuretic hormone, renin-angiotensin-aldosterone system, atrial natriuretic factor).

30. Male reproductive system: structure of the male reproductive organs, their functions. Androgens, their biological effects. Spermatogenesis, factors regulating it.
31. Female reproductive system: structure of the female reproductive organs, their functions. Estrogens and their role in the development of sexual characteristics. Oogenesis. Phases of the ovarian-menstrual cycle. Corpus luteum hormones (progestins), their biological effects.

ANATOMY AND PHYSIOLOGY OF EXCITABLE TISSUES

32. General properties of excitable tissues. Irritability, excitability. Excitation and its forms of manifestation. Parameters of excitability. Changes in excitability during excitation. Refractoriness, its causes and physiological significance.
33. Bioelectric potentials as carriers of information in living organisms. Types of electrical signals in the body, their comparative characteristics. Resting potential and local potentials. Their types and mechanisms of occurrence (maintenance). Factors determining the magnitude of the membrane potential.
34. Receptor potential, its characteristics, mechanisms of occurrence, role in generating the action potential. Action potential as a carrier of information. Generation of the action potential, phases and mechanisms of its development. Structural and functional features of voltage-gated sodium channels.
35. Physiological role of the structural elements of the nerve fiber. Role of afferent and efferent nerve fibers. Classification of nerve fibers. Role of different types of nerve fibers. Mechanism of excitation conduction along myelinated and unmyelinated nerve fibers, laws of excitation conduction. Axonal transport.
36. Synapse. Classification of synapses, their physiological role. Structure of electrical and chemical synapses. Proteins and vesicles of the presynaptic terminal. Receptors of the postsynaptic membrane. Mechanism of signal transmission at the neuromuscular synapse. End-plate potential. Role of acetylcholinesterase.
37. Synapse. Functional properties of synapses. Types of neurotransmitters and their receptors in central and peripheral synapses. Neuromodulators. Factors determining the response of the effector cell to the action of the neurotransmitter. Influence of biologically active substances on signal transmission in neuromuscular and central synapses.
38. Muscle tissues. Structure of skeletal muscle fibers. Sarcomere. Mechanism of contraction and relaxation of a single muscle fiber. Excitation-contraction coupling. Role and sources of calcium ions. Relaxation of the muscle fiber.
39. Physiological properties of skeletal muscles. Relationship among excitation, excitability, and contraction of a skeletal muscle fiber. Single contraction, its phases. Summation of contractions, tetanic contraction. Types and modes of skeletal muscle contraction.
40. Factors determining muscle strength and movement precision. Muscle tone. Muscle fatigue. Metabolic support of muscles. Motor units, their types and characteristics (structural, functional, and metabolic features).
41. Smooth muscles. Classification, physiological properties and features. Factors causing contraction of smooth muscle cells. Membrane receptors and ion channels involved in initiating contraction. The role of calcium, mechanisms of increasing its concentration in the sarcoplasm. Mechanism of contraction and relaxation of smooth muscle.

ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM

42. General structural plan of the CNS: topography, main divisions, gray and white matter. Concept of the meninges and their functions.
43. Neuron. Functional classification of neurons. Physiological properties of nerve cells and functions of neuronal structural elements (soma, axon, dendrites). Morphological and biophysical features of neurons ensuring their specific functions (perception, integration, transmission of information). Features of initiation and propagation of excitation in the neuron. Functions of neuroglia.
44. Organization of neurons into neural circuits. Types and functions of these organizations. Main principles of excitation propagation in neural circuits (divergence, convergence, reverberation, etc.).
45. The reflex principle of nervous system function. Reflex. Types of reflexes. Structure of the reflex arc. Feedback, its significance.
46. Inhibition in the CNS, its forms of manifestation, types and role. Mechanisms of central inhibition. Primary (postsynaptic and its types, presynaptic) and secondary (pessimal, inhibition after excitation) inhibition. Inhibitory neurotransmitters. Mechanism of inhibitory synapse function. Inhibitory postsynaptic potential.

