

MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
EDUCATIONAL INSTITUTION
BELARUSIAN STATE MEDICAL UNIVERSITY

Контрольный
экземпляр

APPROVED
by First Vice-Rector, Professor
I.N.Moroz
27.06.2023
Reg. # UD-091-031/2324edu.

HUMAN ANATOMY AND PHYSIOLOGY

Curriculum of educational institution
in the educational discipline for the specialty:

7-07-0912-01 «Pharmacy»

Curriculum is based on the educational program «Human Anatomy and Physiology» for specialty 7-07-0912-01 «Pharmacy», approved 27.06.2023, registration № УД-091-031/2324/уч.; on the educational plan in the specialty 7-07-0912-01 «Pharmacy», approved 17.05.2023, registration # 7-07-0912-01/2324/mf.

COMPILERS:

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RECOMMENDED FOR APPROVAL:

by the Department of Normal Physiology of the educational institution «Belarusian State Medical University»
(protocol #12 of 02.06.2023);

by the Scientific and Methodical Council of the educational institution «Belarusian State Medical University»
(protocol # 6 of 27.06.2023)

EXPLANATORY NOTE

«Human Anatomy and Physiology» is the academic discipline of the module «Human Physiology», which contains a systematized scientific knowledge of the structure of the body of a healthy person in relation to its functions, mechanisms and processes of vital activity.

The aim of the discipline «Human Anatomy and Physiology» is the formation of basic professional competencies for the integral representation of the mechanisms and processes of vital activity of the body of a healthy person in relation to the structure of its tissues, organs and systems, as well as the principles of its regulation and methods of assessment of physiological functions.

The objectives of the discipline «Human Anatomy and Physiology» are to form students' scientific knowledge of the basic concepts of human anatomy and physiology; morpho-functional features of tissues, organs and systems of a healthy person; the most important mechanisms of functioning of human organs; factors in maintaining and strengthening human health, skills and abilities necessary to assess the physiological functions of the human body during pharmaceutical counseling.

Knowledge, skills, and abilities acquired in the study of the discipline «Human Anatomy and Physiology» are necessary for the successful study of the following academic disciplines: «Biological Chemistry», «Pathologic Physiology», modules «Pharmacology and Pharmacotherapy», «First Aid».

Studying the educational discipline «Human Anatomy and Physiology» should ensure the formation of students' basic professional competency:

BPC. Define symptoms that require immediate medical attention or allow the use of over-the-counter medications.

As a result of studying the discipline «Human Anatomy and Physiology» the student should

know:

structure and functions of human organs and systems;

relationship of organ structure and function, formation of functional adaptive system;

anatomical and physiological features of a healthy person's body;

be able to:

use the knowledge gained in human anatomy and physiology to detect clinical manifestations that require the patient to see a physician immediately;

measure the most important indicators of human activity at rest and under load (blood pressure, pulse);

use medical equipment (tonometer, thermometer, glucometer, pulse oximeter, etc.);

master:

methods of examination of basic physiological functions.

Total number of hours for the study of the discipline is 230 academic hours.

Classroom hours according to the types of studies: lectures - 28 hours (including 9 hours of supervised student independent work), 105 hours of laboratory classes, 97 hours of independent work of the student.

Intermediate assessment is carried out in accordance with the syllabus of the specialty in the form of a credit (1 semester) and examination (2 semester).

Form of higher education – full-time.

ALLOCATION OF ACADEMIC TIME ACCORDING TO SEMESTERS OF STUDY

Code, name of the specialty	semester	Number of hours of training sessions						Form of intermediate assessment
		total	in-class	including			out-of-class self-studies	
				lectures (including supervised independent work)	supervised student independent work	laboratory classes		
7-07-0912-01 «Pharmacy»	1	120	72	18	6	54	48	credit
	2	110	61	10	3	51	49	exam

THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	laboratory
1. Introduction to anatomy and physiology	1	9
2. Anatomy and physiology of excitable tissues	3	12
3. Anatomy and physiology of the nervous system	6	9
4. Anatomy and physiology of the endocrine system. Male and female reproductive system	2	12
5. Anatomy and physiology of sensory systems. Higher nervous activity	2	12
6. The internal environment of the human body. Physiology of blood	2	12
7. Anatomy and physiology of cardiovascular system	4	12
8. Anatomy and physiology of the respiratory system	2	12
9. Anatomy and physiology of the digestive system	2	6
10. The metabolism of substances and energy. Physiological basis of a healthy nutrition	1	2
11. Physiology of thermoregulation	1	1
12. Anatomy and physiology of excretion	2	6
Total hours	28	105

CONTENT OF THE EDUCATIONAL MATERIAL

1. Introduction to anatomy and physiology

Anatomy as a science that studies the macroscopic structure of humans and the topography of their organs. Physiology as a science that studies the activity of a healthy human organism in inseparable connection with the external environment. Main stages of development of human anatomy and physiology. Relationship between structure and function.

The purpose and objectives of the study discipline «Human Anatomy and Physiology», their relation to the pharmaceutical sciences. The value of the academic discipline in the system of pharmaceutical education. Methods of studying the structure of the human body and physiological processes.

Laws characterizing life (self-renewal, self-reproduction, self-regulation, metabolism). Basic properties of the living human organism (metabolism and energy exchange, irritability, homeostasis, adaptation, reproduction). Unity and mutual influence of human organism and external environment.

The concept of somatic and autonomic functions. Levels of regulation: cellular, tissue, organ, organismal. Mechanisms of regulation: nervous (neural-reflex), humoral (local humoral and endocrine regulation). Direct and reverse, positive and negative connections in the regulation of functions. Types of regulation of functions (by deviation and perturbation). Principles of reliability of regulation. Interaction of

nervous and humoral mechanisms of regulation, their comparative characteristics and unity. The system principle of regulation of functions, concept of system (I.P. Pavlov). P.K. Anokhin's functional system. The concept of homeostasis and homeokinesis.

General concept of tissues: their types, structure. Cellular elements and non-cellular substance. Classification of tissues.

Epithelial tissues: peculiarities of structure, classification, types, functions. Glandular epithelium. The concept of secretion products. Types of secretions: protein, mucous, mixed, greasy. Role of various cell organelles in secretion synthesis. Cellular mechanisms of secretion: secretory cycle, secretion phases, types of secretion (apo-, mero-, holocrine).

Regulation of secretion: dependence on nervous, humoral influences, blood flow, capillary permeability.

Skin: structure, functions.

Connective tissues: types, functions, peculiarities of their structure.

Bone tissue: cellular composition and intercellular substance. The role of calcium and phosphates in bone tissue and in the body.

The human skeleton and its sections. Classification of bones by morphological and functional feature. Types and forms of joints of bones. Joints: structure, classification, function. The skeleton of the head, the torso. Skull: bones, joints and main openings. The skeleton of the pectoral and pelvic girdle. The skeleton of upper and lower extremities.

2. Anatomy and physiology of excitable tissues

General properties of excitable tissues (irritability, excitability, conductivity, lability). Basic states of excitable tissues (rest, irritation, excitation, inhibition). Characteristics of stimuli: definition, classification. Irritation threshold as the most important criterion for evaluation of tissue excitability. History of discovery of animal electricity. Theories of electrogenesis. Modern concepts of structure and properties of cell membranes. Structure, electrical characteristics and functions of membrane. Types of transport of substances through the membrane. Ionic channels, their classification. Resting membrane potential. Origin of resting membrane potential. Conditions necessary for formation of resting potential: selective permeability of membrane, ionic asymmetry, activity of sodium-potassium pump. The concept of cell receptors, their morpho-functional features.

The origin of the action potential. Mechanism of depolarization. Mechanism of repolarization. Na-inactivation. Passive shifts of membrane potential. Active shifts of potentials. Local excitation. Comparative characteristics of local and spreading excitation. Excitability changes during excitation. Relative refractory period and its characteristics. Absolute refractory period and its characteristic. Parabiosis and its phases. Dependence of the strength of the tissue response on the strength of the stimulus. The law of force. The law «all or nothing» and its critique. The concept of rebase, chronaxia. Law of response. Parameters of tissue excitability.

General plan of nervous system structure: principles of anatomical (central and peripheral parts) and functional (somatic and autonomous parts) division. Functional classification of neurons. Physiological properties of nerve cells and functions of neuron structural elements (soma, axon, dendrites). Glial cells: types, structure, functions.

Nerve fiber as a structural and functional unit of the mixed nerve. Classification and morphophysiological characteristics of nerve fibers. Mechanism of excitation conduction in myelinated and unmyelinated nerve fibers. Laws of excitation conduction through nerve fibers.

Mixed nerve: structure and physiological properties. Mechanism of excitation conduction in mixed nerves. The concept of principles of pharmacological regulation of excitation conduction along the nerve (conductive blockade).

