

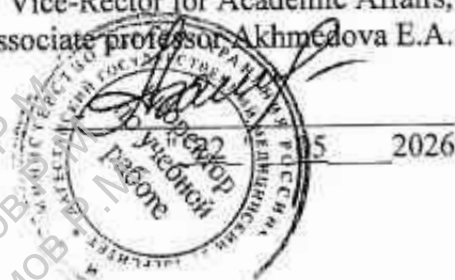


**Federal State Budgetary
Educational Institution of Higher Education
Dagestan State Medical University
Ministry of Health of the Russian Federation**

(FSBEI HE DSMU of the Ministry of Health of the Russian Federation)

APPROVED

**Vice-Rector for Academic Affairs,
Candidate of Medical Sciences, associate professor Akhmedova E.A.**



**WORKING PROGRAM,
DISCIPLINES "Normal physiology"
including an adapted version**

Curriculum Discipline Index B1.O.20
Field of study (specialty) 31.05.01
Name of the profile (specialization) General Medicine
Higher education level speciality
Graduate qualification Medical doctor
Faculty of Medicine
Department of Normal Physiology
Form of study full-time
Grade: 2
Semester: III-IV
Total labor intensity (in credit units/hours): 8 c. u. / 288 hours
Lectures: 44 hours
Practical (seminar) classes: 119 hours
Independent work: 89 hours
Form of control: exam at the IV semester (i.e. u./36 hours)

The working program of the discipline "Normal Physiology" was developed in accordance with the Federal State Educational Standard for Higher Education in the field of training (specialty) 31.05.01 Medical science (higher education level – specialty), approved by Order of the Ministry of Science and Higher Education of the Russian Federation No. 988 of August 12, 2020 (as amended on February 27, 2023).

The working program of the discipline was approved at the meeting of the department 21.05. 2026, record No. 8.

The work program has been approved:

1. Director of the DSMU Library  (V. R. Musaeva)
2. Head of the EMW Department  (G.G. Gadzhiev)
3. Acting dean  (G. M. Dalgatov)

Head of the Department

Doctor of Medical Sciences Professor  (R. M. Ragimov)

Developers of the work program:

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Reviewers:

1. L. D. Tsaturyan-MD, Professor, Head of the Department of Normal Physiology StSMU of the Ministry of Health of the Russian Federation
2. R.K. Shakhbanov - Candidate of Medical Sciences, Associate Professor, Head of the Department of Histology, FSBEI HE DGMU, Ministry of Health of the Russian Federation

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1. PURPOSE AND OBJECTIVES OF MASTERING THE DISCIPLINE

The goal is to develop students' systematic knowledge about the vital activity of the whole organism and its individual parts, about the basic laws of functioning and mechanisms of their regulation, about the physiological foundations of clinical and physiological research methods used in functional diagnostics and in the study of integrative human activity, as well as to teach them the skills of studying various physiological processes and functions, including through the use of information and communication technologies (ICT), develop the ability and readiness to perform professional tasks using digital tools.

Tasks:

- formation of students' skills in analyzing the functions of an integral organism from the perspective of integral physiology and analytical methodology;
- formation of students' systematic approach to understanding the physiological mechanisms underlying the interaction with environmental factors and the implementation of adaptive strategies of the human and animal bodies, the implementation of normal functions of the human body from the perspective of the concept of functional systems;
- teaching students the methods and principles of studying the assessment of the state of regulatory and homeostatic systems of the body in an experiment, taking into account their applicability in clinical practice;
- teaching students the laws of functioning of various systems of the human body and the features of intersystem interactions in the context of performing purposeful activities from the perspective of the theory of adaptation and cross-adaptation;
- teaching students methods for assessing the functional state of a person, the state of regulatory and homeostatic systems in various types of purposeful activities;
- teaching students the role of higher nervous activity in the regulation of human physiological functions and purposeful management of the body's reserve capabilities under normal and pathological conditions;
- introduce to students basic principles of modeling physiological processes and existing computer models (including feedback) for studying and purposefully managing visceral functions of the body;
- formation of students' fundamentals of clinical thinking based on the analysis of the nature and structure of inter-organ and intersystem relations with the position of integral physiology for future professional activity.

2. RESULTS EXPECTED AFTER STUDYING THE DISCIPLINE

Competences formed during studying the academic discipline:

Code and name of the competence (or its part)	Code and name of the competence achievement indica- tor
General professional competencies (GPC)	
GPC-5: ability to assess morphofunctional, physiological conditions and pathological processes in the human body for solving professional tasks	All GPC-5- evaluates morpho- functional processes in physiological conditions
Know: * excitability and its parameters; * membrane-ion theory of the origin of biopotentials; * classification of nerve fibers; * polar effect of constant on excitable tissues; * laws of irritation and patterns of conducting excitation along nerve fibers; * importance of recording biopotentials in medicine (EMG, ECG, EEG); * structure and functions of the myoneural synapse; * the structure of muscle fibers, sarcomeres; * modern theory of the mechanism of muscle contraction ("theory of sliding threads" by H. Huxley and E. Huxley); * strength, work and muscle fatigue; * morpho-functional classification of neurons; * principles of feedback in the central nervous system; * types of CNS synapses and classification of mediators; * the nature of exciting postsynaptic potential and inhibitory postsynaptic potential; * functional characteristics of various departments of the central nervous system. The nature of spinal shock; * vital centers of the medulla oblongata; * mechanisms of functioning and principles of regulation of endocrine cells and endocrine glands; * types and mechanisms of action of hormones; * hypothalamic-pituitary neuroendocrine regulation of physiological functions; * features of their interaction in conditions of purposeful behavior and pathology; * the blood system and its role in maintaining and regulating the body's homeostatic constants, blood function; * characteristics and functional features of physiological blood constants; * rules of blood transfusion; * the value of the biological sample during blood transfusion; * hemostatic processes and current understanding of blood clotting mechanisms; * basic properties of the heart muscle; * cavities and valvular apparatus of the heart; * main mechanisms of regulation of heart activity, cardiac cycle; * physiological role of the vascular system, regulation of vascular tone and systemic hemodynamics; * the relationship between volumetric blood flow and linear velocity at rest and physical exertion; * mechanisms of filtration and reabsorption at the level of the microcirculatory bed and their regulation; * neuro-humoral regulation of vascular tone; * ventilation of the lungs, lung volumes and capacities; * regulation of respiration, features of respiration in various conditions of existence; * digestion as a process necessary for the realization of energy and plastic functions of the body; * Pavlov experiments on the physiology of digestion; * features of functioning of various departments of the gastrointestinal tract. Digestive and non-digestive functions of the gastrointestinal tract; * mechanisms of hunger and satiety;	

- * methods of investigation of the digestive system;
- * basic processes and mechanisms of maintaining a constant body temperature;
- * the main stages of urine formation and mechanisms of their regulation;
- * the principle of operation of the "Artificial kidney" device;
- * basic non-excretory (homeostatic) kidney functions;
- * the main morpho-functional features of the organization of various departments of sensory systems;
- * theories of color perception, perception of sound vibrations, and visual refractive errors.
- * types of higher nervous activity according to Hippocrates and I. P. Pavlov;
- * mechanisms of memory, sleep phases, and cortical rhythms.

Be able to:

- prepare a neuromuscular preparation;
- determine the time of the Turk reflex;
- to reproduce the experience of I. M. Sechenov's central braking;
- determine blood types;
- determine ESR by Panchenkov;
- determine the amount of blood hemoglobin by the Sali method;
- interpret the general blood count and leukocyte formula;
- determine the Rh factor; determine the specific gravity of urine (urometry);
- conduct and analyze an ECG;
- analyze your heart rate;
- perform Stange and Gench spirometry and breath tests;
- calculate the basal metabolic rate using the table and the Harris-Benedict formula, approximate formula, and body surface data;
- calculate the specific dynamic effect of food using the formula;
- calculate the student's food intake;
- perform olfactometry;
- perform a density measurement;
- perform esthesiometry;
- reproduce Galvani's experiments;
- to study the tendon reflexes in humans (knee, achilles, etc.);
- examine samples for detection of cerebellar ataxia (Romberg, finger-nose, knee-heel);
- examine orthostatic and clinostatic samples.

Posses:

- the technique of preparing a neuromuscular preparation of frogs;
- the method of determining the time of the reflex according to the Turk;
- a method for determining muscle strength (using hand and stanovoy dynamometers);
- a method for determining blood groups and Rh factor using soliklons;
- a method for determining blood pressure;
- palpation and counting of arterial pulse;
- техникой проведения pulse oximetry techniques;
- the method of calculating personal income tax;
- the method of determining the eye-heart reflex of Ashner;
- techniques for determining visual acuity and fields of view;
- method for determining color perception;
- technique for calculating the number of red blood cells and white blood cells;
- determination of blood clotting time, ESR, and hemoglobin content;
- methodology for assessing the osmotic stability of red blood cells;
- methodology for evaluating the results of a general urinalysis;
- methodology for determining the types of HNA (Eysenck test).

3. PLACE OF THE DISCIPLINE (MODULE) IN THE STRUCTURE OF THE EDUCATIONAL PROGRAM

The discipline "Normal physiology" belongs to the basic part B1 of the curriculum for the specialty 31.05.01 Medical Science.

The course material is based on students' previously acquired knowledge and skills in biology, cytology, chemistry, physics, histology, embryology, biochemistry, anatomy, Latin language, physical culture and sports.

The study of the discipline "Normal Physiology" is aimed at developing the following general professional and professional competencies in students: GPC-5 - Is able to assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.

To master this competence, it is necessary to know the mechanisms of functioning of the body in normal conditions and under the influence of environmental factors, reflexes, physical and chemical properties of blood plasma, structural and functional features of blood, organs of the respiratory system, excretion, digestion, and other systems of the human body.