47. Main principles of coordination in the CNS: the principle of reciprocal inhibition, the principle of the final common pathway, the principle of dominance, the principle of recurrent afferentation. Integrative activity of the neuron. Mechanisms of interaction between excitation and inhibition processes within the neuron. Summation of excitation.
48. The physiological concept of the nerve center. Functions of nerve centers, their properties (spatial and temporal summation, transformation of the excitation rhythm, tone, plasticity, fatigue of nerve centers).
49. Structure and functions of the blood-brain barrier (BBB). Role of neuroglia. Features of BBB barrier function in different parts of the brain. The role of cerebrospinal fluid in brain vital activity.
50. Spinal cord. Functions of the spinal cord. Spinal level regulation of muscle tone, posture and movement. Main spinal reflexes. Functions of the main ascending and descending spinal cord tracts. Consequences of spinal cord lesion.
51. Brain, main divisions. Brainstem: morphofunctional organization, vital centers, functions. Concept of cranial nerves: number, localization of nuclei, functions.
52. Medulla oblongata and pons. Functions. Vital centers. Functional connections with other divisions of the CNS.
53. Midbrain. Functions. Concept of decerebrate rigidity and the mechanism of its development. The role of the brainstem in the regulation of muscle tone. Functional connections with other divisions of the CNS.
54. Cerebellum. Functions. The role of the cerebellum, basal nuclei, and cerebral cortex in the mechanisms of maintaining muscle tone, posture, and performing movements.
55. Reticular formation: morphofunctional organization. Characteristics of ascending and descending connections and effects of the reticular formation.
56. Diencephalon. Thalamus, metathalamus, epithalamus. Functional characteristics of thalamic nuclei. Hypothalamus. Main functional centers; connections with other divisions of the brain.
57. Limbic system. Structural and functional organization. Its role in the formation of motivations, emotions, memory organization, and goal-directed behavior. Participation of limbic system structures in the integrative activity of the CNS.
58. Basal nuclei. Structural and functional organization. Connections with midbrain structures, the limbic system, and the forebrain cortex.
59. Cerebrum (telencephalon). Cerebral cortex: afferent, efferent, and associative areas and their connections. Localization of functions in the cortex. Concept of interhemispheric asymmetry and hemispheric dominance.
60. The role of the autonomic nervous system (ANS) in ensuring the viability of the organism as a whole. ANS functions. Comparative characteristics of the general structural plan and physiological properties of the ANS and somatic nervous system (afferent, central, efferent divisions).
61. Comparative characteristics of the structure and functions of the sympathetic and parasympathetic divisions of the ANS. Synergism and relative antagonism of sympathetic and parasympathetic influences of the ANS. Effects of the sympathetic division of the ANS on effector organs, sensory functions. Mechanisms of their implementation.
62. Reflex arc of the autonomic reflex. Preganglionic and ganglionic neurons and their axons: morphological, functional, and neurochemical differences. Neurotransmitters, receptors of nerve and effector cells. Morphofunctional features of effector nerve endings and synapses in the ANS. Effects of the parasympathetic division of the ANS on effector organs, sensory functions. Mechanisms of their implementation.

ANATOMY AND PHYSIOLOGY OF THE CIRCULATORY SYSTEM

63. Hemodynamics. Functional classification of vessels. Factors ensuring blood movement through vessels. The basic law of hemodynamics—the relationship between blood pressure, volumetric blood flow rate, and peripheral vascular resistance. Factors determining resistance to blood flow.
64. Volume and linear blood flow velocities in various sections of the vascular bed, factors determining them. Main indicators of blood flow (blood pressure, velocity blood flow, resistance) in the arterial, microcirculatory, and venous segments of the vascular bed.
65. Blood pressure, its types and role. Blood pressure in various segments of the vascular bed. The concept of normal blood pressure values. Factors determining the level of arterial pressure (BP). Mechanisms of BP regulation. Arterial pulse, its origin and clinico-physiological characteristics. Sphygmography, analysis of the sphygmogram.