Synapse. Structure and classification of synapses, their physiological role. Modern ideas about the mechanisms of excitation conduction in synapses. Postsynaptic potentials. Neurotransmitters, their classification. Ionotropic and metabotropic receptors.

Synapse as an object of action and point of application of drugs, poisons and toxins. The concept of pharmacological regulation of synaptic transmission of excitation. Principal ways of action on the rate of synthesis and secretion of neurotransmitter; on the postsynaptic membrane receptors.

Muscle tissues: types, structure, physiological properties.

Morphological and physiological features of skeletal muscles. Classification of muscles by shape, structure, functions. The main functional groups of muscles of the human body: muscles of the head, neck, back, chest, abdomen; muscles of the pectoral girdle and upper extremity; muscles of the pelvic girdle and lower extremity.

The concept of neuromotor units. Types and modes of muscular contraction of skeletal muscles. Single muscle contraction and its phases. Changes in excitability during single muscle contraction. Summation of muscle contractions. Optimum and pessimum of irritation frequency and strength (N.E. Vvedensky). Mechanism of contraction and relaxation of a single muscle fiber and muscle (theory of «sliding»). Strength, work and fatigue of muscles, active rest theory. Contraction. Myorelaxation.

The importance of physical activity for health.

Smooth muscle tissue. Morpho-physiological features of smooth muscles. Mechanisms of contraction and relaxation of smooth muscles. Features of regulation of contraction (force, duration) of smooth muscles (types of mediators and synaptic receptors). The concept of the nature of smooth muscle tone and its correction.

3. Anatomy and physiology of the nervous system

General plan of the structure of the brain and spinal cord. Functions of the central nervous system (CNS) and its role in providing the vital activity of the whole organism and its relationship with the environment. Methods of studying the functions of the nervous system.

Reflex as an elementary act of nervous activity. Development of the doctrine of reflex. Historical significance of the works of R.Descartes, I.Prohazka, C.Sherrington, I.M.Sechenov, I.P.Pavlov. Analysis of the reflex arc: afferent, central, efferent parts. Feedback and its significance. Principles of reflex coordination.

Nerve center: definition, properties. Nerve center as a target for the effects of drugs.

Inhibition in the nerve centers. Types, functions and significance of central inhibition. Mechanisms of primary and secondary inhibition.

The spinal cord. Microstructure of the spinal cord segment, gray and white matter. The spinal canal. Nerve cells of the posterior, anterior and lateral horns. Functions of the anterior and posterior roots. The membranes of the spinal cord. The concept of the conductive pathways of the spinal cord. Spinal (spinal) reflexes, their types and significance. The role of the spinal cord in the regulation of somatic and vegetative functions. The concept of spinal shock.

Brainstem. Medulla oblongata. Structure, vital centers, reflex and conductive functions. The concept of stem nerve centers as points of application of drugs.

Midbrain and pons: structural and functional organization, functions.

Brainstem reticular formation: structure, functions. Participation of reticular formation in maintenance and redistribution of muscle tone, in regulation of vegetative functions.

Cerebellum: morphofunctional organization. The role of the cerebellum in the regulation of motor and autonomic functions.

Thalamus: morphofunctional organization (specific and nonspecific nuclei). The role of thalamus in primary processing of sensory information.

Hypothalamus: morphofunctional organization, functions. Links of hypothalamus with pituitary gland and other parts of the brain.

Limbic system: morphofunctional organization. The role of limbic system in formation of emotions, motivations, memory.

Basal nuclei and their functions.

The large (terminal) brain. Right and left hemispheres of the brain. The concept of interhemispheric asymmetry and hemispheric dominance. Corpus callosum: topography and function. Cerebral cortex. Afferent, efferent and associative areas. Localization of functions in the cerebral cortex. Superior integrative role of the cerebral cortex.

Hematoencephalic barrier: structure, functions.

The membranes of the brain. Ventricles of the brain, vascular plexuses. Connection of cerebral ventricles with cerebrospinal canal cavity. Cerebrospinal fluid: production, composition, ways of outflow, functions. Hemato-liquor barrier. The role of the cerebrospinal fluid in the vital activity of the brain. Peculiarities of brain metabolism and its provision by the cerebral circulatory system.

The role of the autonomic nervous system (ANS) in ensuring the activity of the whole organism. Functions of the ANS. Comparative description of the general structure and physiological properties of the ANS and somatic nervous system (afferent, central, efferent sections). Segmentary and suprasegmentary levels of the ANS. Autonomic reflex arch. Peripheral ANS. Autonomic ganglia, their functions (transmissive, reflexive, integrative).

Structure and physiological features of the parasympathetic part of the ANS. Structure and physiological features of the sympathetic part of the ANS. Peripheral effects of sympathetic and parasympathetic parts of the ANS. Structure and physiological features of the metasympathetic part of the ANS.

Mechanism of excitation transfer from postganglionic fibers to working organs. Classification of receptors in ANS synapses (H- and M-cholinoreceptors; α - and β -adrenoreceptors).

Classification of autonomic reflexes.

4. Anatomy and physiology of the endocrine system. Male and female reproductive system

Morphofunctional organization of the endocrine system. Central and peripheral (glandular and extra glandular) organs of endocrine system. Current views on the functions of endocrine glands, diffuse elements, methods of intercellular communication through chemical signals (paracrine, autocrine regulation).

Hormones: classification, transport forms, pathways of metabolism, inactivation and excretion. Mechanisms of hormones action. Synergism and antagonism of hormone action.

Nervous and humoral, direct and inverse (positive and negative) connections in regulation of endocrine glands activity. Factors determining the concentration of hormones in blood. Physiological rhythms of neuroendocrine secretion.

Pituitary gland: location, structure, sections and functional connections with hypothalamus. Hormones of pituitary gland and hypothalamus, their role in regulation of endocrine organs activity. Significance of pituitary gland in regulation of peripheral endocrine glands. Regulation of endocrine functions of pituitary gland.

Epiphysis, topography and microstructure. Endocrine function of epiphysis, its regulation.

Thyroid gland: location, macro- and microscopic structure. Thyroid hormones, their biological action. Regulation of thyroid function. Hyper- and hypofunction. Thyrocalcitonin.

Parathyroid glands: location, microscopic structure. Parathormone, its biological action. Regulation of calcium and phosphorus homeostasis in organism: role of calcitonin, parathormone and calcitriol. Age and individual norms of calcium, phosphate and fluorine intake for preservation of bone and teeth health.

Adrenal glands: topography, structure, functions. Hormones of cortical and cerebral substance, their biological action. Hypothalamic-pituitary-adrenal system. Participation of hormones in the integrative adaptive activity of the organism. Role of endocrine system in development of general adaptation syndrome and stress (G.Selye). Stress-exercising and stress-limiting systems of the body.

Incretory part of the pancreas, location, microstructure. Pancreatic hormones, their biological action. Physiological mechanisms of self-regulation of blood glucose content.

The concept of the diffuse endocrine system. Concept of endocrine function of liver (somatomedins, angiotensinogen, thrombocytopoietin), heart (atriopeptides), kidneys (erythropoietin, calcitriol, renin, etc.), gastrointestinal apudocytes (gastrin, cholecystokinin, secretin, somatostatin, etc.).

Human reproductive function. Genotypic and phenotypic signs of sex. Male reproductive system: structure of male genital organs, their functions. Androgens, their biological effect. Spermatogenesis, factors of its regulation.

Female reproductive system: external and internal reproductive organs, their localization, structure and functions. Ovaries: topography, structure, functions. Estrogens, their role in the development of sexual characteristics. Ovogenesis. The phases of the menstrual cycle. Hormones of the corpus luteum of pregnancy (progestins), their biological significance.

5. Anatomy and physiology of sensory systems. Higher nervous activity

The concept of sensory organs, analyzers, sensory systems. General principles of the structure of sensory systems. Mechanisms of perception of the action of external and internal environment stimuli by receptors. The concept of receptors of sensory systems. Primary and secondary sensory receptors. Biological significance of receptors. Coding of information in receptors. Receptor and generator potential. Adaptation of receptors.

General principles of the structure of sensory systems, their classification. The role of sensory systems in brain development and cognition of the world.

Visual sensory system, structure, functions. Features of the structure and properties of the eye, providing the function of vision. Structure and functional significance of the retina. Photochemical processes in retinal receptors under the action of light. Theories of color perception. Field of vision. Visual acuity. Refraction and accommodation. Basics of correction of refractive errors. Basic forms of color perception disorders, significance for work activity.

Auditory sensory system. Peculiarities of structure and properties of sound-receiving and sound-conducting apparatuses which provide hearing function. Binaural hearing. Age features of hearing. Fundamentals of hearing impairment correction.

Vestibular sensory system. Features of the structure and properties of the receptor part, providing perception and evaluation of the position of the body in space in statics and during movement.

Taste System. Taste sensitivity. Classification of taste sensations. Methods of definition of threshold of taste sensation and functional mobility of receptors.

