

SYLLABUS

1. General information on the course

Full course name	Physiology
Full official name of a higher education institution	Sumy State University
Full name of a structural unit	Medical Institute. Physiology and Pathophysiology Department with Medical Biology Course
Author(s)	Obukhova Olha Anatoliivna, Harbuzova Viktoriia Yuriivna
Cycle/higher education level	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
Semester	17 weeks during the 3rd semester, 19 weeks during the 4th semester
Workload	The volume of the discipline is 9 ECTS credits (270 hours), of which 182 hours is contact work with the teacher (38 hours of lectures, 144 hours of practical classes), 88 hours is independent work, including: 3rd semester: 28 hours of lectures, 68 hours of practical classes, 54 hours of independent work; 2nd semester: 10 hours of lectures, 76 hours of practical classes, 34 hours of independent work
Language(s)	English

2. Place in the study programme

Relation to curriculum	Compulsory course available for study programme "Medicine"
Prerequisites	Required knowledge of medical biology, biophysics, bioorganic chemistry, anatomy, histology, cytology and embryology
Additional requirements	There are no specific requirements
Restrictions	There are no specific restrictions

3. Aims of the course

The aim of the discipline is to achieve students' fundamental thinking and knowledge system about the functioning of the human body as a whole and the ability to use them in clinical practice.

4. Contents

Module 1. Introduction to physiology. Physiology of excitable structures

Topic 1 Subject and tasks of physiology

Instruction on safety rules. General information about the discipline. Regulations on discipline. Physiology as a scientific basis of medicine about the functions of the body, ways to maintain health and efficiency. The importance of physiology in the training of physicians. Basic concepts of physiology. Levels of structure of a human body. The unity of the organism and the external environment. Physiological characteristics of functions, their parameters. Age and gender features. Functions of cells, tissues, organs, the body as a whole. The main functional characteristics of living organisms - metabolism and energy, homeostasis, adaptation, self-regulation, reproduction, growth, development, irritability.

Topic 2 The main stages of development of physiology. Methods of physiological research

A brief description of the development of physiology. The role of the works of Harvey and Descartes. Formation and development of physiology in the XIX century (K. Bernard, E. Dubois-Raymond, I. Cannon, B. Ludwig, C. Sherrington). The contribution of the works of IM Sechenov, IP Pavlov, ME Vvedensky, OO Ukhtomsky, L.A. Orbeli, P.K. Anokhin in the development of world physiology. Ukrainian School of Physiology - V.Ya. Danilevsky, V.Yu. Chagovets, DS Vorontsov, P.M. Serkov, PG Kostyuk, VI Skok, M.F. Shuba, G.S. Folbort, W.W. Frolkis, V.M. Nikitin. Review of the main methods of physiological research. Characteristics of experimental and clinical methods. Experimental models. Laboratory animals.

Topic 3 The potential for rest of nerve and muscle fibers

Modern idea of the structure and function of cell membranes. The main differences in the chemical composition of extracellular fluid and intracellular environment. Mechanisms of transport of substances across the cell membrane. The concept of membrane potential and rest potential. The role of V.Yu. Chagovets in the development of the hypothesis about the ionic mechanism of origin of the resting potential. Methods of registration of resting potential, physical characteristics, mechanism of origin. Physiological role of resting potential.

Topic 4 Preparation of a neuromuscular preparation

Irritability, irritation, excitability, excitement. The concept of excitable structures. Laws of irritation. Direct and indirect irritation. Preparation of spinal frog preparation, rheoscopic paw, neuromuscular preparation. Checking the physiological integrity of the drug with an electrical stimulator. Demonstration of direct and indirect irritation.

Topic 5 The potential of nerve and muscle fibers

Action potential, its physical and physiological characteristics. Structure and main properties of ionic channel proteins involved in the development of AP. Ionic mechanisms of occurrence of the main phases of AP. Excitability, its changes during the development of AP.

Topic 6 Study of bioelectrical phenomena in living tissues

The concept of bioelectric potentials. Types of potentials arising in a living organism. Damage potential. The mechanism of bioelectric potentials. Reproduction of bioelectric phenomena in the experiments of Galvani, Aldini, Matteucci.

Topic 7 Mechanisms of electrical stimulation of excitatory structures and conduction of excitation through nerve and muscle fibers

Methods of electrical stimulation of nerve and muscle fibers. Parameters of electric current that determine its ability to cause excitation. Passive and active electrical potentials due to electrical stimulation. Changes in the excitability of nerve and muscle fibers due to electric current. The mechanism of nerve impulse conduction through myelin-free and myelin fibers. Laws of excitation on nerve fibers. Factors that determine the rate of action potential on nerve fibers. Characteristics of nerve fibers according to Erlanger-Gasser. Structure and classification of synapses. Features of functioning of electric and chemical synapses. Mechanism of excitation transmission through neuromuscular synapse.

Topic 8 Solving situational problems from the section "Electrophysiology".

Topic 9 Skeletal and smooth muscle contractions

Structural organization of the muscle contractile apparatus. Sarcomere, its components. The essence of Huxley-Hanson's theory ("sliding of myofilaments"). Structure of actin and myosin filaments. Modern understanding of the mechanism of muscle fiber contraction. Stages of the reduction process. Chemistry and energy of muscle contraction. The concept of motor unit. Classification of motor units. The main features of the contractile apparatus and the functioning of smooth muscles.

Topic 10 Study the main characteristics of muscle contraction

Physiological characteristics of muscle contraction: load, strength, duration, speed, work, fatigue. Electromyography. Dynamometry. Determination of absolute strength of hand muscles, level of efficiency and fatigue of hand muscles by dynamometry.

Topic 11 Calculation work from the content module 1 "Introduction to physiology. Physiology of excitable structures".

Calculation of the equilibrium potential by the Nernst equation. Calculation of the magnitude of the membrane potential of a nerve fiber according to the Goldman-Hodgkin-Katz equation. Determination of the deviation of the potential from the normal value of the resting potential of the nerve fiber. Calculation of the reliability factor and assessment of its value. Determination of absolute muscle strength, level of efficiency and rate of reduction of efficiency according to dynamometry. Determining the type of muscle contraction depending on the frequency of its stimulation. Calculate the frequency of muscle stimulation to obtain different types of contractions.

Topic 12 Final lesson from module 1 "Introduction to physiology. Physiology of excitable structures".

Physiology as a science, the connection of physiology with other disciplines. Basic concepts of physiology: function, functional unit, physiological system, functional state of the organism. The main functional properties of the organism as a whole. The concept of stimuli, stimuli, biological reaction, excitation, excitability, excitable structures. Features of the structure of the cell membrane, the functions of its main components. Differences in the chemical composition of extracellular fluid and intracellular environment. Passive transport of substances, its types and mechanisms. Active transport of substances, its types and mechanisms. The concept of membrane potential and rest potential. Methods of registration of resting potential, its physical characteristics. Ionic mechanisms of resting potential origin. The resting potential of nerve and skeletal muscle fibers. The main and additional factors that affect its value. Potential of action: structure, physical and physiological characteristics. Structure and main properties of ionic channel proteins involved in the development of AP. Ionic mechanisms of development of the main phases of AP. Excitability, its changes during the development of AP. The value of the parameters of direct electric current for the occurrence of excitation. Passive and active electrical potentials due to electrical stimulation. Changes in the excitability of nerve and muscle fibers

Module 2. Nervous regulation of body functions

Topic 13 General patterns of nervous regulation of functions

The main features of nervous regulation of functions. The structure and functions of the neuron. Neuroglia, its functional significance. Properties of nerve centers. Coordination of reflex activity. Dominant (OO Ukhtomsky). CNS synapses, their structure, mechanisms of information transfer. Classification of mediators, their general characteristics. Characteristics of excitatory and inhibitory postsynaptic potentials. Central braking, its types, mechanisms, significance. The role of inhibitory neural circuits in the occurrence of central inhibition

Topic 14 Reflex arc analysis. Study of excitation and inhibition in the CNS

The concept of reflexes, their classification. Reflex arc, functions of its separate elements. Reproduction of the Turk's reflex in frogs. Determination of reflex time. Reflex arc analysis. Study of the phenomena of consecutive and simultaneous summation. Study of central inhibition of spinal reflexes (experiment of IM Sechenov)

Topic 15 The role of the spinal cord in the regulation of body functions

General structural and functional characteristics of the spinal cord. Analysis of sensory information by the spinal cord. Mechanisms of muscular and articular reception (proprioception). Muscle spindles (tension receptors), their structure, functions, excitation mechanism. Gamma loop functions. Golgi tendon receptors, their functions, reflexes from tendon receptors. Conductive function of the spinal cord, its role in the regulation of motor functions. Brown-Sekara syndrome. Spinal shock. Autonomic function of the spinal cord. Reflex function of the spinal cord. Characteristics of tonic reflexes (myotatic and cervical tonic), their reflex arc. Characteristics of phase reflexes (tendon, skin, rhythmic, flexion, extensor cross), their reflex arcs

Topic 16 Study of clinically important spinal reflexes in humans

Characteristics and classification of spinal reflexes. Reproduction in humans of clinically important spinal reflexes: tendon (knee, flexion elbow (biceps reflex), extensor elbow (triceps reflex), Achilles), skin (plantar, upper abdominal (upper, middle, lower) 'clear-beam'), the study of their reflex arcs. Determination of the area of spinal cord injury depending on the violation of reflexes. Determination of reflex disorders depending on the level of spinal cord injury

Topic 17 The role of the brain in the regulation of body functions

Neural organization of the hindbrain. Sensory function of the hindbrain. Conductive function of the hindbrain. Descending motor pathways, their role in regulating the activity of alpha and gamma motoneurons of the spinal cord. Autonomic function of the hindbrain. The role of the hindbrain in the provided poses of antigravity. Characteristics of vestibular static and cervical tonic reflexes. Neural organization of the midbrain. Sensory function of the midbrain. Autonomic function of the midbrain. Reflex function of the midbrain. Decerebral rigidity. Characteristics of static, statokinetic and orienting reflexes. The role of reticular formation in the implementation of motor functions. Influence of medial and lateral reticulospinal pathways on spinal cord motoneurons. Functional organization and connections of basal ganglia. Functions of basal ganglia. Neurotransmitters in the system of basal ganglia, their physiological role. Cycles of husk and caudal body. Clinical manifestations of damaged basal ganglia, their physiological mechanisms. Functional and structural organization of the cerebellum, its afferent and efferent connections, their physiological role. Functional organization of the cerebellar cortex. Cerebellar functions. Consequences of removal or damage to the cerebellum that occur in humans, their physiological mechanisms. Functional characteristics of thalamic nuclei. Functions of the hypothalamus.

Topic 18 Study of the functional asymmetry of the cortex of the large hemispheres

Interhemispheric asymmetry. Psychophysiological differences of people depending on the brain organization, features of their emotional sphere. The phenomenon of ambidexterity. Investigation of functional asymmetry of the cortex of large hemispheres by conducting morphological and functional tests. Detection of the leading hemisphere of the brain.

Topic 19 Nervous regulation of autonomic functions

Structural and functional features of the autonomic nervous system. Sympathetic, parasympathetic and metasympathetic division. Features of the reflex arc of the autonomic reflex. Vegetative ganglia, their functions. Preganglionic and postganglionic fibers. The mechanism of excitation transmission in the autonomic ganglia. Mediators and blockers of the autonomic nervous system. Influence of sympathetic, parasympathetic and metasympathetic divisions on organs. Classification of autonomic reflexes. Reflex arc of the autonomic reflex. Research and use of autonomic reflexes in practical medicine. Central regulation of visceral functions. Integrative centers of regulation of visceral functions.

Topic 20 Study of autonomic tone and autonomic reactivity in humans

The concept of autonomic tone (vagotonia, sympathocotonia, eytonia) and autonomic reactivity in humans. Determination of autonomic tone in humans by calculating the Curdue index and dermographism. Assessment of autonomic reactivity by reproducing the reflexes of Danini-Ashner and Chermak. Study of ensuring the work of internal organs by calculating the Hildebrant coefficient and conducting the Letunov test.