"Competence"

There is a specific competence of GPC-5 "Able to assess morphofunctional, physiological and pathological processes in the human body to solve professional problems" A11 / GPC-5

Sections of the discipline "Normal physiology"

№	Section names
1	Introduction to the subject. Physiology of excitable tissues
2	General and private neurophysiology. The autonomic nervous system
3	Physiology of the endocrine system
4	Physiology of the blood system
5	Physiology of the cardiovascular system
6	Respiratory physiology
7	Physiology of digestion
8	Physiology of metabolism and energy
9	Physiology of nutrition and thermoregulation
10	Physiology of the excretory system
11	Physiology of analyzers
12	Physiology of higher nervous activity

Interdisciplinary relations with following disciplines

n/n	Name of the provided (subsequent) disciplines	1	2	3	4	5	6	7	8	9	10	11	12
1	Propaedeutics of internal diseases				+	+	+	+	+	+	+		
2	Ophthalmology		+									+	+
3	Otorhinolaryngology		+				+	+				+	+
4	Obstetrics and Gynecology				+	+	+						
5	Pediatrics		+	+	+	+	+		+	+			+
6	Neurology, medical genetics, neurosurgery	+	+	+								+	+
7	Psychiatry, medical psychology												+
8	Forensic medicine				+		+	+					
9	Medical rehabilitation	+	+	+		+	+					+	+
10	Hospital therapy			+	+	+	+	+	+	+	+		
	Faculty therapy			+	+	+	+	+	+	+	+		
11	Immunology				+	+	+	+					
12	Phthisiology						+						
13	General Surgery		+		+		+		+	+			+
14	Anaesthesiology, intensive care, intensive care		+		+	+	+			+	+		

15	Faculty Surgery			+			+	+					
16	Hospital surgery			+			+	+					
19	Dentistry						+	+				+	
20	Hygiene						+	+	+	+			
21	Radiation diagnostics												
22	Endocrinology		+	+		+	+	+	+	+	+		
23	Urology											+	

4. SCOPE OF THE DISCIPLINE AND TYPES OF ACADEMIC WORK

The total labor intensity of the discipline is 8 credits.

Types of work		Total hours	Number of hours in semesters	
			III	IV
		2	3	4
Contact work (total), including:		160	64	96
Classroom work				
Lectures (L)		44	16	28
Practical exercises (PE)		110	51	68
Seminars (S)				
Laboratory work (LW)				
Extracurricular activities				
Independent work of a student (IWS)		92	41	48
Type of intermediate certification	Exam (E)	36		36
TOTAL:	hours	288	108	180
overall labor intensity	Credit units	8	3	5

5. CONTENT OF THE DISCIPLINE'S WORK PROGRAM

5.1 Sections of the discipline and competencies that are formed during their study

№ of the section	Code of controlled competence/Indicator of achievement	Section name	Section content
1	2	3	4
1	GPC-5 / AI-1	Introduction to the subject.	Normal physiology is a science that studies the life processes of a healthy person. The concept of an organism and its constituent elements. Levels of morpho-functional organization of the human body. The cell and its functions. Body tissues (epithelial, connective, muscular and nervous), their main functional features. The concept of an organ, its structural and functional unit of an organ. Physiological function, ce norm. Relationship between structure and function. Unity of the body and the external environment. The concept of the internal environment of the body and its components (blood, lymph, intercellular fluid). The concept of physiological constants. Concepts of soft and hard constants. Concepts of homeostasis, homeokinesis. Physiological adaptive response. Analytical and systematic approaches to the study of physiological processes and functions. Brief description of the stages of development of normal physiology: empirical, anatomical and physiological, functional (the principal role of the works of W. Harvey, R. Descartes). Formation and development of physiologi-