66. Structural and functional characteristics of the components of the microcirculatory bed, types of capillaries. Mechanisms of transcapillary exchange of fluid and various substances between the blood and tissues. Starling's equation. Filtration and reabsorption of fluid in the capillaries. Structure and functions of the lymphatic system.
67. Heart: topography, structure, characteristics of myocardial metabolism and blood supply at rest and during physical exercise. Coronary blood flow in the myocardium of the right and left ventricles during systole and diastole.
68. Cardiac automatism. Mechanisms of automatism. Structural features of cardiomyocytes of the cardiac conduction system. Structure and functions of the cardiac conduction system. Pathway of excitation propagation through the cardiac conduction system. Features of excitation conduction via the AV junction. Automatism gradient.
69. Physiological properties of contractile myocardium. Propagation of excitation through the myocardium. Electromechanical coupling. Sources and role of calcium ions in different parts of the heart. Relationship between excitation, excitability, and myocardial contraction.
70. Laws of cardiac contraction. Role of preload and afterload. Factors determining the magnitude of preload and afterload. Sequence of phases and periods of the cardiac cycle. Position of valves, changes in pressure and blood volume in the heart chambers during various phases of the cardiac cycle.
71. Electrocardiography. Types of leads. Origin of ECG components. General approach to ECG analysis in lead II, calibration, main standards (duration of P, Q, R, S waves, PQ interval, QRS complex, position of the ST segment).
72. Classification of mechanisms of cardiac activity regulation. Intra- and extracardiac mechanisms regulating the heart. Humoral mechanisms of heart activity regulation: effects of catecholamines, angiotensin II, electrolytes, and metabolites.
73. Mechanisms of reflex regulation of cardiac activity and vascular tone. Characteristics of parasympathetic and sympathetic influences and their mediators: main effects and their receptor, ionic, and molecular mechanisms.
74. Vascular tone, its types and nature. Regulation of vascular tone as a primary mechanism for maintaining blood pressure in the systemic circulation and local blood flow. Humoral regulation of circulation. Endogenous vasoconstrictor and vasodilator substances.
75. Short-term (rapid), medium-term (intermediate), and long-term neurohumoral mechanisms of BP regulation. Role of the excretory organs in long-term regulation of circulating blood volume and arterial blood pressure. The role of the renin-angiotensin-aldosterone system in the regulation of circulating blood volume and arterial blood pressure.

ANATOMY AND PHYSIOLOGY OF THE RESPIRATORY SYSTEM

76. Overview of the topography, structure, and functions of the lungs. Structure of the pleura. Pleural cavity. Concept of blood supply, lymphatic circulation, and innervation of the lungs. Main stages of the respiratory process. Morphofunctional features of the airways and lungs, their physiological role and functions.
77. Pulmonary ventilation. Respiratory muscles. Biomechanics of inspiration and expiration. Elastic recoil and elastic properties of the chest wall and lungs. Role of surfactant. Pressure in the pleural space, its changes during respiration – causes and mechanisms.
78. Methods for studying lung ventilation. Spirometry, spirography. Peak flowmetry (pneumotachometry). Volume and flow parameters of pulmonary ventilation. Concepts of obstructive and restrictive ventilatory disorders, their indicators, changes in lung volumes and capacities. Tiffeneau test.
79. Gas exchange in the lungs. Factors affecting the diffusion of gases between alveolar air and blood. Diffusing capacity of the lungs for oxygen.
80. Transport of oxygen and carbon dioxide by blood. Transport forms. Relationship between oxygen and carbon dioxide gas exchange. Oxygen capacity of blood. Oxygen saturation of hemoglobin. Oxyhemoglobin dissociation curve. Gas exchange between blood and tissues.
81. The respiratory center: its structure, localization, and functions. Mechanisms underlying breathing periodicity. Regulatory influences on the brainstem regions of the respiratory center from peripheral receptors and higher brain regions.
82. Receptors of the airways, lungs, and respiratory muscles. Reflex responses arising in response to their stimulation. Regulation of airway lumen. Receptors for pH, CO_2, and O_2 in the body, their localization,

sensitivity characteristics, and role in the regulation of breathing. Mechanism of the first breath of the newborn infant.