Topic 21 Calculation work and solution of situational problems from the content module 2 "Nervous regulation of body functions"

Calculation of the frequency of presynaptic pulses. Calculation of reflex time according to the complexity of the reflex arc. Calculation of the Kerduh index and its estimation. Calculation of the Hildebrant coefficient and its estimation.

Topic 22 Final lesson from module 2 "Nervous regulation of body functions".

The main features of nervous regulation of functions. The structure and function of the neuron. Functions of neuroglia. Reflex. Classification of reflexes. Reflex arc. Features of excitation by reflex arc. Functions of individual components of the reflex arc. Classification of receptors. General mechanisms of receptor function. The concept of the nerve center. Properties of nerve centers. Principles of interaction between nerve centers. Classification of mediators, their general characteristics. Characteristics of excitatory and inhibitory postsynaptic potentials. CNS synapses, their structure, mechanisms of information transfer. Features of excitation transmission in central synapses. Central braking, its types and significance. Characteristics and mechanisms of pre- and postsynaptic inhibition. Functions of the spinal cord. Mechanisms of muscle and joint reception (proprioception). Characteristics of tonic reflexes (myotatic and cervical tonic), their reflex arcs. Characteristics of phase reflexes (tendon, skin, rhythmic, flexion, extensor cross), their reflex arcs. Neural organization and functions of the hindbrain. Neural organization and functions of the midbrain. The role of reticular formation in the implementation of motor functions. Influence of medial and lateral reticulospinal pathways on spinal cord motoneurons. Functional organization and functions of basal ganglia. Cerebellar functions.

Module 3. Humoral regulation of body functions

Topic 23 General regularities of humoral regulation of vegetative functions

Relationship of nervous and humoral regulation. Contour of humoral regulation, the role of feedback in regulation. Factors of humoral regulation, their characteristics and classification. The role of factors of local regulation. Structural and functional organization of the endocrine system. Endocrine glands, endocrine cells, their hormones and significance.

Topic 24 The concept of endocrine function and its components

Determination of endocrine function and its components. Mechanisms of regulation of endocrine glands. Types of secretion and forms of hormone transport. Characteristics of cyto-reception mechanisms. The main stages of intracellular and cytoplasmic cyto-reception. Values of secondary mediators (cyclic nucleotides, calcium ions, phospholipid messengers). Hormone metabolism

Topic 25 Hypothalamic-pituitary system. The role of liberins and statins

Hypothalamus as the central endocrine organ. Functional connection of the hypothalamus with the pituitary gland. Neurosecretes of the hypothalamus. The role of liberins and statins. Consequences of dysfunction of the hypothalamic-pituitary system.

Topic 26 The role of hormones in the regulation of physical, mental and sexual development

Adenohypophysis, its hormones, their effects. The role of somatotropin (GH) and somatomedins in ensuring the processes of growth and development. Metabolic effects of somatotropin. Contour of regulation of GH secretion, circadian rhythms. Thyroid gland, its hormones (iodothyronines). Mechanisms of action of iodothyronines on target cells, influence on the state of mental functions, growth and development processes, metabolic processes, state of visceral systems, etc. Contour of regulation of synthesis and secretion of thyroxine (T4) and triiodothyronine (T3). The role of other hormones that affect the processes of normal growth (insulin, gonadal steroid hormones, cortisol). Gonads. Sexual differentiation, development and functions of the reproductive system. Puberty. Male reproductive system, its structure and functions. Spermatogenesis. Endocrine function of the testes, regulation of testicular function, the contour of regulation with the participation of the hypothalamic-pituitary system. Erection and ejaculation, hormonal and nervous mechanisms of regulation. Female reproductive system, its structure and functions. Ovarian hormones, their role, regulation of ovarian function. Lunar cycle. Pregnancy. Placental hormones. Lactation. Age features of endocrine gland functions.

Topic 27 The role of hormones in the regulation of homeostasis

Pancreatic hormones (insulin, glucagon, somatostatin) their effects on metabolism and blood glucose concentration. Contour of hormonal regulation of maintenance of constancy of concentration of glucose in blood. Calcium balance in the body and hormones that regulate calcium and phosphate homeostasis: parathyroid hormone, calcitonin, $1,25(\text{OH})_2\text{D}_3$. The effect of other hormones on calcium metabolism (glucocorticoids, somatotropin, IGF-1, thyroid hormones, estrogens, insulin). The role of vasopressin, oxytocin. Hormones of the adrenal medulla (catecholamines), their role in the body, regulation of secretion. Hormones of the adrenal cortex, contours of regulation of their secretion, circadian rhythms of glucocorticoid secretion, their effects and mechanisms of action on target cells.

Topic 28 The role of hormones in regulating the body's adaptation to stress factors

The concept of stress and stressors. Types of adaptation to stress factors. General adaptation syndrome (G. Cellier). The role of the sympatho-adrenal system in adaptation. The role of hormones of the adrenal cortex (glucocorticoids, mineralocorticoids), pituitary gland, thyroid hormones (thyroxine, triiodothyronine), vagoinular system in ensuring non-specific adaptation of the body to stress factors.

Topic 29 Solving situational problems from the content module 3 "Humoral regulation of body functions".

Topic 30 Final lesson from module 3 "Humoral regulation of body functions".

The main features of humoral regulation of functions. Factors of humoral regulation, their characteristics and classification. The concept of hormones. Properties of hormones. Classification of hormones. The concept of endocrine function, its components: regulation of endocrine glands, mechanisms of secretion and forms of hormone transport, mechanisms of cyto-reception. The concept of the hypothalamic-pituitary system. The role of liberins and statins. Neurohypophysis hormones: chemical nature, regulation of secretion, mechanism of action, functional effects. Adenohypophysis hormones: chemical nature, secretion regulation, mechanism of action, functional, metabolic and structural effects. Pancreatic hormones: insulin, glucagon, somatostatin, their effect on metabolism and blood glucose concentration. Hormones that regulate calcium and phosphate homeostasis: parathyroid hormone, calcitonin, 1.25 (OH) 2D3. Influence of other hormones on calcium metabolism (glucocorticoids, somatotropic, thyroid hormones, estrogens, insulin). Thyroid hormones: chemical nature, synthesis and secretion, secretion regulation, mechanism of action. Functional and metabolic effects. Consequences of hypo- and hypersecretion. Adrenal cortex hormones: chemical nature, regulation of secretion, mechanism of action, functional and metabolic effects. Hormones of the adrenal medulla: chemical nature, regulation of secretion, mechanism of action,

Module 4. Physiology of analyzers and HNA

Topic 31 Investigation of sensory systems

The concept of sensor systems (analyzers). General principles of structure and basic functions of analyzers. Properties and functional organization of analyzers. The concept of absolute and differential threshold of sensation. Weber-Fechner law. Classification of receptors, their functions. Functions of the conducting and central departments of the analyzers. Structural and functional organization of the somato-sensory system (skin and proprioceptive sensitivities). Physiological basis of pain. Nociception, physiological characteristics and classification of nociceptors. Nociceptive or pain system, its structural and functional organization, leading paths and levels of information processing. Physiological significance of pain. Antinociceptive system, its structural and functional organization, opiate and non-opiate mechanisms, physiological role. Physiological bases of anesthesia. Structural and functional organization of the taste sensory system. Types of tastes, mechanisms of their perception, physiological role. Structural and functional organization of the olfactory sensory system. Classification of odors, theories of their perception. Structural and functional organization of the visual analyzer. Optical eye system. The mechanism of refraction and accommodation. Anomalies of refraction of the eye. Pupil reflex, its physiological and logical significance. Photochemical and electrical phenomena in the retina.

Topic 32 Investigation of HNA in humans

Types of higher nervous activity, their classification, physiological bases, research methods. Thinking. Consciousness. The concept of signaling systems. Comparative characteristics of signals of I and II signaling systems. Formation of the II signal system in ontogenesis. Language functions. Language centers. Types of higher nervous activity of people depending on the level of functioning of signaling systems. The main provisions of the teachings of IP Pavlov on the types of higher nervous activity of humans and animals. Investigation of short-term memory capacity in humans (visual, auditory, logical). Assessment of the mobility of nervous processes. Determining the type of temperament using the Eisenko questionnaire.

Topic 33 Physiological bases of behavior

Physiological bases of behavior. Congenital and acquired forms of behavior, their significance for the adaptive activity of the organism. Regularities of formation and storage of conditioned reflexes (I.P. Pavlov). Inhibition of conditioned reflexes. Learning and memory, its types, mechanisms. Sleep. Its phases. Mechanisms of sleep development. The value of sleep for the body. Needs and motivations, their physiological mechanisms, the role in shaping behavior. Functional system of behavior. The structure of a holistic behavioral act according to P.K. Anokhin. Emotions, their types, mechanisms of formation, biological role. Theories of emotions.

Topic 34 Final lesson from module 4 "Physiology of analyzers and HNA".

The concept of sensor systems (analyzers). General principles of structure and basic functions of analyzers. Properties and functional organization of analyzers. The concept of absolute and differential threshold of sensation. Weber-Fechner law. Classification of receptors, their functions. Functions of the conducting and central departments of the analyzers. Structural and functional organization of the somato-sensory system (skin and proprioceptive sensitivities). Physiological basis of pain. Nociception, physiological characteristics and classification of nociceptors. Nociceptive or pain system, its structural and functional organization, leading pathways and levels of information processing. Physiological significance of pain. Antinociceptive system, its structural and functional organization, opiate and non-opiate mechanisms, physiological role. Physiological bases of anesthesia. Structural and functional organization of the taste sensory system. Types of tastes, mechanisms of their perception, physiological role. Structural and functional organization of the olfactory sensory system. Types of higher nervous activity, their classification, physiological bases, research methods. Thinking. Consciousness. The concept of signaling systems. Physiological bases of behavior. Congenital and acquired forms of behavior, their significance for the adaptive activity of the organism. Regularities of formation and storage of conditione

Module 5. Physiology of the blood system

Topic 35 Physico-chemical properties of blood

General characteristics of liquid media. Physiological blood system. Its structure. General characteristics and composition of peripheral blood. The main functions of the physiological blood system. Functional significance of water and blood plasma electrolytes. Blood plasma proteins. Their composition and main functions. Basic physical and chemical properties of blood: osmotic pressure, density, viscosity, blood reaction.

Topic 36 Determination of ESR

Erythrocyte sedimentation rate (ESR). Factors influencing this indicator. ESR research methods in the clinic. Determination of ESR by the method of Panchenkov, evaluation of the indicator.

Topic 37 Properties and functions of erythrocytes

General characteristics of erythrocytes. Their function. Hematocrit. Factors on which its value depends. Osmotic resistance of erythrocytes. Its significance. Hemolysis of erythrocytes. Types and mechanisms of hemolysis. Hemoglobin as the main component of erythrocytes. The structure of hemoglobin. Calculation of color index and oxygen capacity of blood. The main forms and compounds of hemoglobin. Color index, its definition. Mechanisms of formation and physiological destruction of erythrocytes. Regulation of erythrocyte content in peripheral blood.

Topic 38 Counting the number of erythrocytes. Determination of hemoglobin level

Methods for counting the number of erythrocytes in the blood in the clinic. Counting the number of erythrocytes using Goryaev's camera, evaluation of the indicator. Methods for assessing the content of hemoglobin in the blood in the clinic. Determination of hemoglobin content using Sally hemometer, evaluation of the indicator.

Topic 39 Protective properties of blood

Leukocytes, their distribution in the body. Quantitative and qualitative composition of peripheral blood leukocytes. The main functions of certain types of leukocytes. Mechanisms of phagocytosis. Characteristics of nonspecific and specific immunity. Regulation of leukopoiesis and leukocyte activity.

Topic 40 Determination of blood groups

The concept of blood groups. Agglutinogens and agglutinins. Characteristics of blood groups of the AB0 system. Modern ideas about blood groups of the AB0 system. Characteristics of blood groups of the CDE system. Determination of blood groups in the ABO system and rhesus factor using standard sera and coliclons. Blood transfusion (blood transfusion), its stages.