		ogy in the XIX-XX centuries (significance of scientific works by W. Harvey, R. Descartes, C. Bernard, E. Dubois-Reymond, G. Helmholtz, C. Sherrington, W. Cannon). Contribution of foreign and domestic physiologists to the development of physiological science (D. V. Ovsyannikov, I. M. Sechenov, N. A. Mislavsky, I. P. Pavlov, N.E. Vvedensky, A. A. Ukhtomsky, A. F. Samoilov, L. A. Orbeli, K. M. Bykov, E. A. Asratyan, V. V. Larin, V. N. Chernihiv, G. I. Kositsky, L. S. Stern, P. K. Anokhin, P. V. Simonov, K. S. Sudakov, G. G. Musalov). Physiological basis of functions. Irritability as the basis of the tissue response to irritation. Classification of stimuli. The concept of excitability and arousal. Excitation and inhibition as an active state of excitable tissue. Their physiological role. System organization of functions (I. P. Pavlov, P. K. Anokhin). The concept of a system. Levels of the system organization. The physiological system. Physiology of excitable tissues. Structure and functions of biological membranes. Types of membrane transport proteins, classification and properties of ion channels. History of the discovery of bioelectric phenomena in living tissues (L. Galvani, E. Dubois-Reymond, K. Matteucci). Membrane and ionic mechanisms of the origin of biopotentials at rest. Methods for recording membrane potentials. Physiological properties of excitable tissues. Types of irritation of excitable tissues. Features of local and propagating excitation processes. Electrophysiological characteristics of the excitation process (A. Hodgkin, A. Huxley, B. Katz). Potential actions and their phases. Ionic mechanisms of excitation. Changes in the permeability of the cell membrane during excitation. Arousal and excitability. Changes in excitability during arousal. Characteristics of refractoriness and exaltation. The laws of stimulation of single and integral excitable structures: "forces", "all or nothing", "forces-durations" (Weiss-Lapick). The concept of rheobase, chronaxia, and useful time. Laws of stimulation under the action of direct current on excitable tissues; physiological electroton, polar action of direct current (E. Pfluger). The concept of cat-and anelectroton, Cathodic depression, and anodic exaltation. The concept of parabiosis (N.E. Vvedensky), phases of parabiosis development. Changes in tissue excitability with a slow increase in depolarizing current, accommodation property. Classification of nerve fibers. Mechanisms of conducting excitation along nerve fibers. Laws of conducting excitation in the nerves. Types of signal transmission between excitable cells. The concept of synapse. Classification of synapses. Functional properties of electrical and chemical synapses. The mechanism of signal transmission in the chemical synapse. Types of synaptic neurotransmitters and neuromodulators. Features of signal transmission in neuromuscular and central synapses: in excitatory and inhibitory synapses. Physical and physiological properties of skeletal muscles. The concept of a motor unit, physiological features of fast and slow motor units. Electromyography. Characteristics of types and modes of muscle contraction. Time ratio of the excitation cycle, excitability and single contraction of skeletal muscle fibers. Mechanism of tetanic contraction. Conditions for the occurrence of the optimum and pessimum. Features of the structure of the membrane and sarcomeres of skeletal muscle fibers. The mechanism of muscle contraction. Electromechanical coupling. Dependence of the muscle contraction force on its initial length. Energy of muscle contraction. Pathways of ATP resynthesis. Power and capacity of the body's energy systems. Functional system of energy supply of muscle activity. Physiological features and properties of smooth muscles. Their significance in
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			the myogenic regulation of motor functions of internal organs.
2.	GPC-5 / AI-1	General and private neurophysiology.	Morphofunctional organization of a neuron as a unit of the nervous system. Occurrence of local and propagating excitations in a neuron. Integrative function of a neuron. Classification of neurons. The concept of neural networks and their types. Block-modular concept of central nervous system activity. The concept of the nerve center in the broad and narrow sense of the word. Physiological properties of nerve centers. Basic principles of excitation propagation in nerve centers and neural networks. Principles of coordination activity of the central nervous system. Reflex principle of activity of the nervous system and principles of reflex theory. Reflex is the main mechanism of the body's adaptive response to changes in internal and external environmental conditions. Links and components of the morphological basis of the reflex from the positions of R. Descartes and P. K. Anokhin. Morphological basis of the simplest somatic reflex. The concept of the adaptive result of reflex activity. Types of reflexes. The value of inhibition in the central nervous system. History of the discovery of peripheral and central inhibition. Braking functions (protective and coordinating). Types of central inhibition (depolarization and hyperpolarization: presynaptic and postsynaptic; translational, lateral, recurrent, reciprocal). Unitary-chemical and binary-chemical theories of central inhibition. Mechanisms of interaction between excitatory and inhibitory effects on the neuron. Mechanisms of depolarization (pessimistic) and hyperpolarization inhibition of a neuron. The role of various parts of the central nervous system in the regulation of physiological functions. Afferent, efferent, and associative areas of the cerebral cortex. Columnar organization of the cortex. Irradiation and convergence of excitations of different modality in the cortex. The role of inhibitory neurons in providing analytical and synthetic activity of the cortex. Plasticity of the cortex (E. A. Asratyan). Cortical-subcortical and cortical-visceral relationships (K. M. Bykov). Functional asymmetry of the hemispheres in humans. The concept of muscle tone. Reflex nature and functional significance of muscle tone. Types of proprioceptors, their localization, structure, and role in maintaining muscle tone. Morphological basis of the tendon reflex. The mechanism of occurrence and regulation of muscle tone at the spinal level (spinal tone). Ways and mechanisms of influence of medulla oblongata and cerebellum structures on muscle tone. Mechanism of occurrence of the state of decerebration rigidity (contractile tone) in a bulbar animal. Midbrain structures involved in the formation of mesencephalic tone. Plastic tone in a diencephalic animal. Participation of components of the striopallidum system and the cerebral cortex in the regulation of muscle tone. The concept of tonic reflex. Types of tonic reflexes (static and statokinetic). Conditions for their occurrence. Participation of spinal, medulla oblongata, and midbrain structures in their implementation. The autonomic (autonomic) nervous system. Its functions. Physiological features of the sympathetic, parasympathetic, and metasympathetic divisions of the autonomic nervous system. The main types of mediators and receptors. The role of various parts of the central nervous system (spinal, bulbar, mesencephalic centers, hypothalamus, cerebellum, reticular formation, cerebral cortex) in the regulation of the functions of the autonomous nervous system. An idea of the typological features of vegetative hemodynamic regulation. Methods for determining dysfunctions of the autonomic nervous system. Types of response to emotional stress by indicators of the autonomic nervous system.
		The autonomic	