Skin sensitivity. Types of skin sensory receptors and their functions. Thermoreception. Proprioceptive sensitivity.

Interoceptive sensitivity. Receptor mechanisms. Types of visceral sensitivity. Reactions of the body to irritation of interoreceptors. The role of interoreception in the maintenance of homeostasis.

Nociceptive receptor and nociceptive system. Conduction of pain sensitivity signals. Pain: types, manifestations and biological significance. Mechanisms of pain sensation formation: role of mediators, hormones and brain oligopeptides. Antinociceptive system. Endogenous opiate peptides (endorphins, enkephalins), their role in pain regulation. Principles of pain management.

Integrative functions of the brain that ensure the integrity of the organism (integration of somatic, autonomic, endocrine functions). Levels of integration. Integrative functions of the brain providing interaction of the organism with the environment and adaptation of the organism to changing conditions of existence.

General characteristics of innate and acquired human behavior. The importance of the works of I.M. Sechenov and I.P. Pavlov for the development of the doctrine of human mental activity and behavior. Conditioned reflexes - the basis of higher nervous activity. Inborn (conditioned reflexes and instincts), acquired (conditioned reflexes) forms of human behavior and learning. Conditioned reflex and functional system. Biological and neurophysiological mechanisms of formation of conditioned reflex and learning. Unconditional (external) and conditional (internal) inhibition of conditioned reflexes.

Types of human higher nervous activity according to I.P. Pavlov. The first and second signaling systems.

Memory. Types of memory. Mechanisms of short-term and long-term memory. Importance of memory in the formation of adaptive reactions.

Attention: neurophysiological mechanisms and biological significance.

The notion of thinking, consciousness, the unconsciousness.

Speech. Functional asymmetry of the large hemisphere cortex related to the development of speech in humans.

Motivations. Neurohumoral mechanisms of formation and properties of motivational arousal. Types of motivations. Dominant motivations.

Emotions. Theories of emotion. Positive and negative emotions, their manifestations and biological significance. Emotional structures of the brain. Emotional stress. Ways to increase the body's resistance to emotional stress.

Sleep: types, manifestations, physiological significance. Structure of sleep. Neurophysiological mechanisms of sleep. The role of neurotransmitters and melatonin in the development of sleep. Integrative activity of the brain in the state of sleep.

6. The internal environment of the human body. Physiology of blood

Fluid media of the human body. The concept of the internal environment of the human body. Homeostasis. Morphophysiological characteristics of external and internal barriers of human body. The role of histohematic barriers in homeostasis maintenance. Regulation of permeability of histohematic barriers and understanding of mechanisms of transport of substances through them.

Blood. The concept of blood system (G.F. Lang). General physico-chemical properties of blood: composition, quantity, properties and functions. Basic physiological constants of blood characterizing homeostasis. Osmotic and oncotic blood pressure, their regulation.

Blood plasma proteins, their classification and importance. Colloid-osmotic pressure of plasma and its role. Hypo-, hyper- and isotonic solutions. Principles of composition of plasma-substituting solutions. Rheological properties of blood.

Acid-base state of blood. Functional system ensuring blood pH constancy. Buffer systems of blood (carbonate, phosphate, protein and hemoglobin buffer systems). Role of organ systems in maintaining pH constancy of internal environment.

Hemopoiesis. Stem cell theory: their types, properties and functions. Nervous and humoral mechanisms of hemopoiesis regulation. The needs of a healthy person's body in essential nutrients, vitamins and trace elements to maintain normal hematopoiesis. General idea of disorders of hematopoiesis in case of deficiency of these substances in the body.

Erythrocytopoiesis and erythrocyte destruction. Features of the structure and properties of red blood cells (RBC). The notion of methods of quantitative assessment of RBC. Norms of erythrocytes in the blood of a healthy person. The concept of erythrocytosis and erythropenia. Hemoglobin, its functions. Features of the structure and properties that ensure the performance of its functions. Types of hemoglobin, quantity, methods of determination. Color index and its calculation. Hemolysis and its types. Sedimentation rate of erythrocytes (sedimentation rate) and the factors affecting it.

Leukocytopoiesis. Leukocyte species, structure, number, functions. Leukocyte formula. The concept of leukocytosis and leukopenia. General concept of immunity (general and specific; natural and artificial). Vaccination and therapeutic serums.

Thrombocytopoiesis. Platelets: number, structure, properties and functions, life span. Participation of platelets in blood coagulation. Platelets as a source of physiologically active substances (histamine, serotonin, etc.). The role of spleen in platelet destruction.

The main indicators of general blood analysis. Physiological evaluation of the results of the analyses. Diagnostic value of complete blood count.

The concept of the hemostasis system and its parts. Primary (vascular-platelet) and secondary (coagulation) hemostasis. Theories of hemostasis. Phases of blood coagulation. Fibrinolysis. Anticoagulants. Introduction of natural and artificial anticoagulants, fibrinolytic and hemostatic agents. Role of liver and lung cells in synthesis of anticoagulants.

Blood types. Blood typing in AB0 and Rh systems. Physiological basis of blood transfusion. Consequences of mismatched blood transfusion. The concept of rhesus conflict between mother and fetus.

7. Anatomy and physiology of cardiovascular system

Physiological essence and significance of blood circulation. General plan of the structure of the cardiovascular system. Large and small circuits of the blood circulation.

Topography of the vessels of the great and small circulatory system. Microstructure of arterial wall. Features of the structure of the arterioles wall. Veins: wall structure; valves, their functions.

Heart: topography and structure. Features of the structure and functions of atypical and working cardiomyocytes.

Topography of nodes and bundles of cardiac conduction system. Current views on the substrate and nature of automatism. Law of decreasing gradient of automatism.

Features of myocardial contractility. Laws of cardiac contraction. Peculiarities of excitability of contractile myocardium. Correlation of excitability and contractility in different phases of the cardiac cycle. Distribution of excitation through the heart. Atrioventricular delay.

Cardiac cycle, phase analysis of systole and diastole. The work of the valve apparatus. Heart tones, their origin.

Hemodynamic function of the heart: basic parameters.

Peculiarities of the coronary circulation.

The concept of methods of heart research: electrocardiography (ECG), phonocardiography, rheography, echocardiography. ECG: leads, waves, intervals and segments.

Regulation of cardiac activity. Intracardiac mechanisms: hetero- and homeometric regulation («heart law» by Starling, Anrep effect, regulation by means of intracardiac nervous system). Extracardiac mechanisms: innervation and nervous regulation of the heart. Characteristics and mechanism of influence of sympathetic and parasympathetic departments of autonomic nervous system on heart activity. Humoral regulation of cardiac activity: influence of hormones, mediators, metabolites, blood pH, electrolytes on cardiac activity.

Morphological and functional classification of vessels. The role of arterioles in creating peripheral resistance to blood flow. Basic law of hemodynamics. Hemodynamic laws of blood movement. Linear and volumetric velocity of blood flow in different parts of the vascular bed. The concept of systemic, organ and local blood flow. Factors that ensure blood flow in vessels.

Blood pressure, its types: arterial pressure (BP) systolic, diastolic, pulse, mean. Factors that determine the value of BP. The concept of «normal values» of BP, age-related changes in BP. Methods of measuring BP. Arterial and venous pulse.

Microcirculation. Structural and functional characteristics of the main components of the microcirculatory system. Capillary blood flow and its characteristics. Mechanisms of transcapillary exchange.

Vascular tone, its nature. Regulation of vascular tone. Nervous regulation: vascular innervation, vasodilation and vasoconstriction. Localization of choline and adrenoreceptors in vascular walls, physiological effects of their stimulation. Structural organization of the cardiovascular center. Pressor and depressor reflexes.

Humoral regulation. Vasodilators: acetylcholine, histamine, kinins, adenosine, metabolites, endothelial factors. Vasoconstrictors: catecholamines, vasopressin, angiotensin, serotonin, endothelin, thromboxanes.

A functional system that maintains optimal blood pressure for metabolism.

Structure of the lymphatic system: topography and structure of lymph nodes, vessels and main lymphatic collectors. The parietal and visceral groups of lymph nodes. Functions of the lymphatic system. Lymph circulation. Lymph formation and composition of lymph. Regulation of lymph circulation.

Recommendations for a healthy lifestyle to preserve the function of the cardiovascular system and increase its reserves.

8. Anatomy and physiology of the respiratory system

The role and place of the respiratory system in the human body as a system that serves metabolic processes. Topography and structure of nose, larynx, trachea, bronchi. Topography and structure of lungs. Structure of pleura and pleural cavity. The importance of respiration for the organism. Basic respiration stages (lung ventilation, gases exchange in the lungs, transport of gases by blood, their diffusion in tissue, cellular respiration). Lung ventilation. Physiology of respiratory airways, their regulation. The significance of ciliated epithelium. Respiratory cycle. Neural control of respiratory muscles. Biomechanics of an inspiration and expiration. Compliance of the lungs and chest wall. Elastic recoil of the lungs. Surfactant functions. Intrapleural pressure, its changes during respiration. Mechanism of inspiration and expiration. Blood flow in the lungs. Effect of gravity on pulmonary blood flow and ventilation. Ventilation/perfusion ratio in different regions of the lungs.