Topic 41 Hemostasis system

The concept of hemostasis and its two main mechanisms. The structure of the hemostasis system. The role of the vascular wall and platelets in hemostasis. Mechanisms of vascular-platelet hemostasis: arteriole spasm, adhesion, platelet aggregation, release reaction, thrombus consolidation. Mechanisms of coagulation hemostasis. Blood clotting system. Phases of blood clotting, their essence. Characteristics of the anticoagulant blood system. Characteristics of the fibrinolysis system. Regulation of blood clotting. Physiological bases of methods of research of a condition of a hemostasis. Age-related changes in the hemostasis system. Mechanisms for maintaining the liquid state of the blood.

Topic 42 Evaluation of clinical blood test. Calculation work from the content module 5 "Physiology of blood".

Evaluate the clinical analysis of the blood of a healthy three-year-old child, a healthy adult adult, a healthy adult woman, a pregnant woman. Calculate the direction of fluid movement in the capillary by the magnitude of hydrostatic and oncotic pressures in the capillary and intercellular fluid. Calculate the oxygen capacity of the blood. Calculate the color index.

Topic 43 Solving situational problems from the content module 5 "Physiology of blood".

Topic 44 Final lesson from module 5 "Physiology of the blood system".

Functions and composition of blood. Physico-chemical properties of blood. Plasma proteins: quantity, classification, functions. Oncotic blood plasma pressure. The role of proteins in the redistribution of water in the body. The role of water and electrolytes in blood plasma. Osmotic pressure of blood plasma, the mechanisms of its support. The concept of hypo-, iso-, and hypertonic solutions. Properties of blood substitutes. blood pH. Mechanisms of its support. Characteristics of buffer systems of blood. Indicators of acid-base balance. Characteristics of blood groups of the ABO system. Modern ideas about blood groups. Characteristics of blood groups of the rhesus system. Rhesus conflict. Stages of blood transfusion. Properties of blood substitutes. General characteristics and properties of erythrocytes. Functions of erythrocytes. Causes and mechanisms of destruction of erythrocytes in the body. The concept of hemolysis of erythrocytes, types of hemolysis. Erythropoiesis. Regulation of erythrocyte content in peripheral blood. The main physiological and pathological compounds of hemoglobin. Color indicator. Distribution of leukocytes in the body. Types and causes of leukocytosis. General characteristics and properties of leukocytes. Leukocyte formula, the concept of its shift. Functions of granulocytes. Functions of agranulocytes. Regulation of leukopoiesis and leukocyte activity. The structure of the hemostasis system.

Module 6. Physiology of the cardiovascular system

Topic 45 General characteristics of the circulatory system

General characteristics of the circulatory system, its structure. Functional departments of the circulatory system. Basic and additional functions of the circulatory system. Functional properties of the heart muscle. Comparative characteristics of atypical and typical muscle fibers. Leading system of the heart, its significance. Mechanisms of spontaneous pulse generation in a conductor system. The law of "gradient of automatism". Conducting pulses through the conduction system to the working myocardium. Functional properties of contractile muscle fibers of the heart. The action potential of contractile myocardial cells. Ionic mechanisms of its main phases. Periods of absolute and relative refractoriness in the myocardium. Their physiological significance. Mechanisms of electromechanical conjugation in contractile myocardial cells. Features of the processes of proper contraction and relaxation in myocardial cells.

Topic 46 Study of the functioning of the conduction system of the frog's heart. Ligatures of Stanius

Investigate the localization of various elements of the conductive system of the frog's heart. Frequency of AP generation in different nodes.

Topic 47 Mechanical work of the heart. Phase analysis of the cardiac cycle

Structural and functional elements of the heart as a pump. Functions of the atria and ventricles. The valvular apparatus of the heart, its functions. Modes of heart contractions and types of loads on it. The concept of the cycle of cardiac activity. Phase structure of the cardiac cycle. Characteristics of ventricular systole: periods of stress and expulsion. Characteristics of ventricular diastole: periods of relaxation and filling. Systolic and minute blood volumes, cardiac index.

Topic 48 Study of apical impulse and heart tones

The concept of heart tones and methods of their study. Investigation of the properties of apical shock and heart tones by auscultation.

Topic 49 Electrocardiography

Discharge of electrical potentials from isolated muscle fibers, individual areas of the myocardium and the heart as a whole. Elements of the electrocardiogram (teeth, segments, intervals) and their characteristics. Electrocardiogram (ECG) recording methods. Fundamentals of vector ECG analysis. The concept of the total instant vector of the heart. The axis of the ECG. Vector analysis of the origin of the ECG teeth. Electric axis of the heart. Causes of deviation of the electrical axis of the heart under normal conditions.

Topic 50 Calculation work "ECG registration and analysis".

ECG examination of the main segments, intervals, teeth, duration of the cardiac cycle, heart rate, systolic index. ECG evaluation of heart rate, sources of excitation, myocardial conduction. Methods for determining the electrical axis of the heart.

Topic 51 Fundamentals of hemodynamics. Patterns of blood flow in arterial and venous vessels.

Basic laws of hemodynamics. Total peripheral vascular resistance. Factors that ensure the movement of blood through the vessels of high and low pressure. Linear and volumetric velocities of blood in different parts of the vascular bed. Reynolds number. Functional classification of blood vessels according to Folkov B. Pulse fluctuations of blood flow, volume and pressure in arterial vessels. The concept of blood pressure. The concept of arterial pulse. Its main characteristics. Pulse wave propagation speed. Factors that determine this indicator. The concept of microcirculation. Structure and functions of the microcirculatory tract. Mechanisms of metabolism between blood and interstitial fluid: diffusion, filtration - reabsorption, microvesicular transport.

Topic 52 Measurement of blood pressure in humans.

Blood pressure: systolic, diastolic, pulse, average. Methods of measuring blood pressure. Measurement of blood pressure in humans by the Riv-Roch's and Korotkov's methods

Topic 53 Regulation of the heart, local and systemic circulation.

Myogenic mechanisms of heart regulation. Frank-Starling's law. Immediate mechanisms of adaptation of the heart to loads of volume and resistance. The nature and mechanisms of the parasympathetic nervous system on the heart. The nature and mechanisms of influence of the sympathetic nervous system on the heart. The role of the metasymphathetic nervous system in the regulation of the heart. Intracardiac reflexes. Influence of humoral regulation factors on heart function. Features of mechanisms of regulation of vessels of a microcirculatory channel. Myogenic, metabolic and histomechanical mechanisms of regulation of local blood circulation. The concept of physiological arterial hyperemia. Nervous regulation of local blood circulation. Humoral mechanisms of regulation of local blood circulation. Vascular tone and its regulation, nervous and humoral mechanisms. Regulation of systemic blood circulation. Cardiovascular center, its structure, afferent and efferent connections. The concept of a single hemodynamic center (Frolkis VV). The main reflexogenic zones, baroreceptors and chemoreceptors of the carotid sinus and aortic arch, their role. Reflexes from receptors of auricles and large veins. Pressor and depressive reflexes. Interrelated mechanisms of nervous and humoral regulation of heart activity, vascular tone and circulating blood volume in different adaptive reactions. Physiological prerequisites for blood pressure disorders.

Topic 54 Investigation of functional tests of the cardiovascular system.

Carrying out and estimation of orthostatic test of Martinat of Shalkov's test (with physical activity).

Topic 55 Solving situational problems from the content module 6 "Physiology of the cardiovascular system".

Topic 56 Final lesson from module 6 "Physiology of the cardiovascular system".

Basic and additional functions of the circulatory system. Functional properties of atypical cardiomyocytes. Leading system of the heart, its significance. Mechanisms of spontaneous pulse generation in a conductor system. The law of "gradient of automatism". Functional properties of contractile muscle fibers of the heart. The action potential of contractile myocardial cells. Ionic mechanisms of its main phases. The concept of the cycle of cardiac activity. Pulse fluctuations in blood flow, volume and pressure in arterial vessels. Patterns of blood flow in venous vessels. The concept of venous pressure, venous pulse, venous return. Myogenic, metabolic and histomechanical mechanisms of regulation of local blood circulation. Frank-Starling's law. Immediate mechanisms of adaptation of the heart to loads of volume and resistance. The nature and mechanisms of the parasympathetic nervous system on the heart. The nature and mechanisms of influence of the sympathetic nervous system on the heart. Nervous mechanisms of regulation of systemic hemodynamics. Characteristics of afferent central and efferent links of regulation. The role of reflexes in the regulation of systemic circulation.

Module 7. Physiology of the respiratory system

Topic 57 General characteristics of the respiratory system. Research of indicators of external respiration.

Stages of respiration. General structure and main functions of the external respiratory system. Functional characteristics of the structural elements of the external respiratory system: chest, respiratory muscles, pleural cavity, airways, lungs. The concept of transpulmonary, pleural and alveolar pressure. Elastic traction of the lungs. Surfactants, their significance. Biomechanics of respiration. Mechanisms of inhalation and exhalation. Static indicators of lung ventilation. The concept of lung volume and lung capacity. Dynamic indicators of lung ventilation. Minute volume and lung capacity. Dynamic indicators of lung ventilation. Minute breathing volume, its definition. Spirometry. Spirography.

Topic 58 Calculation work "Registration and analysis of spirogram".

Determine by spirogram tidal volume, inspiratory reserve volume, expiratory reserve volume, lung vital capacity, respiratory rate, minute tidal volume, minute alveolar ventilation, minute O₂ intake. Find in the Harris-Benedict tables the appropriate value of these indicators by the value of the basic exchange. Calculate the percentage deviation of the obtained indicators from the appropriate ones.

Topic 59 Gas exchange in the lungs. Blood gas transport. Regulation of respiration.

The composition of inhaled, exhaled, alveolar air. The relative constancy of the composition of alveolar air. Tension of gases dissolved in the blood. Partial pressure of gases (PCO₂, PO₂) in alveolar air. Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in pulmonary capillaries. Properties of the pulmonary membrane. Diffusion capacity of the lungs. Relationship between pulmonary circulation and pulmonary ventilation. Anatomical and physiological "dead space". Forms of oxygen transport by blood. Transport of physically dissolved oxygen in blood plasma. Influence of mechanical factors on the activity of the respiratory center. Types of mechanoreceptors in the lungs. Goering-Breyer reflex. Influence of chemical factors on the activity of the respiratory center. Central and peripheral mechanisms of these influences. Evaluation by means of functional respiratory tests of elasticity of pulmonary fabric, width of small bronchial tubes and a tone of bronchial muscles

Topic 60 Investigation of functional tests of the respiratory system

Measure the vital capacity of the lungs with a dry spirometer. Evaluate the elasticity of lung tissue based on the results of Christie's test. Evaluate the width of the small bronchi and the tone of the bronchial muscles according to the results of the Votchal test. Investigate the Stange-Gench test with respiratory arrest.

Module 8. Physiology of the digestive system

Topic 61 General characteristics of the digestive system

Structure and functions of the digestive system. Digestive tract and digestive glands. The main functions of the digestive system: secretion, motility, absorption. Digestion: its types (cavity, membrane, intracellular), main stages. Features of secretory cells, mechanisms of secretion, the role of calcium ions and cellular mediators in the secretory process. Basic principles and mechanisms of digestion regulation. Gastrointestinal hormones. Phases of secretion of the main digestive glands. Periodic activity of the digestive system. Digestive tract motility. Features of the structure and functions of the smooth muscles of the digestive tract. Physiological bases of methods of research of functions of the digestive tract. Physiological bases of hunger and satiety. Nutritional motivation, ideas about the food center. Contour of regulation of maintenance of constancy of the content of nutrients in the internal environment.