		nervous system	
3.	GPC-5 / AI-I	Physiology of the endocrine system	The main components of the endocrine system (local and diffuse endocrine systems). The concept of endocrine glands. Biopotentials of glandulocytes. Secretory cycle. Types of endocrine glands. Central and peripheral glands. Working systems of the endocrine glands (hypothalamic-pituitary, sympatho-adrenal, gastroenteropancreatic, etc.). The concept of endocrine and neuroendocrine cells. Types of biologically active substances: hormones, hormone-like peptides, neurohormones, neurotransmitters, modulators. Functional characteristics of hormones that distinguish them from other biologically active substances. Classification of hormones: by chemical nature (protein-peptide, steroid, amino acid derivatives), by function (tropic, trigger, effector). Forms of transmission of regulatory influences using biologically active substances (autocrine, isocrine, paracrine, endocrine, neurocrine). Methods of transporting hormones by blood. Significance of hormone transport in the bound state. Mechanisms of action of hormones on target cells (membrane, cytosolic-nuclear). Types of physiological action (metabolic, morphogenetic, kinetic, corrective) and the value of hormones. Nervous (trans - and para-pituitary) and humoral regulation of the activity of the endocrine glands. The role of negative feedback loops (ultrashort, short, and long) in the self-regulation of the endocrine glands. Hormones of the endocrine glands (hypothalamus, pituitary, epiphysis, thyroid, thymus, parathyroid, pancreas, adrenal, sexual, placenta), their influence on metabolic processes and body functions. Stress, mechanisms, role in life processes. The role of G. Selye and Russian scientists in the development of the theory of stress. Stress as an adaptation phase. Short-term and long-term adaptations. Cross adaptation and its role in clinical practice.
4.	GPC-5 / AI-I	Physiology of the blood system	The concept of blood, blood systems. The amount of circulating blood, its composition. Blood functions. Basic blood constants, their value and functional significance. The concept of osmotic blood pressure. An idea of the self-regulatory principle of the mechanism of maintaining blood constants. Functional systems that maintain a constant pH and osmotic pressure of the blood. The concept of hemolysis, its types and plasmolysis. Formed blood elements, their physiological significance. The concept of erythro-, leuco- and thrombocytopoiesis, their nervous and humoral regulation. Hemoglobin, its compounds, functional significance. Lymph, its composition and functions. Understanding the protective function of blood and its manifestations (immune reactions, blood clotting). Blood groups as manifestations of immune specificity of the body. Types of blood group systems (ABO, Rh-affinity). Their significance for obstetric and surgical practice. The process of blood clotting (hemostasis), its significance. The main factors involved in the process of blood clotting (tissue, plasma, thrombo-, erythro- and leukocyte), their functional characteristics. Understanding of the external (tissue) and internal (blood) systems of blood clotting, blood clotting phases, retraction and fibrinolysis processes. Factors that accelerate and slow down blood clotting. The concept of the first and second anticoagulant blood systems. An idea of the principles of their functioning.

			An idea of the functional system that ensures the maintenance of the liquid state of blood. Blood coagulation, anticoagulant, and fibrinolytic systems.
5	GPC-5 / AI-1	Physiology of the cardiovascular system	The concept of the physiological circulatory system (cardiovascular system). Pumping function of the heart. Morpho-functional features of the heart organization. Typical and atypical (P - and T-cells) cardiomyocytes, cardiac conduction system, valvular apparatus, heart cavities. Physical and physiological properties of the heart muscle. The concept of functional syncytia for the heart. Occurrence and propagation of excitation in the heart. Automatics, its nature, centers, and gradient. Ion mechanisms of excitation of atypical myocardiocytes. Mechanisms of occurrence of slow diastolic depolarization. Changes in excitability during excitation of typical cardiomyocytes. Electromechanical coupling. Extrasystole. Compensatory pause. Cardiac cycle, its phase structure. Changes in the tone of the muscle walls of the heart cavities, changes in their volumes, blood pressure, and the state of the valvular apparatus during various phases of the cardiac cycle. The concept of chrono-, batmo-, dromo-, ino- and tonotropic effects as manifestations of regulatory influences on heart function. Types of regulation of cardiac activity. Autoregulation: myogenic (hetero- and homeometric) and neurogenic mechanisms. Regularities of manifestations of myogenic autoregulation (Frank-Starling law; Anrep's law; rhythmo-inotropic dependence). Nervous and humoral mechanisms of extracardial regulation of cardiac activity. Humoral effects of hormones, electrolytes, mediators and other factors on the parameters of heart activity. Nervous regulation. Features of sympathetic and parasympathetic innervation of the heart muscle. Mechanisms of parasympathetic and sympathetic influences on heart function. Reflex regulation of heart activity. Nervous centers of regulation of cardiac activity. Endocrine function of the heart. Effect of atrionatriuretic peptide on vascular tone and urination. Functional classification of blood vessels (amortizing or elastic-extensible, distribution, resistive, exchange, bypass, capacitive, blood return). Basic laws of hydrodynamics and their use to explain the physiological functions and functions of hydrodynamics. Patterns of blood flow through the blood vessels. Factors that ensure the movement of blood through the vessels. Parameters of peripheral blood circulation (blood pressure, blood flow velocity, linear and volumetric blood flow velocity, vascular resistance, blood circulation time). Changes in resistance, blood pressure, and blood flow velocity in different areas of the vascular bed. Nervous, humoral and myogenic regulation of vascular tone. The concept of basal vascular tone and autoregulation of vascular tone. Vasomotor center (pressor and depressor divisions). Peripheral and central effects on neuron activity in the vasomotor center. Concepts of systolic, diastolic, pulse and average blood pressure. Factors that determine the value of blood pressure. A functional system that supports normal blood pressure levels. Microcirculation and its role in the mechanisms of fluid and various substances exchange between blood and tissues. Vascular module of microcirculation. Capillary blood flow. Types of capillaries. Mechanisms of transcapillary exchange in the capillaries of the large and small circulatory circles. External manifestations of heart activity (electrical, sound, mechanical). Mechanisms of heart EMF occurrence. Einthoven's theory. Methods of recording electrical manifestations of cardiac activity. Basic ECG leads in humans (standard, enhanced, thoracic). Bipolar and monopolar ECG leads.