Indices of lung ventilation. Lung volumes and capacities. Spirometry, spirography, peakflowmetry. Peak expiratory flow and other flow indices of pulmonary ventilation. Tiffeneau's index (test). The curve "flow-volume". Obstructive and restrictive lung disorders, their causes and changes of lung ventilation indices.

Gas exchange in the lungs. Composition of inhaled, alveolar and exhaled air. Peculiarities of alveolar ventilation. Oxygen capacity of blood. Mechanism of gas exchange between alveolar air and blood.

Oxygen transport in blood. States of hemoglobin bound with gases. Oxyhemoglobin dissociation curve (hemoglobin saturation with oxygen curve). Factors affecting the affinity of hemoglobin to oxygen. Oxygen capacity of the blood. Carbon dioxide transport in the blood. The role of carbonic anhydrase.

Gas exchange between the blood and tissues. The oxygen utilization coefficient for the tissues at rest and at exercise.

Cell respiration. Bases of anaerobic and aerobic types of energy metabolism, their contribution to the cellular metabolism provision depending on the cells functional state.

Regulation of respiration as the way to ensure cell respiration requirements and maintenance of the main gas blood constants (pO_2 , pCO_2 , pH). Lung ventilation indices that are regulated: respiration rate, tidal volume. Respiratory center, its parts. Mechanisms providing respiratory periodicity. Receptors of respiratory ways, lungs and respiratory muscles. Reflex reactions to their stimulation. Herring-Breyer's reflexes. Central and peripheral receptors for O_2 , CO_2 and H^+ ions (pH) in the organism, their role. Factors that stimulate the respiratory center of the brainstem.

Relationship between gas exchange and acid-base balance. Functional system of relative constancy maintenance of blood gases partial pressure. Effects of pH and blood gases level changes on the lung ventilation indices. Relationship between alveolar ventilation and pulmonary blood flow. Mechanisms that provide the constancy of a ratio between these levels. Respiration at exercise, at increased and decreased atmospheric pressure. Respiration and phonation. Mechanisms of the first inspiration of a newborn. Hypoxia and its signs. Theoretic bases of artificial respiration. Age-specific changes of respiration.

9. Anatomy and physiology of digestive system

General characteristics of the digestive process. The importance of digestion. Topography and structure of the organs of the digestive system: innervation, blood and lymph circulation. Functions of the digestive system: secretory, motor, absorptive, excretory, protective.

Digestion in the oral cavity. Topography and structure of the oral organs. The act of chewing. The composition and properties of saliva. Mechanical and chemical processing of food in the oral cavity.

Swallowing. Morphofunctional features of the pharynx and esophagus.

Digestion in the stomach. Topography and structure of the stomach. Glands of the stomach. The composition and properties of gastric juice. Nervous and humoral regulation of gastric secretion, phases of gastric secretion. Gastric motility. Evacuation of chyme from the stomach to the duodenum.

Digestion in the duodenum. Topography, structure and functions of duodenum. Topography, structure of the pancreas, its role in digestion. Composition and properties of pancreatic juice. Nervous and humoral regulation of pancreatic juice secretion, its adaptive character to types of food.

Topography, structure and digestive functions of the liver. Composition and functions of bile. Liver as a polyfunctional organ (participation in the metabolism of proteins, fats, carbohydrates; detoxifying and depositing function; synthesis of biologically active substances, etc.).

Digestion in the jejunum and ileum. Topography and structure of jejunum and ileum. Intestinal glands. Intestinal juice, its composition and properties, its role in digestion. Regulation of secretion of intestinal juice. Hollow and parietal digestion. Mechanisms of absorption of macro- and micromolecules. Motor activity of the small intestine, types of contraction, its regulation.

Digestion in the colon. Topography and structure of the colon. Composition and importance of juice and microflora. The concept of microbiota. Motor activity of the colon, its regulation. Defecation.

A functional system that maintains the optimal level of nutrients in the human body for metabolism. Nutritional motivation, concept of the food center. Regulation of eating behavior. Physiological basis of hunger and satiety.

10. The metabolism of substances and energy. Physiological basis of a healthy nutrition

General characteristics of metabolism. The exchange of substances and energy between the human body and the environment is the basis of life activity and homeostasis. Characteristics of the processes of anabolism and catabolism, their relationship. Plastic role of metabolism. Nutrients and xenobiotics, their role in the body.

The method of determining the energy intake into the human body with food (alimentary calorimetry). Caloric coefficients of proteins, fats, carbohydrates.

The body's energy balance. The direction of energy expenditure in the human body. Methods of determining the energy expenditure of the human body (direct and indirect calorimetry). Respiratory coefficient. Caloric equivalent of oxygen. Balance of energy intake and expenditure. Basic metabolism and factors determining it (sex, age, height, body weight and body condition). The importance of the study of basal metabolism. Definition of the concepts of gross metabolism and work gain. Energy expenditure of the body in various types of work activities (according to the degree of severity of physical labor). Specific-dynamic action of food.

General ideas about the metabolism of proteins, fats and carbohydrates. Nitrogen balance. Positive and negative nitrogen balance. The concept of protein minimum and optimum.

Principles of healthy eating. General rules for making nutritional diets. The concept of the norm of body weight. Excessive (obesity) and insufficient (underweight) body weight. Body mass index.

Basics of rational nutrition: theories of balanced and adequate nutrition. Mode of nutrition. Daily norms of consumption of fats, proteins, carbohydrates, essential vitamins, microelements. Mechanisms of regulation of metabolism in human body. The importance of rational nutrition for the preservation of human health.

11. Physiology of thermoregulation

The role of temperature in the metabolism and vital functions of the human body. Thermal homeostasis. Types of heat exchange. Parts of homothermic human body (shell, core) and their temperature. Daily fluctuations of human body temperature.

Thermoregulation: chemical (heat production) and physical (heat release). Characteristics of chemical thermoregulation. Mechanisms of non-reducing and contractile thermogenesis. Characteristics of physical thermoregulation. Ways of heat transfer (heat conduction, heat radiation, convection and evaporation). Physiological

mechanisms of heat dissipation (vascular reactions, changes in the amount of circulating blood, sweating, breathing, pilomotor reflex, posture). Role of behavioral reaction in regulation of human body temperature.

Thermoreception. Peripheral and deep cold and heat thermoreceptors. Role of afferentation, thermoregulation center and efferentation in regulation of human body temperature. Setting point of thermoregulation. Role of hormones and biologically active substances in thermoregulation. Changes in thermoregulation in conditions of cold and hot climate. Mechanisms of human body adaptation to cold and heat.

12. Anatomy and physiology of excretion

The essence of excretion processes. Excretory organs and systems of the organism (kidney, skin, lungs, and digestive tract).

The structure of a kidney. Excretory and non-excretory functions of the kidney. Nephron as a morphological and functional unit of the kidney. Peculiarities of blood circulation in the kidney.

Basic processes of urine formation (glomerular filtration, tubular reabsorption and secretion). Mechanisms of glomerular filtration. Primary urine composition. Mechanisms of substances reabsorption in nephron tubules and collecting ducts. Countercurrent multiplying system and mechanisms of its functioning. Processes of the excretory secretion in tubules. Final urine, its composition.

Neuro-humoral regulation of urine formation. Factor which are regulated (kidney hemodynamics; glomerular filtration rate; reabsorption of water, glucose, Na, K, Ca, P, H, HCO₃, urea and other substances).

Non-excretory functions of the kidney: the role of kidneys in regulation of the systemic arterial blood pressure; regulation of blood volume; maintaining of the blood osmotic pressure, acid-base balance and ion blood composition; participation in the blood formation and in metabolic processes. Indices of urine excretion (frequency, volume, night and day diuresis). Regulation of urine excretion.

Consequences of kidney removal. Principles of artificial kidney functioning. Dialysis. Physiological basis of transplanted kidney regulation possibility. Age-related changes of urine formation and excretion.