Topic 62 Digestion in the mouth and stomach

The value of the oral cavity as the initial part of the digestive system. Composition, properties and significance of saliva. Mechanisms and regulation of salivation. Mechanical processing of food. Mechanisms of chewing and swallowing. Taste analyzer, its structure and value. The importance of the stomach in digestive processes. Gastric juice, its composition, properties and values

Topic 63 Digestion in the intestines. The role of the liver and pancreas

Pancreatic juice, its composition, properties and values

Topic 64 Absorption in the gastrointestinal tract

Suction processes. Research methods. Absorption of substances in different parts of the digestive tract, its mechanisms. Features of absorption of water, salts, carbohydrates, proteins, fats, vitamins and other substances. Suction regulation

Module 9. Physiology of metabolism and energy. Thermoregulation

Topic 65 Metabolism and energy. Thermoregulation

Physiological significance of proteins, fats and carbohydrates. The concept of nitrogen balance. Energy conversion in the body. Methods of studying energy metabolism: direct and indirect calorimetry. Caloric equivalent of oxygen and respiratory rate, their importance in metabolic studies. The concept of basic exchange. Factors influencing its value. Determination of basal metabolism according to indirect calorimetry and proper basal metabolism according to Harris-Benedict tables. Specific-dynamic action of food. Energy expenditure of the body during physical and mental activity. Physiological bases of a rational food. Caloric ratios of nutrients. The concept of the nucleus and shell as the temperature zones of the body. Periodic fluctuations in body temperature, changes in body temperature under physiological conditions. Mechanisms of heat generation. The concept of contractile and non-contractile thermogenesis. Heat transfer mechanisms. Environmental factors affecting heat transfer. Properties and physiological reactions of the organism that determine the intensity of heat transfer. Thermoregulation center, its structure and basic principles of operation. Afferent and efferent links of thermoregulation.

Topic 66 Estimated work "Compilation of food ration".

Determine the basic exchange in humans according to the tables of Harris-Benedict. Determine the daily energy consumption in humans by incomplete gas analysis. Determine the daily energy expenditure of a person in different activities. Make a diet.

Module 10. Physiology of the excretory system

Topic 67 General characteristics of the selection system. Regulation of kidney function.

Selection system, its structure, functions. Organs of excretion (kidneys, skin, lungs, digestive tract), their participation in maintaining homeostasis. Kidneys as the main organs of the excretory system. Nephron as a structural and functional unit of the kidney. Circulation in the kidney, its features. The main processes of urination: filtration, reabsorption, secretion. Filtration mechanisms, composition of primary urine. Filtration speed regulation. Reabsorption in tubules, its mechanisms. Rotary-counterflow-plural system, its role. Secretory processes in the proximal and distal tubules and collecting tubules. Final urine, its composition, quantity. Urination and its regulation. Physiological bases of methods of research of function of kidneys. Evaluation of clinical analysis of urine. Determination and evaluation of glomerular filtration, the amount of water reabsorption, maximum glucose reabsorption and routes of excretion in the kidneys. Age-related changes in urination and urination.

Topic 68 Calculation work "Determination of filtration and reabsorption in the kidneys."

Investigate the glomerular filtration rate by inulin clearance, evaluate the value obtained. Investigate the amount of water reabsorption, evaluate the value obtained. Evaluate the clinical analysis of urine. Investigate the value of maximum glucose reabsorption, evaluate the value obtained. Investigate the amount of reabsorption and secretion of various substances, evaluate the results.

Topic 69 Solving situational problems from the content modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism". Thermoregulation ", " Physiology of selection ".

Topic 70 Final lesson from modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism and energy". Thermoregulation ", "Physiology of the excretory system ".

Stages of respiration. General structure and main functions of the external respiratory system. Functional characteristics of the structural elements of the external respiratory system: chest, respiratory muscles, pleural cavity, airways, lungs. Biomechanics of respiration. Mechanisms of inhalation and exhalation. Static and dynamic indicators of lung ventilation. Composition and partial pressure of alveolar mixture gases. The concept of the respiratory center. Methods of research of its localization. Physiological significance of proteins, fats and carbohydrates. The concept of nitrogen balance. Energy conversion in the body. Methods for determining energy metabolism: direct and indirect calorimetry. Thermoregulation center, its structure and basic principles of operation. Afferent and efferent link of thermoregulation The concept of types of digestion. General characteristics of the mechanisms of regulation of digestive processes. Gastrointestinal hormones. Basic methods of studying the functions of the digestive tract. The value of the oral cavity as the initial part of the digestive system. General characteristics of the selection system. Kidney function. Nephron as a functional unit of the kidneys. Features of blood supply to the kidneys. Processes that ensure the formation of urine. Characteristics of filtration processes in the kidneys. Evaluation of filtration in the clinic.

Topic 71 Practical skills from the course "Physiology".

Determining the absolute strength of the muscles of the hand. Determining the efficiency of the muscles of the hand. Determination of the rate of decrease in the efficiency of the muscles of the hand. Determining the type of muscle contraction. You-value the reflex time. Determining the type of response of the neuron during its stimulation. Reproduction of clinically important reflexes. Determination of the leading part of the body and the dominant hemisphere. You-value of the patient's autonomic tone. Determination of the type of autonomic reactivity. Determining the type of intersystem relations at rest and during exercise. Determination of sensitivity of different parts of the body. Characteristics of the general analysis of blood. Study of erythrocyte sedimentation rate (ESR), assessment of the magnitude and determination of factors that affect it. Study of the content of hemoglobin in the blood by the method of Sali and evaluation of the obtained value. Examination of the number of erythrocytes in the blood and evaluation of the obtained value. Calculation of color index. Calculation of blood oxygen capacity. Investigation of blood groups in the ABO and Rh systems using standard sera and coliclons. Determination of blood pressure, calculation of pulse and mean blood pressure and assessment of their values. Determining the type of response of the cardiovascular system to exercise.

Topic 72 Preparation for the license exam "KROK-1".

5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	To explain the mechanisms of functioning of human organs and systems under different conditions.
LO2	To analyze the role of nervous and humoral regulation in ensuring homeostasis.
LO3	To recognize the age characteristics of the human body and assess the health status of people of different ages.

LO4	To apply laboratory and instrumental research methods to assess the condition of organs and systems of the human body.
LO5	To make calculations of the indicators reflecting functioning of an organism, on the basis of laboratory and instrumental inspection.
LO6	To anticipate physiological changes in the activities of organs and systems under the influence of various environmental factors.
LO7	To identify the leading mechanisms to ensure the integrative activity of the organism.

6. Role of the course in the achievement of programme learning outcomes

Programme learning outcomes achieved by the course.

For 222 Medicine:

PO1	To detect and identify the leading clinical symptoms and syndromes (according to the List 1); to establish the most probable nosological or syndromic preliminary clinical diagnosis of diseases (according to the List 2) using standard methods, preliminary data of the patient's anamnesis, patient's examination data, and knowledge about a human, his organs and systems.
PO2	To collect information about the patient's general condition; to assess the patient's psychomotor and physical development and the state of organs and systems of the body; to assess information on the diagnosis (according to the List 4) based on laboratory and instrumental findings.
PO9	To determine an appropriate approach, plan, and management of physiological pregnancy, physiological delivery, and postpartum period by making a reasonable decision according to existing algorithms and standard procedures.
PO10	To assess the general condition of a newborn child by making an informed decision according to existing algorithms and standard schemes and adhering to the relevant ethical and legal norms.
PO14	To perform medical procedures (according to the List 5) at a medical facility, at home or at work on the basis of a provisional clinical diagnosis and/or health parameters through making an informed decision and adhering to the relevant ethical and legal norms.
PO18	To search for the necessary information in the professional literature and databases; to analyze, evaluate, and apply this information. To apply modern digital technologies, specialized software, statistical methods of data analysis to solve complex health problems.

7. Teaching and learning activities

7.1 Types of training

Topic 1. Subject and tasks of physiology

pr.tr.1 "Subject and tasks of physiology." (full-time course)

Instruction on safety rules. General information about the discipline. Regulations on discipline. Physiology as a scientific basis of medicine about the functions of the body. The importance of physiology in the training of physicians. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 2. The main stages of development of physiology. Methods of physiological research

pr.tr.2 "The main stages of development of physiology. Methods of physiological research (discussion of presentations)." (full-time course)

A brief description of the development of physiology. Review of the main methods of physiological research. The study of this topic involves theoretical work in the classroom, a speech with presentations followed by discussion.

Topic 3. The potential for rest of nerve and muscle fibers

lect.1 "Bioelectrical phenomena in living tissues." (full-time course)

The concept of membrane potential and rest potential. The role of V.Yu. Chagovets in the development of the hypothesis about the ionic mechanism of origin of the resting potential. Methods of registration of resting potential, physical characteristics, mechanism of origin. Physiological role of resting potential. Teaching is carried out in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.3 "The potential of nerve and muscle fibers." (full-time course)

The concept of membrane potential and rest potential. Methods of registration of resting potential, physical characteristics, mechanism of origin. Physiological role of resting potential. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 4. Preparation of a neuromuscular preparation

pr.tr.4 "Preparation of a neuromuscular preparation." (full-time course)

The study of this topic involves laboratory studies in the classroom, namely the manufacture of a spinal frog, rheoscopic foot, neuromuscular drug, demonstration of direct and indirect irritation, checking the physiological integrity of the drug with an electrical stimulator.

Topic 5. The potential of nerve and muscle fibers

pr.tr.5 "The potential of nerve and muscle fibers" (full-time course)

Action potential, its physical and physiological characteristics. Structure and main properties of ionic channel proteins involved in the development of PD. Ionic mechanisms of occurrence of the main phases of PD. Excitability, its changes during the development of PD. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 6. Study of bioelectrical phenomena in living tissues

pr.tr.6 "Study of bioelectrical phenomena in living tissues." (full-time course)

The concept of bioelectric potentials. Types of potentials that arise in a living organism. Damage potential. The mechanism of bioelectric potentials. Reproduction of bioelectric phenomena in the experiments of Galvani, Aldini, Matteucci. The study of this topic involves laboratory research in the classroom (experiments Galvani, Aldini, Matteucci) with subsequent discussion of the results.

Topic 7. Mechanisms of electrical stimulation of excitatory structures and conduction of excitation through nerve and muscle fibers

pr.tr.7 "Mechanisms of electrical stimulation of excitable structures. Mechanisms of excitation through nerve and muscle fibers." (full-time course)

Methods of electrical stimulation of nerve and muscle fibers. Parameters of electric current that determine its ability to cause excitation. The mechanism of nerve impulse conduction through myelin-free and myelin fibers. Structure and classification of synapses. Features of functioning of electric and chemical synapses. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 8. Solving situational problems from the section "Electrophysiology".

pr.tr.8 "Solving situational problems from the section "Electrophysiology"." (full-time course)

The study of this topic involves solving situational problems from the section "Electrophysiology" with further discussion of the results.

Topic 9. Skeletal and smooth muscle contractions

pr.tr.9 "Skeletal and smooth muscle contractions." (full-time course)

Structural organization of the muscle contractile apparatus. Modern understanding of the mechanism of muscle fiber contraction. Stages of the reduction process. The main features of the contractile apparatus and the functioning of smooth muscles. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 10. Study the main characteristics of muscle contraction

pr.tr.10 "Study the main characteristics of muscle contraction." (full-time course)

Physiological characteristics of muscle contraction: load, strength, duration, speed, work, fatigue. Electromyography. Dynamometry. The study of this topic involves laboratory studies in the classroom (determination of the absolute strength of the muscles of the hand, the level of efficiency and fatigue of the muscles of the hand by dynamometry), followed by discussion of the results.

Topic 11. Calculation work from the content module 1 "Introduction to physiology. Physiology of excitable structures".

pr.tr.11 "Calculation work from the content module 1 "Introduction to physiology. Physiology of excitable structures "." (full-time course)

The study of this topic involves theoretical work in the classroom: performing computational tasks (equilibrium potential according to the Nernst equation, the value of the membrane potential of the nerve fiber according to the Goldman-Hodgkin-Katz equation, reliability factor, determination of absolute muscle strength, efficiency and efficiency , the type of muscle contraction depending on the frequency of its stimulation, the frequency of muscle stimulation to obtain different types of contraction), followed by discussion of the results.