			Structural analysis of a normal ECG in standard II assignment. Prongs, complexes, intervals, and segments. time and amplitude characteristics. Propagation of excitation in the myocardium (depolarization and repolarization waves). De-and repolarization potentials at the active electrode. Vector theory of ECG genesis. Electrical axis of the heart. Physiological variants of its location (normal, horizontal and vertical). Methods of investigation of sound manifestations of heart activity (auscultation, phonocardiography). The origin of heart tones, their types and places of best-listening. Methods of investigation of arterial (sphygmography) and venous (phlebography) pulse. Clinical OCR of pulse in humans. Methods for measuring blood pressure (direct and indirect). Methods of Riva-Rocci and Korotkov, the technique of their application. The concept of vascular tones, an idea of the mechanisms of their occurrence. Definition of the Functional Change Index (FFI) as a method of rapid diagnostics of the state of the cardiovascular system. Method of variational heart rate monitoring. Statistical analysis of ECG, its use for assessing the nature of regulatory influences on heart rate. Cardiac activity during physical exertion. Cardiac output is an integral indicator of the work of the heart. Mechanism of changes in cardiac output during exercise. Changes in the heart rate structure under conditions of physically strenuous activity. Regulation of vascular tone during exercise. Mechanisms of strengthening venous return during muscle work (venous, muscular, respiratory 'pumps'). Methods for assessing a person's physical performance based on heart performance indicators: Harvard Step Test, PWC170 (testing methodology, evaluation data for middle-aged people).
6.	GPC-5 / AI-1	Respiratory physiology	The importance of respiration for the body. Main stages of the process? External breathing. Biomechanics of inhalation and exhalation. Pressure in the pleural cavity. Its changes during inhalation and exhalation. Lung volumes and capacities. Backup capabilities of the respiratory system. Spirometry, spirometry. Composition of the inhaled, exhaled, and alveolar air. Anatomical, physiological and functional dead spaces. Ventilation and perfusion coefficients, their significance in clinical practice. Aerohemetic barrier. Diffusion capacity of the lungs. Transport of gases by blood. Graph of octemoglobin dissociation. Factors influencing the formation and dissociation of oxyhemoglobin. The concept of oxygen capacity of blood. Nasal and oral respiration, their features. Functional connection of respiration, chewing and swallowing processes. Regular breathing. The concept of the respiratory center in the broad and narrow sense of the word. An idea of the localization and organization of the structure of the respiratory center in the broad sense of the word Types of respiratory neurons of the medulla oblongata, their automatics. The role of various receptors and parts of the respiratory center in the mechanisms of changing the phases of respiration. An idea of the regulation of respiration based on the perturbation principle and the deviation principle. Protective respiratory reflexes. Mechanism of the first breath of a newborn. Breathing at high and low barometric pressure. FUS scheme. ensuring the maintenance of constancy of the gas environment of the body. Breathing during physical activity. Estimation of the minute volume of breath. Regulation of respiration during muscle work (humoral and nervous mechanisms). Maximum oxygen consumption (MPC). Relationship between oxygen consumption and heart rate. True steady state. Oxygen demand, oxygen con-