ACADEMIC DISCIPLINE CURRICULAR CHART

Section number, topic	Section (topic) name	Number of class hours				Form of control
		lectures (including supervised student independent work)	supervised student independent work)	laboratory	Self-studies	
	1 semester	18	6	54	48	
1	Introduction to anatomy and physiology	2	0,5	9	3	
	The subject and objectives of human anatomy and physiology. Biological basis of human life. Bioelectrical potentials. Bioelectrogenesis	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
	Introduction. The subject and objectives of human anatomy and physiology. Biological basis of human life. Laboratory work (L. w.) «Studying the receptor mechanism of adrenaline's effect on heart rate (performing an experiment on a virtual animal (rat))»	-	-	3	1	
	General concept of tissues. Connective tissues: types, functions. Human skeleton. Role of calcium and phosphates in bone tissue and in the body	-	-	3	1	
	Epithelial tissues: types, peculiarities of structure, functions. Glandular epithelium, secretion. Glands: types, peculiarities of structure, functions. Skin: peculiarities of structure, functions. Skin: peculiarities of structure, functions. L. w. «Calculation of skin areas by Turovsky and body surface according to nomogram»	-	-	3	1	

2.	Anatomy and physiology of excitable tissues	2	0,5	12	12	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
	Structure and functions of peripheral nerves. Synaptic transmission. Muscular tissues: types, structure, functions. Skeletal, smooth muscle tissues	2	0,5	-	-	
	General properties of excitable tissues. Generation of bioelectrical potentials. Bioelectrogenesis. Laws of irritation of excitable tissues. L. w. «Study of the effects of Na^+ ions and K^+ on resting membrane potential and action potential (on a virtually simulated isolated neuromuscular preparation)».	-	-	3	3	
	Structure and functions of peripheral nerves, conduction of excitation along them. Synapses: structure, types, functions. Synaptic transmission	-	-	3	2	
	Physiology of muscle tissue. Skeletal and smooth muscles L. w. «Study of electrical activity of biceps brachii muscle by electromyography», «Assessment of muscle strength by means of hand and standing dynamometry»	-	-	3	3	
	Concluding lesson «Introduction to anatomy and physiology. Anatomy and physiology of excitable tissues»			3	4	Colloquiums; electronic tests; quizzes, control questioning
3.	Anatomy and physiology of the nervous system	6	2	9	9	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
	General physiology of the central nervous system. Nerve centers. Reflex theory	2	0,5	-	-	
	Special anatomy and physiology of the central nervous system (role and functions of spinal cord, medulla and medulla, cerebellum, reticular formation. Role and functions of thalamus, hypothalamus, basal nuclei, limbic system and cerebral hemisphere cortex).	2	1	-	-	
	Autonomic (autonomic) nervous system: structure, functions, mechanism of controlling the work of internal organs. Autonomic reflexes	2	0,5	-	-	
	General physiology of the central nervous system Reflex theory. Nerve centers: their properties, principles of	-	-	3	3	

<p>functioning. Excitation and inhibition in CNS, their neurotransmitter mechanisms.</p> <p>L. w. «Study of the knee (tendon) reflex in humans», «Study of reciprocal inhibition of motor reactions by electromyography»</p> <p>Special anatomy and physiology of the central nervous system, its role in movement control. Role and functions of spinal cord, medulla and medulla, cerebellum, reticular formation. Role and functions of thalamus, hypothalamus, basal nuclei, limbic system and cerebral hemisphere cortex. Somatic reflexes</p> <p>L. w. «Study of some myotatic reflexes of the spinal cord», «Study of motor functions of some cranial nerves», «Study of cerebellar control of motor activity»</p>					
<p>Autonomic nervous system</p> <p>L. w. «Study of the functional state of the centers regulating the heart (orthostatic reflex, clinostatic reflex, Goering's respiratory-cardiac reflex)», «Study of neurotransmitter mechanisms of the influence of sympathetic and parasympathetic sections of the ANS on cardiac function»</p>		3	2	3	4
<p>4. Anatomy and physiology of the endocrine system. Male and female reproductive system</p>		1	2	12	12
<p>Endocrine system, physiological role and regulation of hormone formation. Mechanisms of hormonal regulation of physiological functions</p>		1	2	-	-
<p>Endocrine system, physiological role and regulation of hormone formation</p> <p>L. w. «Evaluation of human height»</p>		-	-	3	3
<p>Mechanisms of hormonal regulation of physiological functions</p> <p>L. w. «Assessment of the influence of catecholamines as hormones (adrenal medulla) and as neurotransmitters (sympathetic ANS) on cardiovascular system indicators (heart rate and blood pressure)»</p>		-	-	3	2
<p>Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works, electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work</p>					

	<p>Male and female reproductive system</p> <p>L. w. «Assessment of hand muscle strength in men and women», «Study of the nature of crystallization of saliva»</p> <p>Concluding lesson «Anatomy and physiology of the nervous system. Anatomy and physiology of the endocrine system. Male and female reproductive system»</p>	-	-	3	3	Colloquiums; electronic tests; quizzes, control questioning
5.	<p>Anatomy and physiology of sensory systems. Higher nervous activity</p> <p>General principles of structure and function of sensory systems. Structure and functions of visual, auditory and vestibular sensory systems</p> <p>L. w. «Determination of visual acuity and its evaluation», «Determination of the boundaries of the visual field (perimetry)»; «Determination of the sensitivity of the central regions of the retina»; «A study of color vision»; «Determining the direction of the sound source», «Examination of bone and air conduction (tunnel audiometry (Weber and Rinne tests))»; «Study of the dependence of auditory sensitivity on sound frequency and sound pressure level (tonal audiometry)».</p> <p>Special physiology of sensory systems. Structure and functions of olfactory, taste, somatovisceral sensory systems. Nociception. Nociceptive and antinociceptive systems: structure, functions, mechanisms</p> <p>L. w. «Study of tactile sensitivity. Measurement of spatial thresholds (esthesiometry)»; «Study of sensitivity of the taste analyzer», «Analysis of the spatial summation of excitation in the central representation of the taste analyzer»</p>	2	1	12	12	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
	<p>Higher nervous activity</p> <p>L. w. «Determination of the volume of semantic memory»; «Determination of short-term auditory memory with the help of letter and number complexes»; «Determination of the latent period of the sensorimotor reaction under various conditions», «Manifestation of functional asymmetry of the hemispheres»,</p>	2	1	3	3	

«Assessment of attention parameters by means of a proofreading test», «Assessment of an individual's neuro-psychic adaptation»						
Concluding lesson «Anatomy and physiology of sensory systems. Higher nervous activity»	-	-	3	4	Colloquiums; electronic tests; quizzes, control questioning. Credit	
6. The internal environment of the human body. Physiology of blood Homeostasis. Blood types	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays	
7. Anatomy and physiology of the cardiovascular system The structure and functions of the heart and blood vessels. Cardiac cycle. The concept of cardiac automatism. Regulation of cardiac activity	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays	
	10	3	51	49		
6. The internal environment of the human body. Physiology of blood Homeostasis. Fluid media of the body and barrier functions. Blood: general properties, quantity, composition and functions. Basic constants of blood Hemopoiesis. Blood cells L. w. «Calculation of the color index»; «Determination of the ESR according to the Panchenkov method»; «Physiological evaluation of the results of the general blood test»	-	-	12	12	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical	

Hemostasis. Blood types L. w. «Blood typing AB0 using standard sera»; «Determination and physiological evaluation of primary hemostasis indices»	-	-	-	3	3	3	exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Concluding lesson «The internal environment of the human body. Physiology of blood»	-	-	2	3	12	4	Colloquiums; electronic tests; quizzes, control questioning.
7. Anatomy and physiology of the cardiovascular system	2	1	2	-	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Hemodynamics. Functional indices of blood circulation. Regional blood flow. The regulation of blood circulation. Structure and functions of the lymphatic system	2	1	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
The structure and functions of the heart and blood vessels. Cardiac cycle. The concept of cardiac automatism	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Determination of the duration of the cardiac cycle in humans by pulse»	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Regulation of cardiac activity. Methods of the heart investigation	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Analysis of receptor mechanisms of the influence of sympathetic and parasympathetic sections of the ANS and their neurotransmitters on cardiac function»; «Registration and analysis of electrocardiogram (ECG)»; «Registration and analysis of phonocardiogram (recorded synchronously with ECG)»	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Hemodynamics. Functional indices of blood circulation. Structure and functions of blood vessels. Blood pressure: its types and role. Microcirculation. Structure and functions of lymphatic system	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Determination of blood pressure in humans by the Korotkoff method»; «Study of the properties of the arterial pulse by palpation»; «Application of the information test to detect hypertension»	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Regional blood flow. Regulation of circulation	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Analysis of physiological mechanisms of blood-pressure regulation»; «Determination of a person's physiological	-	-	-	3	3	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work

capacity for work according to the PWC ₁₇₀ test»; «Assessment of cardiovascular reactivity (postural (orthostatic reflex) baroreflex)»	2	0,5	12	12	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
8. Anatomy and physiology of the respiratory system	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Anatomy and physiology of the respiratory system: lung ventilation, gas exchange in the lungs, blood gas transport, gas exchange in tissues	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Lung ventilation. Gas exchange in the lungs	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Study of lung ventilation (spirometry, spirometry, pneumotachometry)»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Transport of gases by the blood. Gas exchange in tissues	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Assessment of blood oxygen saturation (oxyhemometry, oxyhemography, pulse oximetry)»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Regulation of respiration	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Study of the effect of increasing CO ₂ tension in alveolar air on external respiration»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Concluding lesson «Anatomy and physiology of the cardiovascular system and respiratory systems»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
9. Anatomy and physiology of the digestive system	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Structure and functions of the digestive system. Digestion in the mouth and stomach. Digestion in the small and large intestine. The role of the pancreas and liver in digestion. Absorption	2	0,5	-	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Structure and functions of the digestive system. Digestion in the mouth and stomach	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Study of the action of α -amylase (ptialin) of saliva on starch»; «Assessment of the rate of mixed saliva secretion (sialometry)»; «Determination of oral fluid pH»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
Digestion in the small and large intestine. The role of the pancreas and liver in digestion. Absorption	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
L. w. «Study of the influence of neurotransmitters of the sympathetic nervous system on the peristalsis of the small intestine and analysis of the neurotransmitter mechanisms of excitation conduction on the smooth muscles of the intestine»	-	-	3	3	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work