Topic 12. Final lesson from module 1 "Introduction to physiology. Physiology of excitable structures ".

pr.tr.12 "Final lesson from the content module 1 "Introduction to physiology. Physiology of excitable structures "." (full-time course)

Computer testing and oral examination from module 1 "Introduction to physiology. Physiology of excitable structures"

Topic 13. General patterns of nervous regulation of functions

lect.2 "General patterns of nervous regulation of body functions." (full-time course)

The main features of nervous regulation of functions. Properties of nerve centers. Coordination of reflex activity. CNS synapses, their structure, mechanisms of information transfer. Classification of mediators, their general characteristics. Characteristics of excitatory and inhibitory postsynaptic potentials. Central braking, its types, mechanisms, significance. The role of inhibitory neural circuits in the occurrence of central inhibition. Teaching is carried out in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.13 "General patterns of nervous regulation of functions." (full-time course)

The main features of nervous regulation of functions. Properties of nerve centers. Coordination of reflex activity. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 14. Reflex arc analysis. Study of excitation and inhibition in the CNS

pr.tr.14 "Reflex arc analysis. Study of excitation and inhibition in the CNS." (full-time course)

The concept of reflexes, their classification. Reflex arc, functions of its separate elements. The study of this topic involves laboratory studies in the classroom (reproduction of the Turk's reflex in frogs, determining the reflex time, analysis of the reflex arc, the study of sequential and simultaneous summation, the study of central inhibition of spinal reflexes (IM Sechenov's experiment) with further discussion of the results .

Topic 15. The role of the spinal cord in the regulation of body functions

lect.3 "The role of the spinal cord in the regulation of motor and autonomic functions of the body." (full-time course)

General structural and functional characteristics of the spinal cord. Analysis of sensory information by the spinal cord. Mechanisms of muscular and articular reception (proprioception). Muscle spindles (tension receptors), their structure, functions, excitation mechanism. Gamma loop functions. Golgi tendon receptors, their functions, reflexes from tendon receptors. Conductive function of the spinal cord, its role in the regulation of motor functions. Reflex function of the spinal cord. Characteristics of tonic reflexes (myotatic and cervical tonic), their reflex arc. Characteristics of phase reflexes, their reflex arcs. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.15 "The role of the spinal cord in the regulation of body functions." (full-time course)

General structural and functional characteristics of the spinal cord. Analysis of sensory information by the spinal cord. Conductive function of the spinal cord, its role in the regulation of motor functions. Brown-Sekara syndrome. Spinal shock. Autonomic function of the spinal cord. Reflex function of the spinal cord. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 16. Study of clinically important spinal reflexes in humans

pr.tr.16 "Study of clinically important spinal reflexes in humans." (full-time course)

Characteristics and classification of spinal reflexes. Determination of the area of

Topic 17. The role of the brain in the regulation of body functions

lect.4 "The role of the brain in the regulation of motor and autonomic functions of the body." (full-time course)

Neural organization of the hindbrain. Sensory function of the hindbrain. Conductive function of the hindbrain. Descending motor pathways, their role in regulating the activity of alpha and gamma motoneurons of the spinal cord. Autonomic function of the hindbrain. The role of the hindbrain in the provided antigravity poses. Neural organization of the midbrain and its functions. Decerebral rigidity. Characteristics of static, statokinetic and orienting reflexes. The role of reticular formation in the implementation of motor functions. Influence of medial and lateral reticulospinal pathways on spinal cord motoneurons. Functional organization and connections of basal ganglia. Functions of basal ganglia. Functional and structural organization of the cerebellum, its afferent and efferent connections, their physiological role. Cerebellar functions. Consequences of removal or damage to the cerebellum that occur in humans, their physiological mechanisms. Functional characteristics of thalamic nuclei. Functions of the hypothalamus. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.17 "The role of the brain in the regulation of body functions" (full-time course)

Neural organization of the hindbrain. Sensory function of the hindbrain. Conductive function of the hindbrain. Descending motor pathways, their role in regulating the activity of alpha and gamma motoneurons of the spinal cord. Autonomic function of the hindbrain. The role of the hindbrain in the provided poses of antigravity. Characteristics of vestibular static and cervical tonic reflexes. Neural organization of the midbrain. Sensory function of the midbrain. Autonomic function of the midbrain. Reflex function of the midbrain. Decerebral rigidity. Characteristics of static, statokinetic and orienting reflexes. The role of reticular formation in the implementation of motor functions. Influence of medial and lateral reticulospinal pathways on spinal cord motoneurons. Functional organization and connections of basal ganglia. Functions of basal ganglia. Neurotransmitters in the system of basal ganglia, their physiological role. Cycles of husk and caudal body. Clinical manifestations of damaged basal ganglia, their physiological mechanisms. Functional and structural organization of the cerebellum, its afferent and efferent connections, their physiological role. Functional organization of the cerebellar cortex. Cerebellar functions. Consequences of removal or damage to the cerebellum that occur in humans, their physiological mechanisms. Functional characteristics of thalamic nuclei. Functions of the hypothalamus.

Topic 18. Study of the functional asymmetry of the cortex of the large hemispheres

pr.tr.18 "Determination of functional asymmetry of the cortex of large hemispheres." (full-time course)

Interhemispheric asymmetry. Psychophysiological differences of people depending on the brain organization, features of their emotional sphere. The phenomenon of ambidexterity. The study of this topic involves laboratory research in the classroom: the study of functional asymmetry of the cortex of the large hemispheres by conducting morphological and functional tests, identifying the leading hemisphere of the brain.

Topic 19. Nervous regulation of autonomic functions

pr.tr.19 "Nervous regulation of autonomic functions." (full-time course)

Structural and functional features of the autonomic nervous system. Features of the reflex arc of the autonomic reflex. Classification of autonomic reflexes. Vegetative ganglia, their functions. The mechanism of excitation transmission in the autonomic ganglia. Mediators and blockers of the autonomic nervous system. Influence of sympathetic, parasympathetic and metasympathetic divisions on organs. Research and use of autonomic reflexes in practical medicine. Central regulation of visceral functions. Integrative centers of regulation of visceral functions. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 20. Study of autonomic tone and autonomic reactivity in humans

pr.tr.20 "Study of autonomic tone and autonomic reactivity in humans." (full-time course)

The concept of autonomic tone (vago-tonia, sympatho-tonia, e-tonia) and autonomic reactivity in humans. The study of this topic involves laboratory studies in the classroom with the following discussion and evaluation of the obtained indicators: determination of autonomic tone in humans by calculating the Curdew index and dermographism; assessment of autonomic reactivity by reproducing the reflexes of Danini-Ashner and Chermak; study of ensuring the work of internal organs by calculating the Hildebrandt coefficient and conducting the Letunov test.

Topic 21. Calculation work and solution of situational problems from the content module 2 "Nervous regulation of body functions"

pr.tr.21 "Calculation work and solution of situational problems from the content module 2 "Nervous regulation of body functions"." (full-time course)

The study of this topic involves theoretical work in the classroom: performing computational tasks (calculating the frequency of presynaptic pulses, calculating the reflex time by the complexity of the reflex arc, calculating the Curduy index and its estimation, calculating the Hildebrant coefficient and its estimation) and solving situational problems the following discussion of the obtained results.

Topic 22. Final lesson from module 2 "Nervous regulation of body functions".

pr.tr.22 "Final lesson from the content module 2 "Nervous regulation of body functions"." (full-time course)

Computer testing and oral examination from module 2 "Nervous regulation of body functions".

Topic 23. General regularities of humoral regulation of vegetative functions

lect.5 "General patterns of humoral regulation of body functions." (full-time course)

Relationship of nervous and humoral regulation. The contour of humoral regulation, the role of feedback in regulation. Factors of humoral regulation, their characteristics and classification. The role of factors of local regulation. Structural and functional organization of the endocrine system. Endocrine glands, endocrine cells, their hormones and significance. Determination of endocrine function and its components. Mechanisms of regulation of endocrine glands. Types of secretion and forms of hormone transport. Characteristics of cytoception mechanisms. The main stages of intracellular and cytoplasmic cytoception. The value of secondary intermediaries. Hormone metabolism. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.23 "General regularities of humoral regulation of vegetative functions." (full-time course)

The main features of humoral regulation of functions. Factors of humoral regulation, their characteristics and classification. The role of factors of local regulation. Structural and functional organization of the endocrine system. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 24. The concept of endocrine function and its components

pr.tr.24 "The concept of endocrine function and its components." (full-time course)

Determination of endocrine function and its components. Mechanisms of regulation of endocrine glands. Types of secretion and forms of hormone transport. Characteristics of cytoception mechanisms. The main stages of intracellular and cytoplasmic cytoception. Values

Topic 25. Hypothalamic-pituitary system. The role of liberins and statins

pr.tr.25 "Hypothalamic-pituitary system. The role of liberins and statins." (full-time course)

The hypothalamus as the central endocrine organ. Functional connection of the hypothalamus with the pituitary gland. Neurosecretes of the hypothalamus. The role of liberins and statins. Consequences of dysfunction of the hypothalamic-pituitary system. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 26. The role of hormones in the regulation of physical, mental and sexual development

lect.6 "The role of endocrine glands in the regulation of body functions." (full-time course)

The concept of the hypothalamic-pituitary system. The role of liberins and statins. Neurohypophysis hormones: chemical nature, regulation of secretion, mechanism of action, functional effects. Adenohypophysis hormones: chemical nature, secretion regulation, mechanism of action, functional, metabolic and structural effects. Pancreatic hormones: insulin, glucagon, somatostatin, their effect on metabolism and blood glucose concentration. Hormones that regulate calcium and phosphate homeostasis: parathyroid hormone, calcitonin, 1.25 (OH) 2D3. Influence of other hormones on calcium metabolism (glucocorticoids, somatotropic, thyroid hormones, estrogens, insulin). Thyroid hormones: chemical nature, synthesis and secretion, secretion regulation, mechanism of action. Functional and metabolic effects. Consequences of hypo- and hypersecretion. Adrenal cortex hormones: chemical nature, regulation of secretion, mechanism of action, functional and metabolic effects. Hormones of the adrenal medulla: chemical nature, regulation of secretion, mechanism of action, functional and metabolic effects. The concept of stress. Types of adaptation to stress factors. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.26 "The role of hormones in the regulation of physical, mental and sexual development." (full-time course)

Adenohypophysis, its hormones, their effects. The role of somatotropin (STG) and somatomedins in ensuring the processes of growth and development. Metabolic effects of somatotropin. Contour of regulation of STG secretion, circadian rhythms. Thyroid gland, its hormones (iodothyronines). Mechanisms of action of iodothyronines on target cells, influence on the state of mental functions, growth and development processes, metabolic processes, state of visceral systems, etc. Contour of regulation of synthesis and secretion of thyroxine (T4) and triiodothyronine (T3). The role of other hormones that affect the processes of normal growth (insulin, gonadal steroid hormones, cortisol). Gonads. Sexual differentiation, development and functions of the reproductive system. Puberty. Male reproductive system, its structure and functions. Spermatogenesis. Endocrine function of the testes, regulation of testicular function, the contour of regulation with the participation of the hypothalamic-pituitary system. Erection and ejaculation, hormonal and nervous mechanisms of regulation. Female reproductive system, its structure and functions. Ovarian hormones, their role, regulation of ovarian function. Lunar cycle. Pregnancy. Placental hormones. Lactation. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 27. The role of hormones in the regulation of homeostasis

pr.tr.27 "The role of hormones in the regulation of homeostasis." (full-time course)

Pancreatic hormones (insulin, glucagon, somatostatin) and their effects on metabolism and blood glucose concentration. Contour of hormonal regulation of maintenance of constancy of concentration of glucose in blood. Calcium balance in the body and hormones that regulate calcium and phosphate homeostasis: parathyroid hormone, calcitonin, 1.25 (OH) 2 D3. The effect of other hormones on calcium metabolism (glucocorticoids, somatotropin, IGF-1, thyroid hormones, estrogens, insulin). The role of vasopressin, oxytocin. Hormones of the adrenal medulla (catecholamines), their role in the body, regulation of secretion. Hormones of the adrenal cortex, contours of regulation of their secretion, circadian rhythms of glucocorticoid secretion, their effects and mechanisms of action on target cells. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 28. The role of hormones in regulating the body's adaptation to stress factors

pr.tr.28 "The role of hormones in the regulation of the body's adaptation to stress factors (discussion of presentations)." (full-time course)

The concept of stress and stressors. Types of adaptation to stress factors. General adaptation syndrome (G. Cellier). The role of the sympathetic-adrenal system in adaptation. The role of hormones of the adrenal cortex (glucocorticoids, mineralocorticoids), pituitary gland, thyroid hormones (thyroxine, triiodothyronine), weight-insular system in ensuring non-specific adaptation of the body to stress factors. The study of this topic involves theoretical work in the classroom, a speech with presentations followed by discussion.