83. Functional system for maintaining the relative constancy of respiratory constants of the internal environment.

ANATOMY AND PHYSIOLOGY OF DIGESTION

84. Food motivations. Appetite. Physiological mechanisms of hunger and satiety. Mechanisms regulating feeding behavior. Digestive and non-digestive functions of the digestive system. Types of digestion depending on the origin of hydrolases and localization of hydrolysis.
85. Digestion in the oral cavity. Overview of the topography and structure of the organs of the oral cavity. Mechanical and chemical processing of food. Salivation, chewing, swallowing. Mechanisms of their regulation. The quantity, composition, properties, and functions of saliva. The role of saliva in digestion.
86. Gastric digestion. Overview of the topography, structure, and functions of the stomach and its glands. Composition and properties of gastric juice. The role of hydrochloric acid and mucus in gastric juice. Mechanism of formation and secretion of hydrochloric acid. Neural and humoral mechanisms of their regulation. Phases and mechanisms of regulation of gastric gland secretion in the fasting state and after food intake. Motor and evacuatory functions of the stomach in the fasting state and after food intake, and their regulation.
87. Small intestine: overview of its topography, sections, structure, features of blood and lymph circulation, innervation.
88. Digestion in the duodenum. The role of the pancreas in digestion. Composition and properties of pancreatic juice. Mechanisms regulating pancreatic juice secretion during fasting and after food intake. Phases of pancreatic secretion.
89. Liver: overview of its topography, structure, functions. The role of the liver in digestion. Bile formation and bile excretion. The role of the gallbladder. Composition and properties of bile, its involvement in digestive processes. Mechanisms regulating bile formation and bile excretion during fasting and after food intake.
90. Digestion in the jejunum and ileum. Composition and properties of intestinal juice. Mechanisms regulating intestinal secretion. Luminal and membrane hydrolysis of nutrients. Absorption of hydrolysis products of fats, proteins, and carbohydrates, vitamins and trace elements in various sections of the digestive tract, and its mechanisms.
91. Digestion in the large intestine. Motility of the large intestine and its regulation. The significance of the large intestine microbiota for the body. Features of the processes of digestion, synthesis, and absorption in the large intestine. Defecation.

METABOLISM AND ENERGY. PHYSIOLOGICAL FOUNDATIONS OF HEALTHY NUTRITION

92. Metabolism and energy in the body. Processes of anabolism and catabolism, their ratio in various functional states of the organism. Plastic and energetic roles of nutrients. Protein, fat, and carbohydrate metabolism. Essential substances for the body. Nitrogen balance and its types of disturbances.
93. Total metabolism. Basal metabolic rate and the factors determining its magnitude. Energy expenditure of the body under basal metabolic rate conditions. Methods for investigating basal metabolism. Specific dynamic action of food. Energy expenditure of the body in various types of labor activity.
94. Nutrition. Physiological foundations and principles of healthy nutrition. Nutrition standards depending on age, type of work, and physical condition. The concept of dietary and non-dietary health risk factors. Daily requirements for protein, fats, carbohydrates, dietary fiber, water.

PHYSIOLOGY OF THERMOREGULATION

95. Thermoregulation. The concept of homeothermy, poikilothermy, and heterothermy. Human body temperature and its circadian fluctuations. Temperature of various areas of the skin and internal organs. The concept of hypo- and hyperthermia, fever. Neural and humoral mechanisms of thermoregulation. Peripheral and central thermoreceptors. Thermoregulatory centers. The functional system that maintains constancy of the internal environment's temperature.
96. Heat production in the body. Sources of heat production in the body. Shivering and non-shivering thermogenesis. Metabolic processes in brown adipose tissue. Heat loss from the body. The concept of heat transfer within the body. Physical processes and physiological mechanisms that provide for heat loss.

PHYSIOLOGY OF EXCRETION

97. The excretory system. Organs of excretion (kidneys, skin, lungs, gastrointestinal tract). Their role in maintaining homeostasis. The kidney. Excretory and non-excretory functions of the kidney. The nephron as the structural and functional unit of the kidney. Renal blood flow and its characteristics. Structure of the renal filter. Mechanism of glomerular filtration. Effective filtration pressure and factors influencing it. Formation of primary urine, its volume and composition. Glomerular filtration rate. Clearance.
98. Mechanisms of tubular reabsorption in various segments of the nephron tubules and collecting ducts. Features and mechanisms of reabsorption and secretion of various substances in nephron segments. The countercurrent system of the renal medulla and its physiological role. Mechanism of urine concentration. The role of urea.
99. Excretory secretion and synthesis in the kidney. The involvement of the kidneys in maintaining acid–base balance, osmotic pressure, blood ion composition, circulating blood volume, regulation of systemic blood flow, hematopoiesis, and water–electrolyte balance. Indicators of urinary system function (frequency, urine output, nocturnal and daytime diuresis). Quantity, composition, and properties of final urine.
100. Adaptive changes in kidney function and their mechanisms under various environmental conditions: elevated and lowered temperature, water loading and deprivation, consumption of foods with increased glucose and salt content.