10.	<p>The metabolism of substances and energy. Physiological basis of a healthy diet</p> <p>The metabolism of substances and energy. Physiological basis of healthy nutrition. Physiology of thermoregulation</p> <p>The metabolism of substances and energy. Physiological basis of a healthy diet</p> <p>L. w. «Calculation of the proper values of the basic exchange by tables and formulas», «Body Mass Assessment (BMA)»</p>	2	0,5	2	2	2	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
11.	<p>Physiology of thermoregulation</p> <p>L. w. «Measurement of human body temperature in the armpit»; «Determination of the average temperature of the skin of the human body»</p>	-	-	2	2	-	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work
12.	<p>Physiology of excretion</p> <p>Physiology of excretion</p> <p>L. w. «Physiological evaluation of the results of general urinalysis», «Study some functions of the kidney on a model»</p>	2	0,5	6	5	5	Interviews; control questioning; written accounts on classroom (home) practical exercises; written accounts on practical works electronic tests; quizzes, essays; reports

<p>Concluding lesson «Anatomy and physiology of the digestive system. The metabolism of substances and energy. Physiological basics of healthy eating. Physiology of thermoregulation. Anatomy and physiology of excretion»</p>	-	-	3	4	<p>on classroom (home) practical exercises with their oral defense; laboratory reports with their oral defense; electronic workshops; visual laboratory work</p> <p>Colloquiums; electronic tests; quizzes; control questioning. Exam</p>
	10	9	105	97	

INFORMATION AND INSTRUCTIONAL UNIT

LITERATURE

Basic:

1. Нормальная физиология : учебник = Normal Physiology : textbook / В. В. Зинчук [и другие]; под редакцией В. В. Зинчука. – Минск : Вышэйшая школа, 2020. – 496 p.

Additional:

2. Hall, J. E. Guyton and Hall Textbook of Medical Physiology / J. E. Hall. – 13th ed., Elsevier Inc., 2015. – 1168 p.

3. Ganong's Review of Medical Physiology / K. E. Barret [at al.] –25th ed., McGraw-Hill Companies, 2016. – 726 p.

4. Fox, S. I. Human Physiology / S. I. Fox. – 14th ed. – New York : McGrawHill, 2016. – 832 p.

5. Северина, Т. Г. Физиология крови. Материалы лекций = Physiology of blood. Lecture notes : пособие / Т. Г. Северина. – Минск : БГМУ, 2014. – 51 p.

6. Constanzo, L. S. Physiology / L. S. Constanzo – 6th ed., Elsevier Inc., 2016. – 520 p.

7. Rhoades, R. A. Medical Physiology: Principles for Clinical Medicine / R. A. Rhoades, D. R. Bell. – 4th ed. – LWW, 2018. – 968 p.

8. Physiology : textbook / edited by V. M. Moroz, O. A. Shandra. – Vinnitsia : Nova Knyha, 2016. – 728 p.

METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE

The time allotted for independent work can be used by students for:

- preparation for lectures and laboratory classes;
- preparation for colloquiums, tests and exams in the academic discipline;
- working through the topics (issues) assigned for independent study;
- problem solving;
- research and creative assignments;
- preparation of thematic reports, essays, and presentations;
- practical assignments;
- taking notes from the textbook;
- making a review of the scientific literature on a given topic;
- design of information and demonstration materials (stands, posters, charts, tables, newspapers, etc.);
- making mock-ups, laboratory-teaching aids;
- compilation of a thematic selection of literary sources, Internet sources;
- making tests to organize mutual control.

METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE

Main forms of supervised student independent work:
 preparation and presentation of abstracts;
 presentation of reports and essays;
 studying topics and problems that have not been discussed at the lectures;
 taking notes of original sources (sections of anthologies, collections of documents, monographs, textbooks);
 computer (electronic) testing;
 preparation of tests for the organization of mutual assessment;
 preparation of didactic materials;
 participation in active forms of education.

Control of supervised student independent work is carried out in the form of:
 test paper;
 concluding class, colloquium in the form of an oral conversation, written work, testing;
 discussion of abstracts;
 defense of educational assignments;
 defense of the accounts (protocols) of the practical works;
 evaluation of an oral answer to a question, report, or problem solving in a practical class;
 checking up abstracts, written essays, and reports;
 electronic tests;
 individual interview.

LIST OF AVAILABLE DIAGNOSTIC TOOLS

The following forms are used for competences assessment:

Oral form:

interview;
 quizz;
 colloquium;

Written form:

tests;
 control questioning;
 accounts on classroom (home) practical exercises;
 accounts on practical works;
 essays.

Oral-written form:

reports on classroom (home) practical exercises with their oral defense;
 credit;
 examination;
 assessment based on a modular rating system.

Technical form:

electronic tests;
 electronic workshops;
 visual laboratory work.

LIST OF AVAILABLE TEACHING METHODS

Traditional method (lecture, practical classes);

Active (interactive) methods:

- Problem-Based Learning (PBL);
- Team-Based Learning (TBL);
- Research-Based Learning (RBL);

LIST OF PRACTICAL SKILLS

1. Implementation of measures to prevent infection with viral hepatitis and human immunodeficiency virus during the investigation of blood and other biological materials. Technique of taking capillary blood.
2. Physiological evaluation of complete blood count indices obtained using manual and semi-automatic methods of counting (number of erythrocytes, hemoglobin, color index and erythrocyte indices, leukocyte count and leukocyte formula, platelet count, erythrocyte sedimentation rate according to Panchenkov's method).
3. Blood typing in AB0 and Rh systems using standard sera and monoclonal antibodies.
4. Physiological evaluation of electromyography results.
5. Dynamometry (manual and standing, ergometry) and physiological evaluation of the results.
6. Measurement of arterial pressure and physiological assessment of the results.
7. Assessment of arterial pulse properties by palpation and sphygmography and physiological evaluation of pulse indices.
8. Conducting electrocardiography. ECG analysis (calibration, rhythm, heart rate (heart excitations rate), waves, intervals, segments, complexes).
9. Physiological evaluation of phonocardiography results.
10. Calculation of filtration/reabsorption ratio in different parts of the vascular bed.
11. Conducting spirometry and spirography. Calculation of proper values. Physiological evaluation of the obtained values.
12. Pneumotachometry (peakflowmetry). Calculation of proper values. Physiological evaluation of the values obtained.
13. Calculation of blood oxygen capacity and oxygen utilization coefficient, and their physiological evaluation.
14. Conducting sialometry and physiological evaluation of the results.
15. Calculation of the proper values of the basal metabolic rate and the total energy expenditure of the body.
16. Determination of energy expenditure by indirect calorimetry with complete and incomplete gas analysis.

17. Determination of the respiratory quotient and its physiological evaluation.
18. Body mass evaluation. Calculation of body mass index. Physiological assessment of the obtained indices and the formation of evidence-based recommendations for the correction of body mass.
19. Measuring axillary body temperature using mercury (or similar) and electronic thermometers. Evaluation of possible performance errors. Physiological evaluation of the results.
20. Studying of basic tendon reflexes (knee, Achilles, etc.), physiological evaluation of the results.
21. Studying of pupillary reflexes. Physiological evaluation of the obtained indices.
22. Studying of the state of cerebellar functions. Physiological evaluation of the obtained indices.
23. Assessment of functions of the visual sensory system (visual acuity, perimetry, campimetry, color vision examination).
24. Assessment of auditory sensory system functions (audiometry, Weber and Rinne experiments).
25. Determination of taste sensitivity thresholds.
26. Assessment of somatosensory system functions (examination of tactile, pain, temperature, proprioceptive sensitivity, esthesiometry).
27. Calculation of glomerular filtration rate by inulin (creatinine) clearance.
28. Physiological evaluation of the composition and properties of the final urine.
29. Assessment of tone and reactivity of sympathetic and parasympathetic divisions of ANS (clinostatic and orthostatic tests, cold test, study of Hering's respiratory-cardiac reflex, Dagnini-Ashner reflex and physiological evaluation of obtained indices).
30. Evaluation of endocrine system functions (measurement and evaluation of body height, body weight, temperature, basal metabolic rate, carbohydrate metabolism indices and others).
31. Evaluation of integrative functions of the brain (evaluation of indicators of attention and information processing speed according to the results of the correction test, evaluation of emotions manifestation, memory, functional asymmetry of the brain hemispheres, etc.).