Topic 29. Solving situational problems from the content module 3 "Humoral regulation of body functions".

pr.tr.29 "Solving situational problems from the content module 3 "Humoral regulation of body functions"." (full-time course)

The study of this topic involves theoretical work in the classroom, solving situational problems in the section "Humoral regulation of body functions" with subsequent discussion of the results.

Topic 30. Final lesson from module 3 "Humoral regulation of body functions".

pr.tr.30 "Final lesson from the content module 3 "Humoral regulation of body functions"." (full-time course)

Computer testing and oral examination from the module "Humoral regulation of body functions".

Topic 31. Investigation of sensory systems

pr.tr.31 "Study of sensory systems." (full-time course)

The concept of sensor systems (analyzers). General principles of structure and basic functions of analyzers. Properties and functional organization of analyzers. The concept of absolute and differential threshold of sensation. Weber-Fechner law. Classification of receptors, their functions. Functions of the conducting and central departments of the analyzers. Structural and functional organization of the somato-sensory system (skin and proprioceptive sensitivities). Physiological basis of pain. Nociception, physiological characteristics and classification of nociceptors. Nociceptive or pain system, its structural and functional organization, leading paths and levels of information processing. Physiological significance of pain. Antinociceptive system, its structural and functional organization, opiate and non-opiate mechanisms, physiological role. Physiological bases of anesthesia. Structural and functional organization of the taste sensory system. Types of tastes, mechanisms of their perception, physiological role. Structural and functional organization of the olfactory sensory system. Classification of odors, theories of their perception. Structural and functional organization of the visual analyzer. Optical eye system. The mechanism of refraction and accommodation. Anomalies of refraction of the eye. Pupil reflex, its physiological meaning. Photochemical and electrical phenomena in the retina. Light and contrast sensitivity

Topic 32. Investigation of HNA in humans

pr.tr.32 "Research of HNA in humans." (full-time course)

Types of higher nervous activity, their classification, physiological basis, research methods. Thinking. Consciousness. The concept of signaling systems. Comparative characteristics of signals of I and II signaling systems. Formation of the II signal system in ontogenesis. Language functions. Language centers. Types of higher nervous activity of people depending on the level of functioning of signaling systems. The main provisions of the teachings of IP Pavlov on the types of higher nervous activity of humans and animals. The study of this topic involves laboratory research in the classroom: the study of the capacity of short-term memory in humans (visual, auditory, logical); assessment of the mobility of nervous processes; determining the type of temperament using the Eisenko questionnaire.

Topic 33. Physiological bases of behavior

pr.tr.33 "Physiological bases of behavior (defense of abstracts)." (full-time course)

Physiological bases of behavior. Congenital and acquired forms of behavior, their significance for the adaptive activity of the organism. Regularities of formation and storage of conditioned reflexes (IP Pavlov). Inhibition of conditioned reflexes. Learning and memory, its types, mechanisms. Sleep. Its phases. Mechanisms of sleep development. The value of sleep for the body. Needs and motivations, their physiological mechanisms, the role in shaping behavior. Functional system of behavior. The structure of a holistic behavioral act according to P.K. Anokhin. Emotions, their types, mechanisms of formation, biological role. Theories of emotions. The study of this topic involves theoretical work in the classroom, defense of abstracts with further discussion.

Topic 34. Final lesson from module 4 "Physiology of analyzers and HNA".

pr.tr.34 "Final lesson from the content module 4 "Physiology of analyzers and HNA"." (full-time course)

Computer testing and oral examination from the module "Physiology of analyzers and HNA".

Topic 35. Physico-chemical properties of blood

lect.7 "Physico-chemical properties of blood." (full-time course)

Physiological blood system. Its structure. General characteristics and composition of peripheral blood. The main functions of the physiological blood system. Functional value of water and blood plasma electrolytes. Blood plasma proteins. Their composition and main functions. Basic physical and chemical properties of blood: osmotic pressure, density, viscosity, blood reaction. Teaching is carried out in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.35 "Physico-chemical properties of blood." (full-time course)

General characteristics of liquid media. Physiological blood system. Its structure. General characteristics and composition of peripheral blood. The main functions of the physiological blood system. Functional value of water and electrolytes of blood plasma. Blood plasma proteins. Their composition and main functions. Basic physical and chemical properties of blood: osmotic pressure, density, viscosity, blood reaction. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 36. Determination of ESR

pr.tr.36 "Determination of ESR." (full-time course)

Erythrocyte sedimentation rate (ESR). Factors influencing this indicator. ESR research methods in the clinic. The study of this topic involves laboratory research in the classroom: determination of ESR by the method of Panchenkov, evaluation of the indicator.

Topic 37. Properties and functions of erythrocytes

lect.8 "General characteristics of formed blood elements." (full-time course)

General characteristics of erythrocytes, their function. Hematocrit. Factors on which its value depends. Osmotic resistance of erythrocytes. Its significance. Hemolysis of erythrocytes. Types and mechanisms of hemolysis. Hemoglobin as the main component of erythrocytes. Calculation of color index and oxygen capacity of blood. Mechanisms of formation and physiological destruction of erythrocytes. Regulation of erythrocyte content in peripheral blood. Leukocytes, their distribution in the body. Quantitative and qualitative composition of peripheral blood leukocytes. The main functions of certain types of leukocytes. Mechanisms of phagocytosis. Characteristics of nonspecific and specific immunity. Regulation of leukopoiesis and leukocyte activity. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.37 "Properties and functions of erythrocytes." (full-time course)

General characteristics of erythrocytes. Their function. Hematocrit. Factors on which its value depends. Osmotic resistance of erythrocytes. Its significance. Hemolysis of erythrocytes. Types and mechanisms of hemolysis. Hemoglobin as the main component of erythrocytes. The structure of hemoglobin. Calculation of color index and oxygen capacity of blood. The main forms and compounds of hemoglobin. Color index, its definition. Mechanisms of formation and physiological destruction of erythrocytes. Regulation of erythrocyte content in peripheral blood. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 38. Counting the number of erythrocytes. Determination of hemoglobin level

pr.tr.38 "Counting the number of erythrocytes. Determination of hemoglobin level." (full-time course)

Methods of counting the number of erythrocytes in the blood in the clinic. Methods for assessing the content of hemoglobin in the blood in the clinic. The study of this topic involves laboratory tests in the classroom: counting the number of erythrocytes using Goryaev's camera, evaluation of the indicator; determination of hemoglobin content using Sally hemometer, evaluation of the indicator.

Topic 39. Protective properties of blood

pr.tr.39 "Protective properties of blood." (full-time course)

Leukocytes, their distribution in the body. Quantitative and qualitative composition of peripheral blood leukocytes. The main functions of certain types of leukocytes. Mechanisms of phagocytosis. Characteristics of nonspecific and specific immunity. Regulation of leukopoiesis and leukocyte activity. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 40. Determination of blood groups

pr.tr.40 "Determination of blood groups." (full-time course)

The concept of blood groups. Agglutinogens and agglutinins. Characteristics of blood groups of the AB0 system. Modern ideas about blood groups of the AB0 system. Characteristics of blood groups of the CDE system. Blood transfusion (blood transfusion), its stages. The study of this topic involves laboratory tests in the classroom: determination of blood groups in the ABO system and rhesus factor using standard sera and coliclons, discussion of the results.

Topic 41. Hemostasis system

lect.9 "Hemostasis system." (full-time course)

The concept of hemostasis and its two main mechanisms. The structure of the hemostasis system. The role of the vascular wall and platelets in hemostasis. Mechanisms of vascular-platelet hemostasis: arteriole spasm, adhesion, platelet aggregation, release reaction, thrombus consolidation. Mechanisms of coagulation hemostasis. Blood clotting system. Phases of blood clotting, their essence. Characteristics of the anticoagulant blood system. Characteristics of the fibrinolysis system. Regulation of blood clotting. Physiological bases of methods of research of a condition of a hemostasis. Age-related changes in the hemostasis system. Mechanisms for maintaining the liquid state of the blood. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.41 "Hemostasis system." (full-time course)

The concept of hemostasis and its two main mechanisms. The structure of the hemostasis system. The role of the vascular wall and platelets in hemostasis. Mechanisms of vascular-platelet hemostasis: arteriole spasm, adhesion, platelet aggregation, release reaction, thrombus consolidation. Mechanisms of coagulation hemostasis. Blood clotting system. Phases of blood clotting, their essence. Characteristics of the anticoagulant blood system. Characteristics of the fibrinolysis system. Regulation of blood clotting. Physiological bases of methods of research of a condition of a hemostasis. Age-related changes in the hemostasis system. Mechanisms for maintaining the liquid state of the blood. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 42. Evaluation of clinical blood test. Calculation work from the content module 5 "Physiology of blood".

pr.tr.42 "Evaluation of clinical blood test. Calculation work from the content module 5 "Physiology of blood"." (full-time course)

Age and sex characteristics of blood parameters. Changes in blood parameters during pregnancy and under conditions of pathological processes. The study of this topic involves theoretical work in the classroom: the implementation of calculation tasks (calculation of the direction of fluid movement in the capillary, blood oxygen capacity, color index) with further discussion of the results and interpretation of laboratory research methods (clinical blood tests).

Topic 43. Solving situational problems from the content module 5 "Physiology of blood".

pr.tr.43 "Solving situational problems from the content module 5 "Physiology of blood"." (full-time course)

The study of this topic involves theoretical work in the classroom, solving situational problems in the section "Physiology of blood" with further discussion of the results.

Topic 44. Final lesson from module 5 "Physiology of the blood system".

pr.tr.44 "Final lesson from the content module 5 "Physiology of blood"." (full-time course)
Computer testing and oral examination from the module "Physiology of blood"

Topic 45. General characteristics of the circulatory system

lect.10 "General characteristics of the circulatory system. Functional characteristics of the heart muscle." (full-time course)

General characteristics of the circulatory system
General characteristics of the circulatory system, its structure. Functional departments of the circulatory system. Basic and additional functions of the circulatory system. Functional properties of the heart muscle. Comparative characteristics of atypical and typical muscle fibers. Leading system of the heart, its significance. Mechanisms of spontaneous pulse generation in a conductor system. The law of "gradient of automatism". Conducting pulses through the conductive system to the working myocardium. Functional properties of contractile muscle fibers of the heart. The action potential of contractile myocardial cells. Ionic mechanisms of its main phases. Periods of absolute and relative refractoriness in the myocardium. Their physiological significance. Mechanisms of electromechanical conjugation in contractile myocardial cells. Features of the processes of proper contraction and relaxation in myocardial cells. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.45 "General characteristics of the circulatory system. Functional characteristics of the heart muscle." (full-time course)

General characteristics of the circulatory system, its structure. Basic and additional functions of the circulatory system. Comparative characteristics of atypical and typical muscle fibers. Leading system of the heart, its significance. Mechanisms of spontaneous pulse generation in a conducting system. The law of "gradient of automatism". Functional properties of contractile muscle fibers of the heart. The action potential of contractile myocardial cells. Ionic mechanisms of its main phases. Periods of absolute and relative refractoriness in the myocardium. Mechanisms of electromechanical conjugation in contractile myocardial cells. Features of the processes of proper contraction and relaxation in myocardial cells. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 46. Study of the functioning of the conduction system of the frog's heart. Ligatures of Stanius

pr.tr.46 "Study of the conductive system of the frog's heart." (full-time course)

The study of this topic involves laboratory studies in the classroom: the study of the localization of the elements of the conduction system in the heart of the frog, the frequency of generation of PD in different nodes.