ANATOMY AND PHYSIOLOGY OF SENSORY SYSTEMS. HIGHER NERVOUS AND MENTAL ACTIVITY OF HUMANS

101. Concept of sense organs, analyzers, sensory systems. I.P. Pavlov's theory of analyzers. General principles of structure, functioning, general properties and structural principles of sensory systems, their role in maintaining the functional state of the organism. Classification and functions of sensory systems
102. Visual system. Structure, functions. Structural features and properties of the eye that ensure the function of vision. Optical media of the eye. Refraction and accommodation.
103. Structure and functional significance of the retina. Distribution, structure, functions of photoreceptors. Scotopic and color vision. Visual pigments. Theories of color perception. Main forms of color vision deficiency. Regulation of pupil diameter. Transmission and processing of information in the conducting and central parts of the visual system.
104. Auditory system. Physiological features of perception of sounds of different frequency and intensity. Structural features and properties of the sound-conducting apparatus. Functions of the outer and middle ear.
105. Sound-perceiving apparatus of the auditory system. Structures of the inner ear, their functions. Mechanism of excitation of hair cells. Transmission and processing of information in the pathways and central parts of the auditory system.
106. Vestibular system, its functions. Structural features and properties of the receptor section. Functions of vestibular receptors of the vestibule and semicircular canals. Transmission and processing of information in the pathways and central parts of the vestibular system. Bodily responses to vestibular apparatus stimulation (vestibulospinal, vestibulo-ocular, and vestibuloautonomic reactions).
107. Olfactory system. Odor reception. Conducting pathways and central parts of the olfactory system. Bodily responses to stimulation of the olfactory system.
108. The taste system. Conducting pathways and central parts of the taste system. Perception of taste. Classification of taste sensations. Bodily responses to taste stimuli.
109. Pain and its significance. Modern understanding of nociception and central mechanisms of pain. Theories of pain. Types of pain. Antinociceptive system. Neurochemical mechanisms of antinociception. Concepts of principles of analgesia.
110. Somatosensory system. Types of sensory receptors of the skin and their functions. Thermoreception. Proprioceptive sensitivity. Structural features of pathways and central parts.
111. Interoceptive sensitivity. Types of interoceptive sensitivity. Bodily responses to stimulation of interoceptors. Role of interoception in maintaining homeostasis and regulating physiological functions.
112. Innate forms of behavior (unconditioned reflexes and instincts). Classification, conditions of their realization, physiological role. Concept of higher nervous activity (I.P.Pavlov).
113. Conditioned reflex as a form of adaptation of animals and humans to changing conditions of existence. Laws of formation and manifestation of classical and operant conditioned reflexes. Classification of conditioned reflexes. Types of higher nervous activity, their classification and characteristics. Conditioned reflexes, their role. Formation of conditioned reflexes, their structural-functional basis. Mechanism of establishing a

temporary connection. Rules for developing conditioned reflexes. Dynamic stereotype as the physiological basis of occupational activity (motor skills, automated movements). Inhibition in higher nervous activity and its role. Classification of inhibition of conditioned reflexes.

114. Motivation. Emotions. Classification. Mechanisms underlying biological motivation. The biological role of emotions, theories, neuroanatomy and neurochemistry of emotions. Autonomic and somatic components of emotions.
115. Physiology of memory. Types of memory. Major CNS structures responsible for selection, encoding, and storage of different types of information. Mechanisms of short-term and long-term memory. The role of attention in memorization and learning. The concept of types of memory disorders.
116. Physiology of sleep. Sleep phases, changes in somatic, endocrine, and autonomic functions during different sleep phases. Functions of sleep. Contemporary views on the physiological mechanisms of sleep and wakefulness. The concept of human biological rhythms and the neurophysiological bases of their regulation.
117. First and second signaling systems. Speech, functions of speech. Functional asymmetry of the cortex associated with speech development in humans. Speech as a brain function: the speech system, major speech centers.