LIST OF EQUIPMENT USED

1. Antiseptics and disinfectants;
2. Audiometer (sound generator);
3. Adaptometer
4. Biological material of the experimental animal (rats) – blood, blood plasma, intestines;
5. Bicycle ergometer;
6. Floor scales;
7. Sali's hemometer kit;
8. Glucometer;

9. Laboratory dynamometer;
10. Hand dynamometer;
11. Dynamometer for back muscles strength measurement;
12. Nose clip;
13. Ionometer (pH-meter);
14. Alveolar air collection chamber;
15. Capillaroscope (with video adapter);
16. Barani's chair;
17. Couch;
18. Lancet device;
19. Ruler;
20. Magnifying glass;
21. Gauze, absorbent cotton;
22. Microscope;
23. Donders model;
24. Neurological mallet with needle and brush;
25. A set of weights 0.5-3 kg;
26. Set of containers for disinfection of biological materials and equipment, small (100-300 ml) and large (1-5 liters);
27. A set of tuning forks;
28. A set of laboratory utensils and equipment (graduated and non-graduated test tubes, flasks, vials, pipettes, burettes, funnels; tripods, rubber and friction glass stoppers, beakers, glassograph, cotton, tweezers, round glass sticks, glass sticks with spatula, dissecting needle, surgical scissors, eye scissors, glass tubes, rubber tubes; litmus paper);
29. Monoclonal reagent kit for determination of AB0 and Rh blood groups;
30. Set of disposable mouthpieces, masks, connecting hoses for spirometry and pneumotachometry;
31. Set of standard sera for blood typing in AB0 system and reagent for blood typing in Rh system;
32. Chemicals kits (distilled water, NaCl, sodium bicarbonate, glucose, ammonia, hydrochloric acid, Lugol or iodine solution, Ringer's solution, hydrogen peroxide, sodium glutamate, quinine or benzalkonium chloride, citric acid, acetic acid, sodium citrate or EDTA, methylene blue, ionometer calibration buffer set, saccharin; egg white or fibrin, gastric juice; starch; bile; vegetable oil);
33. Electrocardiogram, phonocardiogram, polycardiogram, electroencephalogram sets;
34. Headphones;
35. Nomograms (DuBois to determine the surface area of the body; to determine the minute volume of respiration; to determine the proper values of indicators of human physical development);
36. Objects of different colors for perimetry;
37. Oxyhemograph;
38. Osmometer;
39. Oscilloscope;

40. Forster's Perimeter;
41. Personal computer;
42. Blood typing plates;
43. Pneumotachograph;
44. Pneumotachometer (peakflowmeter);
45. Rabkin or Ishihara polychromatic tables;
46. Watch slides, flat slides, slides with Goriaev grid, cover slides.
47. Panchenkov's device with Panchenkov capillaries;
48. Projector;
49. Pulse oximeter;
50. Pulse oximeter wrist gauge;
51. Height meter;
52. Measuring tape for 5 m;
53. Sanitary and hygienic clothing (rubber gloves, masks, goggles or face shield, waterproof apron and armbands);
54. Stopwatch;
55. Sterile scarifiers (lancets) disposable;
56. Leukocyte mixer;
57. Erythrocyte mixer;
58. Spirograph automatic;
59. Water spirometer;
60. Dry-air spirometer;
61. Spirit stove;
62. Harris-Benedict tables;
63. Tables for determination of visual acuity (Golovin, Sivtsev, Orlova) with standard light;
64. Standard correction tables;
65. Tables with numeric and letter complexes;
66. TV set;
67. Medical mercury-free thermometer;
68. Water thermometer (0-50° C);
69. Infrared thermometer with the ability to determine body temperature and surface temperature;
70. Electronic thermometer;
71. Thermostat or water bath;
72. Test strips for general urinalysis;
73. Tonometer automatic;
74. Tonometer mechanical with phonendoscope;
75. Pointer;
76. Biopotential amplifier;
77. Filter paper;
78. Neurological flashlight;
79. Phonendoscope with tubes of different lengths;
80. Hourglass for 5 min;
81. Standard cap for EEG recording;

82. Eye shield;
83. Electrodes (push-button metal; plate metal; disposable surface electrodes; crocodile type; bridge electrodes for EEG recording);
84. Electrocardiographer;
85. Electromyographer;
86. Electromyoreflexometer;
87. Electrical conductive paste;
88. Electroencephalographer;
89. Esthesiometer (Weber's compass).

LIST OF LECTURES

1st semester

1. The subject and objectives of human anatomy and physiology. Biological basis of human life. Bioelectrical potentials. Bioelectrogenesis.
2. Structure and functions of peripheral nerves. Synaptic transmission. Muscular tissues: types, structure, functions. Skeletal, smooth muscle tissues.
3. General physiology of the central nervous system. Nerve centers. Reflex theory.
4. Special anatomy and physiology of central nervous system (role and functions of spinal cord, medulla and medulla, cerebellum, reticular formation. Role and functions of thalamus, hypothalamus, basal nuclei, limbic system and cerebral hemisphere cortex).
5. Autonomic (autonomic) nervous system: structure, functions, mechanism of controlling the work of internal organs. Autonomic reflexes.
6. Endocrine system, physiological role and regulation of hormone formation. Mechanisms of hormonal regulation of physiological functions.
7. Integrative brain functions.
8. Hemostasis. Blood types.
9. The structure and functions of the heart and blood vessels. The cardiac cycle. The concept of cardiac automatism. Regulation of cardiac activity.

2^d semester

1. Hemodynamics. Functional indices of blood circulation. The regulation of blood circulation. Structure and functions of the lymphatic system.
2. Anatomy and physiology of the respiratory system: lung ventilation, gas exchange in the lungs, blood gas transport, gas exchange in tissues.
3. Structure and functions of the digestive system. Digestion in the mouth and stomach. Digestion in the small and large intestine. The role of the pancreas and liver in digestion. Absorption.
4. The metabolism of substances and energy. Physiological basis of healthy nutrition. Physiology of thermoregulation.
5. Physiology of excretion.

LIST OF LABORATORY CLASSES

1st semester

- Class 1. Introduction. The subject and objectives of human anatomy and physiology. The biological basis of human life.
Laboratory work:
Studying the receptor mechanism of adrenaline's effect on heart rate (performing an experiment on a virtual animal (rat))
- Class 2: General concept of tissues. Connective tissues: types, functions. Human skeleton. Role of calcium and phosphates in bone tissue and in the body.
- Class 3: Epithelial tissues: types, peculiarities of structure, functions. Glandular epithelium, secretion. Glands: types, peculiarities of structure, functions. Skin: peculiarities of structure, functions.
Laboratory work:
Calculation of skin areas by Turovsky and body surface according to nomogram.
- Class 4: General properties of excitable tissues. Generation of bioelectrical potentials. Bioelectrogenesis. Laws of irritation of excitable tissues
Laboratory work:
Study of the effects of Na ions⁺ and K⁺ on resting membrane potential and action potential (on a virtually simulated isolated neuromuscular preparation).
- Class 5. Structure and functions of peripheral nerves, conduction of excitation along them. Synapses: structure, types, functions. Synaptic transmission.
- Class 6. Physiology of muscle tissue. Skeletal and smooth muscles.
Laboratory work:
Study of electrical activity of biceps brachii muscle by electromyography;
Assessment of muscle strength by means of hand and standing dynamometry.
- Class 7. Concluding lesson on the sections «Introduction to anatomy and physiology. Anatomy and physiology of excitable tissues».
- Class 8. General physiology of the central nervous system. Reflex theory. Nerve centers: their properties, principles of functioning. Excitation and inhibition in CNS, their neurotransmitter mechanisms.
Laboratory work:
Study of the knee (tendon) reflex in humans;
Study of reciprocal inhibition of motor reactions by electromyography.
- Class 9. Special anatomy and physiology of the central nervous system, its role in movement control. Role and functions of spinal cord, medulla and medulla, cerebellum, reticular formation. Role and functions of thalamus, hypothalamus, basal nuclei, limbic system and cerebral hemisphere cortex. Somatic reflexes.
Laboratory work:
Study of some myotatic reflexes of the spinal cord;
Study of motor functions of some cranial nerves;
Study of cerebellar control of motor activity.
- Class 10. Autonomic nervous system
Laboratory work:
Study of the functional state of the centers regulating the heart (orthostatic reflex, clinostatic reflex, Goering's respiratory-cardiac reflex);
Study of neurotransmitter mechanisms of the influence of sympathetic and parasympathetic sections of the ANS on cardiac function.