			sumption, and oxygen debt during exercise.
7.	GPC-5 / AI-1	Physiology of digestion	Digestion, its meaning, types and forms. Neuro-humoral mechanisms of hunger and satiety. Analysis of components of the functional system for maintaining a constant level of nutrients in the blood. Regularities of the organization of the gastrointestinal tract activity on the principle of the digestive conveyor. General principles of neuro-humoral regulation of digestive tract functions. Chewing, its nature, self-regulation. Features of the same behavior when chewing food of different consistency. Masticationography, masticationogram analysis. Salivation and salivation. Nervous and humoral mechanisms of regulation of these processes. Salivation phases, salivation reflex, adaptive nature of salivation. Swallowing, its phases and mechanisms. Functions of the stomach. Quantity, composition and properties of gastric juice. The value of hydrochloric acid and other components of gastric juice. Phases of gastric secretion, their neuro-humoral mechanisms. Introduction to the features of experimental gastric surgeries and their use for studying nervous and humoral effects on gastric secretion. Motor activity of the stomach. Nervous and humoral factors affecting the motor and evacuation functions of the stomach. Importance and role of digestion in the duodenum. Functions of the pancreas. Quantity, composition and properties of pancreatic juice. Pancreatic juice enzymes released in the active state and in the form of zymogens. Mechanisms of regulation of pancreatic secretion. Self-regulation mechanisms of pancreatic secretion, their significance. Liver function. Bile, its quantity, composition, significance for the esophagus. Mechanisms of bile formation, deposition and bile excretion, their regulation. Enterohepatic recirculation of bile acids. Importance and role of digestion in the small intestine. Mechanism of intestinal juice formation. Quantity, property, and enzymatic composition of intestinal juice. Regulation of intestinal juice separation. Oral and membranous digestion, their interrelation and severity in various parts of the gastrointestinal tract. Intracellular digestion. Immunocompetent cells of the gastrointestinal tract. Motor activity of the small and large intestine, its features, significance, mechanisms of regulation. Features of digestion, the importance of microflora in this process. Enzyme composition of colon juice. The act of defecation as the end result of digestion in the colon. Absorption of digestive products in various parts of the digestive tract, its mechanisms.
8.	GPC-5 / AI-1	Physiology of metabolism and energy	Metabolism — as the main condition for ensuring vital activity and maintaining homeostasis. Plastic and energy role of nutrients. Processes of assimilation and dissimilation of substances. Metabolism of proteins, fats and carbohydrates, their regulation. Regulation of the content of nutrients in the body. The importance of water for the body. Understanding the regulation of water and mineral metabolism. An idea of the energy balance of the body. Caloric value of various nutrients. Methods of direct and indirect (complete and incomplete gas analysis) calorimetry. The concept of caloric value, respiratory coefficient and caloric equivalent of oxygen, their values for different types of oxidized nutrients. Daily exchange

			and its components. Main exchange, conditions for determining the main exchange, factors affecting its value. Specific dynamic action of nutrients. Working increase, working exchange. The value of labor exchange in different types of labor.
9.	GPC-5 / AI-1	Physiology of nutrition and thermoregulation	Physiology of nutrition. Principles of rational nutrition organization. Daily food ration and basic requirements for it. The norms of nutrients in the daily food intake in accordance with age, profession, and other factors affecting metabolic processes. A balanced diet. Power mode. The concept of thermoregulation. Heat production. Heat transfer. Constant temperature of the internal environment of the body, as a necessary condition for the normal course of metabolic processes. Body temperature scheme, its daily fluctuations. Poikilothermy, homothermy, and hibernation. A functional system that maintains a constant temperature of the internal environment of the body.
10	GPC-5 / AI-1	Physiology of the excretory system	The concept of isolation, its role in maintaining homeostasis. The kidney is the main excretory organ. Morpho-functional characteristics of the nephron, features of its blood supply. Glomerular filtration mechanism and its regulation. Primary urine, the difference in its composition from blood plasma. Reabsorption: mandatory (obligate) and elective (optional). Active and passive processes underlying reabsorption. The concept of threshold and non-threshold substances. Rotary-countercurrent mechanism of urine concentration at the level of the Henle loop and collecting tube. Mechanisms of reabsorption regulation. The role of the main humoral factors: aldosterone and antidiuretic hormone. Secretion in the renal tubules. Secondary urine. Understanding of the homeostatic functions of the kidneys (regulation of fluid volume, osmotic pressure, acid-base balance, the amount of inorganic and organic substances, blood pressure, hematopoiesis). Mechanism of urination, its regulation.
11	GPC-5 / AI-1	Physiology of analyzers	The concept of the sensory system. The concept of the analyzer from the positions of I. P. Pavlov's teaching. Correlation between the concepts of "sensor system" and "analyzer". The concept of a sense organ. An idea of the basic and auxiliary structures of the sensory organ. The concept of the peripheral (receptor) part of the sensory system, the receptor, the receptive field of a neuron. Functional properties and features of receptors: specificity, high excitability, low accommodation, ability to adapt; rhythmic generation of excitation pulses. Classification of receptors according to the following criteria: reception of internal or external stimuli; the nature of an adequate stimulus; the nature of sensations; modality; threshold of irritation; speed of adaptation; connection of the receptor with a sensory neuron. Mechanism of receptor excitation. Receptor and generator potentials. Coding of signals in receptors. Functional properties and organization features of the sensor system's wiring department (multi-level, multi-channel, presence of "sensor funnels", specific and non-specific ways of transmitting information). An idea of the three-neuron organization of the wiring department. Participation of the conduction department in conducting and processing afferent excitements. Features of the organization of the cortical part of the sensory system. Functional differences in neurons that are part of different cortical zones. Understanding the mono- and polymodality of neurons, the mechanism of interaction of sensory systems (convergence and divergence of excitements, lateral and recurrent inhibition, mediator interaction, synaptic receptor synthesis).