METHODS OF PHYSIOLOGICAL FUNCTIONS STUDYING

1. Safety rules when working with physiological practicum: safety regulations when working with electrical equipment, actions in case of fire, general rules of first aid (knowledge).
2. Description of morphological structures of the human body (comparative characteristics of the four tissue types) (knowledge).
3. Implementation of measures to prevent infection with viral hepatitis and human immunodeficiency virus when examining blood and other biological materials (knowledge).
4. Physiological evaluation of complete blood count indicators (number of erythrocytes, hemoglobin, hematocrit, color index and erythrocyte indices, number of leukocytes and leukocyte formula, ESR by the Panchenkov method, platelets) (knowledge).
5. Assessment of primary hemostasis indicators (skill).
6. Evaluation of results in determining blood group (AB0 and Rh systems) using standard sera (reagent) and monoclonal antibodies (knowledge).
7. Description of morphological structures of the skin as an organ (knowledge) and calculation of its area using a nomogram and formula (skill).
8. Measurement of human height (skill). Assessment of endocrine system functions (height as an indicator of the hypothalamic-pituitary-liver endocrine axis) (knowledge).
9. Assessment of endocrine system functions (hypothalamic-pituitary-adrenal axis) (knowledge).
10. Performing dynamometry (hand and back) in men and women and comparing them taking into account sex and the influence of sex hormones (skill).
11. Assessment of the impact of shifts in extracellular Na^+ and K^+ ion concentrations on membrane potential levels (knowledge).
12. Potential for pharmacological modulation of synaptic signal transmission processes (using the neuromuscular synapse as an example) (knowledge).
13. Study of basic tendon reflexes using the knee reflex as an example (morphological basis [reflex arc]). Physiological assessment of obtained parameters (skill).
14. Comparative characteristics of mono- and polysynaptic reflex arcs (knowledge).
15. Assessment of the tone and reactivity of the sympathetic and parasympathetic branches of the ANS by heart rate using the example of the clinostatic and orthostatic reflexes (knowledge).
16. Characteristics of the arterial pulse and assessment of its regularity and rate by palpation (skill).
17. Measurement of arterial blood pressure. Physiological assessment of obtained parameters (skill).
18. Assessment of cardiac cycle duration at rest using ECG. Physiological assessment of obtained parameters (skill).
19. Spirometry: determination of vital capacity of the lungs (VC), calculation of due VC (VC^{due}), physiological assessment of obtained results (skill).
20. Assessment of the spirogram (knowledge). Pneumotachometry (peak flowmetry) (skill).
21. Calculation of due values. Physiological assessment of obtained parameters (knowledge). Performing pulse oximetry and physiological assessment of the obtained result. Calculation of blood oxygen capacity (skill).

22.Study of the three-level organization of the respiratory center: its vital sections (knowledge).
23.Performing sialometry and physiological assessment of obtained parameters (skill).
24.Assessment of the effect of bile on the state of fats (knowledge).
25.Measurement of body mass. Calculation of body mass index. Physiological assessment of obtained parameters and development of scientifically based recommendations for body weight correction (skill).
26.Measurement of axillary body temperature using liquid (glass) and electronic thermometers: assessment of possible errors during the procedure. Physiological assessment of obtained parameters (skill).
27.Physiological assessment of the composition and properties of final urine (general urinalysis) (skill).
28.Assessment of the visual sensory system functions (visual acuity studying) (skill).
29.Assessment of the visual sensory system functions (perimetry) (skill).
30.Assessment of the visual sensory system functions (color vision studying) (skill).
31.Assessment of the auditory sensory system functions (Weber and Rinne tests) (skill).
32.Studying of taste sensitivity (skill).
33.Assessment of short-term auditory memory volume using letter and digit complexes (knowledge).
34.Assessment of attention parameters using the correction test (knowledge).

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