- Class 11. Endocrine system, physiological role and regulation of hormone formation.
Laboratory work:
Evaluation of human height.
- Class 12. Mechanisms of hormonal regulation of physiological functions.
Laboratory work:
Assessment of the influence of catecholamines as hormones (adrenal medulla) and as neurotransmitters (sympathetic ANS) on cardiovascular system indicators (heart rate and blood pressure);
- Class 13. Male and female reproductive system
Laboratory work:
Assessment of hand muscle strength in men and women;
Study of the nature of crystallization of saliva.
- Class 14. Concluding lesson on «Anatomy and physiology of the nervous and endocrine systems. Male and female reproductive system».
- Class 15. General principles of structure and function of sensory systems. Structure and functions of the visual, auditory and vestibular sensory systems.
Laboratory work:
Determination of visual acuity and its evaluation;
Determination of the boundaries of the visual field (perimetry);
Determination of the sensitivity of the central regions of the retina;
A study of color vision;
Determining the direction of the sound source;
Examination of bone and air conduction (tunnel audiometry (Weber and Rinne tests);
Study of the dependence of auditory sensitivity on sound frequency and sound pressure level (tonal audiometry).
- Class 16. Special physiology of sensory systems. Structure and functions of olfactory, taste, somatovisceral sensory systems. Nociception. Nociceptive and antinociceptive systems: structure, functions, mechanisms.
Laboratory work:
Study of tactile sensitivity. Measurement of spatial thresholds (esthesiometry);
Study of sensitivity of the taste analyzer;
Analysis of the spatial summation of excitation in the central representation of the taste analyzer.
- Class 17. Higher nervous activity
Laboratory work:
Determination of the volume of semantic memory;
Determination of short-term auditory memory with the help of letter and number complexes;
Determination of the latent period of the sensorimotor reaction under various conditions;
Manifestation of functional asymmetry of the hemispheres;
Assessment of attention parameters by means of a proofreading test;
Assessment of an individual's neuro-psychic adaptation.

Class 18. Concluding lesson on «Anatomy and physiology of sensory systems. Higher nervous activity».

2^d semester

Class 19. Homeostasis. Fluid media of the body and barrier functions. Blood: general properties, quantity, composition and functions. Basic constants of blood.

Class 20. Hemopoiesis. Blood cells.

Laboratory work:

Calculation of the color index;

Determination of the ESR according to the Panchenkov method;

Physiological evaluation of the results of the general blood test.

Class 21. Hemostasis. Blood types.

Laboratory work:

Blood typing AB0 using standard sera;

Determination and physiological evaluation of primary hemostasis indices.

Class 22. Concluding lesson on «The internal environment of the human body. Physiology of blood»

Class 23. The structure and functions of the heart and blood vessels. Cardiac cycle. The concept of cardiac automatism.

Laboratory work:

Determination of the duration of the cardiac cycle in humans by pulse.

Class 24. Regulation of cardiac activity. Methods of the heart investigation.

Laboratory work:

Analysis of receptor mechanisms of the influence of sympathetic and parasympathetic sections of the ANS and their neurotransmitters on cardiac function;

Registration and analysis of electrocardiogram (ECG);

Registration and analysis of phonocardiogram (recorded synchronously with ECG).

Class 25. Hemodynamics. Functional indices of blood circulation. Structure and functions of blood vessels. Blood pressure: its types and role. Microcirculation.

Structure and functions of the lymphatic system.

Laboratory work:

Determination of blood pressure in humans by the Korotkoff method;

Study of the properties of the arterial pulse by palpation;

Application of the information test to detect hypertension.

Class 26. Regional blood flow. Regulation of circulation.

Laboratory work:

Analysis of physiological mechanisms of blood pressure regulation;

Determination of a person's physiological capacity for work according to the PWC₁₇₀ test;

Assessment of cardiovascular reactivity (postural (orthostatic reflex) baroreflex).

Class 27. Lung ventilation. Gas exchange in the lungs.

Laboratory work:

Study of lung ventilation (spirometry, spirometry, pneumotachometry).

Lesson 28. Transport of gases by the blood. Gas exchange in tissues.

Laboratory work:

Assessment of blood oxygen saturation (oxyhemometry, oxyhemography, pulse oximetry).

Class 29. Regulation of respiration.

Laboratory work:

Study of the effect of increasing CO₂ tension in alveolar air on external respiration.

Class 30. Concluding lesson on the sections «Anatomy and physiology of the cardiovascular and respiratory systems».

Class 31. Structure and functions of the digestive system. Digestion in the mouth and stomach.

Laboratory work:

Study of the action of α -amylase (ptialin) of saliva on starch;

Assessment of the rate of mixed saliva secretion (sialometry)

Determination of oral fluid pH.

Class 32. Digestion in the small and large intestine. The role of the pancreas and liver in digestion. Absorption.

Laboratory work:

Study of the influence of neurotransmitters of the sympathetic nervous system on the peristalsis of the small intestine and analysis of the neurotransmitter mechanisms of excitation conduction on the smooth muscles of the intestine.

Class 33. The metabolism of substances and energy. The physiological basis of healthy diet.

Laboratory work:

Calculation of the proper values of the basic exchange by tables and formulas;

Body Mass Assessment (BMA).

Class 34. Physiology of thermoregulation.

Laboratory work:

Measurement of human body temperature in the armpit;

Determination of the average temperature of the skin of the human body

Class 35. Physiology of excretion.

Laboratory work:

Physiological evaluation of the results of general urinalysis.

Study some functions of the kidney on a model

Class 36. Concluding lesson on the sections «Anatomy and physiology of the digestive system. The metabolism of substances and energy. The physiology of thermoregulation. Anatomy and physiology of excretion.

SAMPLES OF ABSTRACT TOPICS

1. Electrophysiological activity of the brain in different states.
2. Development of student scientific work at the Department of Normal Physiology. Anniversary dates.
3. Electrophysiological activity of the brain in extra- and intraverts.
4. Physiological basis of regeneration of nerve fibers and other tissues.
5. Functional organization of the basal nuclei of the brain.
6. The role of calcium potentials of the cerebellum.
7. Age-related changes in the organ of vision.
8. Basics of nonspecific and specific immunity.
9. Leukocyte formula in children and adults.
10. The blood aggregate state regulation system, its components and functions.
11. Anti-coagulation and fibrinolytic systems.
12. Apoptosis. A review of the physiological mechanisms of cell death.
13. Current understanding of the mechanisms of cardiac automaticity.
14. Physiological role of HCN channels.
15. Central regulation of cardiac activity.
16. Blood flow in coronary and cerebral vessels and peculiarities of its regulation.
17. Renin-angiotensin-aldosterone and kallikrein-kinin systems.
18. Modern methods of investigation of cardiovascular system functions.
19. Circulatory system in the fetus and newborn.
20. Mechanisms that ensure the patency of the upper airways.
21. Reflex influences from the receptors of the nose, pharynx and mouth on respiration.
22. The effect of gravity on blood flow.
23. Mechanisms of regulation of O₂ and CO₂ transport.
24. Breathing under special conditions (hypo- and hyperbaric).
25. Physiological basis of a decompression sickness.
26. The role of aquaporins in physiological functions.
27. Regulation of body mass.
28. Mechanisms of regulation of energy metabolism in children and adults.
29. Principles of healthy diets. The basics of diet therapy.
30. Nervous and hormonal mechanisms of the general adaptation syndrome.
31. Physiological mechanisms of alcohol and other addictions formation.
32. Current state of alcohol and other addictions control in the Republic of Belarus and in the world. Physiological basis of addiction prevention.
33. Current state of tobacco addiction control in the Republic of Belarus and in the world. Changes of physiological functions in tobacco smoking.
34. Sleep and its disorders.
35. Mental and physical performance. Fatigue and its prevention.
36. Epiphysis hormones and their role in the regulation of physiological functions of the body.
37. Participation of calcium (Ca²⁺) and phosphates (P_i) ions in the maintenance of the functional state of bone tissue.
38. The importance of vitamin D₃, physical activity and other factors for bone formation in children and adults.
39. Nobel Prize in Physiology or Medicine. A review of the most important scientific achievements.
40. Reviews of scientific literature in the field of physiology.

**PROTOCOL OF THE CURRICULUM APPROVAL
BY OTHER DEPARTMENTS**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department that designed the curriculum (date, protocol)
1. Pathological Physiology	Pathological Physiology	There are no offers	Take into account 19.05.2023, protocol #11
2. Biological Chemistry	Biological Chemistry	There are no offers	Take into account 19.05.2023, protocol #11
3. Pharmacology	Pharmacology	There are no offers	Take into account 19.05.2023, protocol #11

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Y.V.Haikovich

Curriculum content, composition and the accompanying documents comply with the established requirements.

Dean of the Medical Faculty for International Students of the educational institution «Belarusian State Medical University»

26.06. 2023

O.S.Ishutin

Methodologist of the educational institution «Belarusian State Medical University»

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