Topic 47. Mechanical work of the heart. Phase analysis of the cardiac cycle

lect.11 "Mechanical work of the heart. Phase analysis of the cardiac cycle." (full-time course)

Structural and functional elements of the heart as a pump. Functions of the atria and ventricles. The valvular apparatus of the heart, its functions. Modes of heart contractions and types of loads on it. The concept of the cycle of cardiac activity. Phase structure of the cardiac cycle. Characteristics of ventricular systole: periods of stress and expulsion. Characteristics of ventricular diastole: periods of relaxation and filling. Systolic and minute blood volumes, cardiac index. Teaching is carried out in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.47 "Mechanical work of the heart. Phase analysis of the cardiac cycle." (full-time course)

Structural and functional elements of the heart as a pump. Functions of the atria and ventricles. The valvular apparatus of the heart, its functions. Modes of heart contractions and types of loads on it. The concept of the cycle of cardiac activity. Phase structure of the cardiac cycle. Characteristics of ventricular systole: periods of stress and expulsion. Characteristics of ventricular diastole: periods of relaxation and filling. Systolic and minute blood volumes, cardiac index. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 48. Study of apical impulse and heart tones

pr.tr.48 "Study of apical impulse and heart tones." (full-time course)

The concept of heart tones and methods of their study. The study of this topic involves laboratory research in the classroom: the study of the properties of the apical shock and heart tones by auscultation.

Topic 49. Electrocardiography

pr.tr.49 "Electrocardiography." (full-time course)

Discharge of electrical potentials from isolated muscle fibers, individual areas of the myocardium and the heart as a whole. Elements of the electrocardiogram (teeth, segments, intervals) and their characteristics. Electrocardiogram (ECG) recording methods. Fundamentals of vector ECG analysis. The concept of the total instant vector of the heart. The axis of the ECG. Vector analysis of the origin of the ECG teeth. Electric axis of the heart. Causes of deviation of the electrical axis of the heart under normal conditions. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 50. Calculation work "ECG registration and analysis".

pr.tr.50 "Calculation work "ECG registration and analysis"." (full-time course)

The study of this topic involves laboratory tests in the classroom and calculation work: registration of human ECG; ECG examination of the main segments, intervals, teeth, duration of the cardiac cycle, heart rate, systolic index; ECG evaluation of heart rate, sources of excitation, myocardial conduction; determining the direction of the electrical axis of the heart. Interpretation of the obtained results.

Topic 51. Fundamentals of hemodynamics. Patterns of blood flow in arterial and venous vessels.

lect.12 "Fundamentals of hemodynamics. Patterns of blood circulation in arterial and venous vessels." (full-time course)

Basic laws of hemodynamics. Total peripheral vascular resistance. Factors that ensure the movement of blood through the vessels of high and low pressure. Linear and volumetric velocities of blood in different parts of the vascular bed. Reynolds number. Functional classification of blood vessels according to Folkov B. Pulse fluctuations of blood flow, volume and pressure in arterial vessels. The concept of blood pressure. The concept of arterial pulse. Its main characteristics. Pulse wave propagation speed. Factors that determine this indicator. The concept of microcirculation. Structure and functions of the microcirculatory tract. Mechanisms of metabolism between blood and interstitial fluid: diffusion, filtration - reabsorption, microvesicular transport. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.51 "Fundamentals of hemodynamics. Patterns of blood circulation in arterial and venous vessels." (full-time course)

Basic laws of hemodynamics. Total peripheral vascular resistance. Factors that ensure the movement of blood through the vessels of high and low pressure. Linear and volumetric blood flow velocities in different parts of the vascular bed. Reynolds number. Functional classification of blood vessels according to Folkov. Pulse fluctuations in blood flow, volume and pressure in arterial vessels. The concept of blood pressure and blood pulse. Pulse wave propagation speed. Factors that determine this indicator. The concept of microcirculation. Mechanisms of metabolism between blood and interstitial fluid: diffusion, filtration - reabsorption, microvesicular transport. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 52. Measurement of blood pressure in humans.

pr.tr.52 "Measurement of blood pressure in humans." (full-time course)

Blood pressure: systolic, diastolic, pulse, average. Methods of measuring blood pressure. The study of this topic involves laboratory research in the classroom: measuring blood pressure in humans by the methods of Riva-Rocha and Korotkov.

Topic 53. Regulation of the heart, local and systemic circulation.

lect.13 "Regulation of the heart, local and systemic circulation." (full-time course)

Myogenic mechanisms of heart regulation. Immediate mechanisms of adaptation of the heart to loads of volume and resistance. The nature and mechanisms of the parasympathetic and sympathetic nervous systems on the heart. The role of the metasympathetic nervous system in the regulation of the heart. Intracardiac reflexes. Influence of humoral regulation factors on heart function. Features of mechanisms of regulation of vessels of a microcirculatory channel. Myogenic, metabolic and histomechanical mechanisms of regulation of local blood circulation. Nervous and humoral regulation of local blood circulation. Regulation of systemic circulation. Cardiovascular center, its structure, afferent and efferent connections. The main reflexogenic zones, baroreceptors and chemoreceptors of the carotid sinus and aortic arch, their role. Reflexes from receptors of auricles and large veins. Pressor and depressive reflexes. Interrelated mechanisms of nervous and humoral regulation of heart activity, vascular tone and circulating blood volume in different adaptive reactions. Physiological prerequisites for blood pressure disorders. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.53 "Regulation of the heart, local and systemic circulation (defense of abstracts)." (full-time course)

Local, nervous and humoral mechanisms of regulation of heart function, local and systemic circulation. The study of this topic involves theoretical work in the classroom, defense of abstracts with further discussion.

Topic 54. Investigation of functional tests of the cardiovascular system.

pr.tr.54 "Investigation of functional tests of the cardiovascular system." (full-time course)

Changes in blood circulation during the transition from horizontal to vertical position and during exercise. The study of this topic involves laboratory research in the classroom: conducting and evaluating orthostatic test Martinat, Shalkov test (with exercise).

Topic 55. Solving situational problems from the content module 6 "Physiology of the cardiovascular system".

pr.tr.55 "Solving situational problems from the content module 6 "Physiology of the cardiovascular system"." (full-time course)

The study of this topic involves theoretical work in the classroom, solving situational problems in the section "Physiology of the cardiovascular system" with further discussion of the results.

Topic 56. Final lesson from module 6 "Physiology of the cardiovascular system".

pr.tr.56 "Final lesson from the content module 6 "Physiology of the cardiovascular system"." (full-time course)

Computer testing and oral examination from the module "Physiology of the cardiovascular system".

Topic 57. General characteristics of the respiratory system. Research of indicators of external respiration.

lect.14 "General characteristics of the respiratory system. Mechanisms of pulmonary ventilation." (full-time course)

Stages of respiration. General structure and main functions of the external respiratory system. Functional characteristics of the structural elements of the external respiratory system: chest, respiratory muscles, pleural cavity, airways, lungs. The concept of transpulmonary, pleural and alveolar pressure. Elastic traction of the lungs. Surfactants, their significance. Biomechanics of respiration. Mechanisms of inhalation and exhalation. Static indicators of lung ventilation. The concept of lung volume and lung capacity. Dynamic indicators of lung ventilation. Minute volume and lung capacity. Dynamic indicators of lung ventilation. Minute tidal volume, its definition. Spirometry. Spirography. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.57 "General characteristics of the respiratory system. Research of indicators of external respiration." (full-time course)

Stages of respiration. General structure and main functions of the external respiratory system. Functional characteristics of the structural elements of the external respiratory system: chest, respiratory muscles, pleural cavity, airways, lungs. Respiratory biomechanics: mechanisms of inhalation and exhalation. Static and dynamic indicators of lung ventilation. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 58. Calculation work "Registration and analysis of spirogram".

pr.tr.58 "Calculation work "Registration and analysis of SPG"." (full-time course)

The study of this topic involves the implementation of calculation tasks (determination of LNG tidal volume, reserve volume of inspiration, reserve volume of exhalation, vital capacity of the lungs, respiratory rate, minute tidal volume, minute alveolar ventilation, minute O₂ consumption; calculation according to Harris-Benedict tables of the appropriate value of these indicators by the value of basal metabolism) and interpretation of the obtained indicators).

Topic 59. Gas exchange in the lungs. Blood gas transport. Regulation of respiration.

lect.15 "Blood gas transport. Regulation of respiration." (full-time course)

The composition of inhaled, exhaled, alveolar air. Voltage of gases dissolved in the blood. Partial pressure of gases (PCO₂, PO₂) in alveolar air. Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in pulmonary capillaries. Diffusion capacity of the lungs. Relationship between pulmonary circulation and pulmonary ventilation. Anatomical and physiological "dead space". Forms of oxygen transport by blood. Transport of physically dissolved oxygen in blood plasma. Influence of mechanical factors on the activity of the respiratory center. Types of mechanoreceptors in the lungs. Influence of chemical factors on the activity of the respiratory center. Central and peripheral mechanisms of these influences. Evaluation by means of functional respiratory tests of elasticity of pulmonary fabric, width of small bronchial tubes and a tone of bronchial muscles. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.59 "Gas exchange in the lungs. Blood gas transport. Regulation of respiration." (full-time course)

Mechanisms of gas exchange between inhaled air and alveolar gas mixture, between alveoli and blood in pulmonary capillaries. Forms of transport of oxygen and carbon dioxide by blood. Influence of mechanical factors on the activity of the respiratory center. Hering-Breuer reflexes. Influence of chemical factors on the activity of the respiratory center. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 60. Investigation of functional tests of the respiratory system

pr.tr.60 "Investigation of functional tests of the respiratory system." (full-time course)

The study of this topic involves laboratory research in the classroom: conducting a test of Christie and assessing the results of the elasticity of lung tissue; performing the Votchal test and evaluating the width of the small bronchi and the tone of the bronchial muscles based on its results; study of the Stange-Gench test with respiratory arrest; measurement with a dry spirometer of vital capacity of the lungs and interpretation of the results.

Topic 61. General characteristics of the digestive system

lect.16 "General characteristics of the digestive system. Digestion in the mouth and stomach." (full-time course)

Structure and functions of the digestive system. Digestive tract and digestive glands. The main functions of the digestive system: secretion, motility, absorption. Digestion: its types (cavity, membrane, intracellular), main stages. Basic principles and mechanisms of digestion regulation. Gastrointestinal hormones. Phases of secretion of the main digestive glands. Periodic activity of the digestive system. Digestive tract motility. Features of the structure and functions of the smooth muscles of the digestive tract. Physiological bases of methods of research of functions of the digestive tract. Physiological bases of hunger and satiety. Nutritional motivation, ideas about the food center. The contour of regulation of maintaining the stability of the content of nutrients in the internal environment. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.61 "General characteristics of the digestive system." (full-time course)

Structure and functions of the digestive system. Types of digestion. Basic principles and mechanisms of digestion regulation. Gastrointestinal hormones. Periodic activity of the digestive system. Digestive tract motility. Physiological bases of methods of research of functions of the digestive tract. Physiological bases of hunger and satiety. Nutritional motivation, ideas about the food center. The contour of the regulation of maintaining the stability of the content of nutrients in the internal environment. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 62. Digestion in the mouth and stomach

pr.tr.62 "Digestion in the mouth and stomach." (full-time course)

The value of the oral cavity as the initial part of the digestive system. Composition, properties and significance of saliva. Mechanisms and regulation of salivation. Mechanical processing of food. Mechanisms of chewing and swallowing. Taste analyzer, its structure and value. The importance of the stomach in the processes of digestion. Gastric juice, its composition, properties and values

Topic 63. Digestion in the intestines. The role of the liver and pancreas

lect.17 "Digestion in the intestines. The role of the liver and pancreas in the digestive process." (full-time course)

Pancreatic juice, its composition, properties and values

pr.tr.63 "Digestion in the intestines. The role of the liver and pancreas." (full-time course)

Pancreatic juice, its composition, properties and values

Topic 64. Absorption in the gastrointestinal tract

pr.tr.64 "Absorption in the gastrointestinal tract (discussion of presentations)." (full-time course)

Suction processes. Research methods. Absorption of substances in different parts of the digestive tract, its mechanisms. Features of absorption of water, salts, carbohydrates, proteins, fats, vitamins and other substances. Suction regulation. The study of this topic involves theoretical work in the classroom, a speech with presentations followed by discussion.

Topic 65. Metabolism and energy. Thermoregulation

lect.18 "Metabolism and energy. Thermoregulation." (full-time course)

Physiological significance of proteins, fats and carbohydrates. The concept of nitrogen balance. Methods of studying energy metabolism: direct and indirect calorimetry. Caloric equivalent of oxygen and respiratory rate, their importance in metabolic studies. The concept of basic exchange. Factors influencing its value. Determination of basal metabolism according to indirect calorimetry and proper basal metabolism according to Harris-Benedict tables. Specific-dynamic action of food. Energy expenditure of the body during physical and mental activity. Physiological bases of a rational food. Caloric coefficients of nutrients. The concept of the nucleus and shell as the temperature zones of the body. Periodic fluctuations in body temperature, changes in body temperature under physiological conditions. Mechanisms of heat generation. The concept of contractile and non-contractile thermogenesis. Heat transfer mechanisms. Environmental factors affecting heat transfer. Properties and physiological reactions of the organism that determine the intensity of heat transfer. Thermoregulation center, its structure and basic principles of operation. Afferent and efferent links of thermoregulation. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.65 "Metabolism and energy. Thermoregulation." (full-time course)

Physiological significance of proteins, fats and carbohydrates. Energy conversion in the body. Methods of studying energy metabolism: direct and indirect calorimetry. The concept of basic exchange. Factors influencing its value. Determination of basal metabolism according to indirect calorimetry and proper basal metabolism according to Harris-Benedict tables. Specific-dynamic action of food. Energy expenditure of the body during physical and mental activity. Physiological bases of a rational food. The concept of the nucleus and shell as the temperature zones of the organism. Periodic fluctuations in body temperature, changes in body temperature under physiological conditions. Mechanisms of heat generation. Heat transfer mechanisms. Thermoregulation center, its structure and basic principles of operation. Afferent and efferent links of thermoregulation. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 66. Estimated work "Compilation of food ration".

pr.tr.66 "Estimated work "Compilation of food ration"." (full-time course)

The study of this topic involves theoretical work in the classroom: calculation tasks (determination of basic human metabolism according to Harris-Benedict tables; determination of daily energy consumption by incomplete gas analysis; determination of daily human energy consumption in various activities; preparation of diet) and discussion of results.

Topic 67. General characteristics of the selection system. Regulation of kidney function.

lect.19 "Physiology of selection. Regulation of kidney function." (full-time course)

Selection system, its structure, functions. Excretory organs (kidneys, skin, lungs, digestive tract), their participation in maintaining homeostasis. Kidneys as the main organs of the excretory system. Nephron as a structural and functional unit of the kidney. Circulation in the kidney, its features. The main processes of urination: filtration, reabsorption, secretion. Mechanisms of filtration, composition of primary urine. Filtration speed regulation. Reabsorption in tubules, its mechanisms. Rotary-counterflow-plural system, its role. Secretory processes in the proximal and distal tubules and collecting tubules. Final urine, its composition, quantity. Urination and its regulation. Physiological bases of methods of research of function of kidneys. Evaluation of clinical analysis of urine. Determination and evaluation of glomerular filtration, the amount of water reabsorption, maximum glucose reabsorption and routes of excretion in the kidneys. Age-related changes in urination and urination. Teaching is conducted in the form of multimedia lectures (in the presence of quarantine - on-line).

pr.tr.67 "General characteristics of the Excretory system. Regulation of kidney function." (full-time course)

Excretory system, its structure, functions. Organs of excretion (kidneys, skin, lungs, digestive tract), their participation in maintaining homeostasis. Kidneys as the main organs of the excretory system. Nephron as a structural and functional unit of the kidney. Circulation in the kidney, its features. The main processes of urination: filtration, reabsorption, secretion. Filtration mechanisms, composition of primary urine. Filtration speed regulation. Reabsorption in tubules, its mechanisms. Rotary-counterflow-plural system, its role. Secretory processes in the proximal and distal tubules and collecting tubules. Final urine, its composition, quantity. Physiological bases of methods of research of function of kidneys. Evaluation of clinical analysis of urine. The study of this topic involves theoretical work in the classroom, the use of virtual simulation (watching a movie on this topic) with further discussion.

Topic 68. Calculation work "Determination of filtration and reabsorption in the kidneys."

pr.tr.68 "Calculation work "Determination of filtration and reabsorption in the kidneys"." (full-time course)

The study of this topic involves theoretical work in the classroom: calculation tasks (study of glomerular filtration rate by inulin clearance, water reabsorption, maximum glucose reabsorption, reabsorption and secretion of various substances) and interpretation of the obtained indicators.

Topic 69. Solving situational problems from the content modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism". Thermoregulation ", " Physiology of selection ".

pr.tr.69 "Solving situational problems from the content modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism". Thermoregulation ", " Physiology of selection "." (full-time course)

The study of this topic involves theoretical work in the classroom, solving situational problems in the section "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism". Thermoregulation ", " Physiology of selection "with the subsequent discussion of results.

<p>Topic 70. Final lesson from modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism and energy". Thermoregulation ", " Physiology of the excretory system ".</p>
<p>pr.tr.70 "Final lesson on content modules 7 - 10 "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism". Thermoregulation ", " Physiology of selection "." (full-time course)</p> <p>Computer testing and oral examination of the modules "Physiology of the respiratory system", "Physiology of the digestive system", "Physiology of metabolism and energy. Thermoregulation ", " Physiology of the excretory system ".</p>
<p>Topic 71. Practical skills from the course "Physiology".</p>
<p>pr.tr.71 "Practical skills from the course "Physiology"." (full-time course)</p> <p>The study of this topic involves laboratory work, evaluation of the results of functional tests, interpretation of laboratory data (clinical blood test) and instrumental (ECG, SPG) research methods.</p>
<p>Topic 72. Preparation for the license exam "KROK-1".</p>
<p>pr.tr.72 "Preparation for the license exam "KROK-1"." (full-time course)</p> <p>Computer testing</p>

7.2 Learning activities

LA1	Self-learning
LA2	Preparation for practical classes.
LA3	Completion of obligatory homework: writing essays on topics 33, 53, preparation of presentations on topics 2, 28, 64.
LA4	Solving situational problems on topics 8,21, 29, 43, 55, 69.
LA5	Laboratory studies on topics 4,6, 10, 14, 16, 18, 20, 31, 32, 36, 38, 40, 46, 48, 50, 52, 54, 58, 60, 66, 68, 71.
LA6	Calculation works on topics 11, 21, 42, 50, 58, 66, 68.
LA7	Preparing for Krok-1
LA8	Interpretation of laboratory (clinical analysis of blood and urine) and instrumental (ECG, SPG) examination methods
LA9	E-learning in systems (Zoom, Google Meet, MIX.sumdu.edu.ua)
LA10	Exam preparation
LA11	Watching educational films
LA12	Individual research project (student research paper, article, thesis)
LA13	Work with textbooks and relevant information sources

8. Teaching methods

Course involves learning through:

TM1	Interactive lectures
TM2	Demonstration method
TM3	Search laboratory work
TM4	Educational discussion
TM5	Case-based learning (CBL). Learning based on the analysis of specific situations
TM6	Team-based learning (TBL).
TM7	Research-based learning (RBS)

The discipline is taught using modern teaching methods (CBL, TBL), which not only promote the development of professional skills, but also stimulate creative and scientific activities and are aimed at training practice-oriented professionals.

The discipline provides students with the following soft skills: GC 2. Ability to learn, master modern knowledge, and apply the knowledge in practice. GC 3. Knowledge and understanding of the subject area and professional activity comprehension. GC 7. Ability to use information and communication technologies.

9. Methods and criteria for assessment

9.1. Assessment criteria

ECTS	Definition	National scale	Rating scale
	Outstanding performance without errors	5 (Excellent)	$170 \leq RD \leq 200$
	Above the average standard but with minor errors	4 (Good)	$140 \leq RD < 169$
	Fair but with significant shortcomings	3 (Satisfactory)	$120 \leq RD < 139$
	Fail – some more work required before the credit can be awarded	2 (Fail)	$0 \leq RD < 119$

9.2 Formative assessment

FA1	Peer assessment
FA2	Protection of presentations and reports
FA3	Testing
FA4	Defense of an individual research project (presentation at a conference, competition of student research papers)
FA5	Teacher's instructions in the process of performing practical tasks
FA6	Interviews and oral comments of the teacher on his results
FA7	Checking and evaluating written assignments
FA8	Solving situational problems
FA9	Checking the results of laboratory work

9.3 Summative assessment

SA1	Evaluation of written works, reports, surveys, testing, solving situational problems, results of laboratory work
SA2	Final control: exam (according to the regulations)
SA3	Defense of an individual research project (incentive activities, additional points)

Form of assessment:

4 semester	200 scores
SA1. Evaluation of written works, reports, surveys, testing, solving situational problems, results of laboratory work	120
6x20	120
SA2. Final control: exam (according to the regulations)	80
	80

Form of assessment (special cases):

4 semester	200 scores
SA1. Evaluation of written works, reports, surveys, testing, solving situational problems, results of laboratory work	120
In case of quarantine restrictions. Evaluation of written works, reports, surveys, solving situational problems, results of laboratory works are carried out remotely using the platform Mix.sumdu.edu.ua, Zoom, Google meet. (6x20)	120
SA2. Final control: exam (according to the regulations)	80
In case of quarantine restrictions, the exam is conducted remotely using the platform Mix.sumdu.edu.ua, Zoom, Google meet.	80

Students who have attended all the classes provided by the curriculum in the discipline, passed all the modules, the final testing of KROK-1 and practical skills are admitted to the exam. Incentive points: For achievements in the All-Ukrainian subject Olympiad and the All-Ukrainian competition of scientific student works the student can receive 10 additional points to the result.

10. Learning resources

10.1 Material and technical support

MTS1	Information and communication systems
MTS2	Library funds, archive of spiograms, electrocardiograms, results of laboratory research methods
MTS3	Computers, computer systems and networks
MTS4	Laboratory equipment (electrical stimulators, galvanic tweezers, aesthesiometers, dissection kits, dynamometers, chemical reagents, microscopes, Goryaev cameras, Panchenkov tripods, hemometers))

MTS5	Multimedia, video and audio, projection equipment (video cameras, projectors, screens, smart boards, etc.)
MTS6	Software (to support distance learning)
MTS7	Medical equipment (neurological hammers, electrocardiographs, spirometers, phonendoscopes, tonometers, scales, height meter)

10.2 Information and methodical support

Essential Reading	
1	Textbook of medical physiology Arthur C. Guyton, John E. Hall.—16th ed., 2020. – 1116 p. ; cm
2	Ganong - Review of Medical Physiology, - Twenty sixth Edition 26th Edition, - 2019.
Supplemental Reading	
1	Boron, W.F. & Boulpaep, E.L. (2012) Medical Physiology, 2nd updated ed. Philadelphia: Saunders Elsevier.
2	Garbuzova V. Yu. The general and cellular basis of medical physiology / V. Yu. Garbuzova, O.A. Obukhova // Суми: Вид-во СумДУ. – 2013. – 132 с.
3	Trull, T. & Prinstein, M. (2013) Clinical Psychology (8th Edition)
4	USMLE Step 1 Lecture Notes 2018: 7-Book Set Physiology -Kaplan Medical 2018: P 3-425.
5	Guyton & Hall Textbook of Medical Physiology, 13th edition. (2016) Philadelphia: Elsevier
6	Obukhova, V.Yu. Test problems in physiology state licensing examination KROK-1 [Електронний ресурс] : for the second-year students in speciality 7.110101 "Medicine" / O. A. Obukhova, V.Y. Harbuzova. - Електронне видання каф. Фізіології і патофізіолог
7	The associason of vitamin D receptor gene (VDR)polymorphisms with high blood pressure in stroke patients of ukrainian population / Obukhova O.A., Ataman A.V., Zavadaska M.M., Piven S.M., Levchenko Z.M.// Wiadomosci lekarskie (Warsaw, Poland : 1960). –
Web-based and electronic resources	
1	Physiology - https://ocw.sumdu.edu.ua/content/990