			Coding of information in various departments of sensor systems. The ratio of the intensity of irritation and the intensity of sensation. The Weber-Fechner law. The main methods of regulating the activity of sensory systems based on the use of various forms of inhibition of descending influences from the overlying departments to the underlying ones. The concept of functional mobility. Adaptation of sensor systems. Morpho-functional characteristics of the visual sensory system. The concept of visual field and visual acuity. Methods for determining them. The concept of refraction, accommodation and adaptation of the eye. Mechanisms of these processes, their anomalies (astigmatism, myopia, hyperopia, presbyopia). Pupillary reflex. Mechanisms of color reception and perception. The main types of color perception disorders. Auditory sensory system. Sound-trapping structures, sound-conducting pathways, and sound-receiving apparatus of the auditory sensory system. Mechanisms of sound reception. Binaural hearing. Methods of research of the auditory sensory system. General morphological and functional organization of the skin sensory system. Tactile and temperature sensor systems as its components. Classification of tactile receptors, their structural and functional differences. Methods of studying the tactile sensory system. The concept of spatial threshold of tactile sensitivity. Classification of thermoreceptors. Methods for studying the temperature sensor system. General morphological and functional organization of the taste sensory system. Receptors of the taste sensory system. Taste buds, taste buds. Types of taste buds of the tongue. The mechanism of reception and perception of taste. Methods of investigation of the taste sensory system (gustometry and functional mobility). General morphological and functional organization of the olfactory sensory system. Mechanism of smell reception and perception. Methods of olfactory sensory system research (olfactometry). The role of the interaction of the olfactory and other sensory radii in the formation of taste sensations. The concept of pain, nociception. Pain functions. Classification of pain. Morpho-functional characteristics of the parts of the moresensory system. An idea of the theories of the mechanism of the occurrence of pain (intensity, synchronization of afferent flow, specificity, gate control, generators). Pain as an integrative reaction of the body to the damaging effect of a stimulus. Components of the pain response. The role of the thalamus and cerebral cortex in the integration and analysis of pain arousal. Sensory-discriminative and semantic analysis of damaging effects. Concepts of antinociception and antinociceptive system (ANCS). Components and functions of ANCS. ANCS levels: system of descending inhibitory control of primary afferents and first relay nuclei; limbic-hypothalamic level; cortical level (secondary somatosensory and orbitofacial regions of the cerebral cortex). Neurochemical and neurophysiological mechanisms of ANCS. Presynaptic and postsynaptic changes in the ANCS activation pathway. The concept of pain threshold. Algometry. Physiological bases of analgesia.
12	GPC-5 AI-1	Physiology of higher nervous activity	The concept of HNA. Understanding the manifestations of HNA (innate and acquired behaviors, higher mental functions). The concept of a conditioned reflex. History of the discovery of conditioned reflexes. The significance of the works of I. P. Pavlov and his followers in creating the theory of conditioned reflexes and the physiology of HNA. Comparative characteristics of conditioned and unconditioned reflexes. The value of conditioned reflexes in the adaptation of animals and humans to the conditions of existence.

		tivity Rules and stages of developing conditioned reflexes. Classification of conditioned reflexes by criteria: correlations of the nature of conditioned and unconditioned stimuli (natural and artificial); biological significance of the unconditioned stimulus (food, defense, etc.); the type of receptors excited by the conditioned irritant (sound, light, etc.); the ratio of the conditioned stimulus to the first or second signal systems; the complexity of the conditioned reflex (reflexes 1, 2, 3, etc. orders); the nature of changes in the activity of the body (positive, negative); the ratio of the time of action of conditional and unconditional stimuli (present, delayed, trace). The concept of a temporary connection. Pavlov's and modern ideas about the levels of localization of temporal communication and the mechanisms of its formation. Inhibition in HNA, its types: unconditional (out-of-bounds and external), conditional (fading, differentiated, conditional inhibition, delayed), conditions of their occurrence. Modern understanding of the mechanisms of inhibition in HNA. The significance of inhibition of conditional reflexes for the organization of adaptive human activity. The concept of HNA type (according to I. P. Pavlov). Classification and characteristics of HNA types. The role of HNA types and other individual-typological characteristics of a person in the implementation of adaptive activity Concepts of the psyche and higher mental functions. Types of basic mental functions (sensation, perception, representation, attention, emotion, motivation, memory, speech, thinking, consciousness). The concept of sensation. An idea of the nature of sensation. The concept of perception. An idea of its mechanism. The concept of attention. Types of attention. Understanding the mechanisms of attention from the positions of Pavlov, Ukhtomsky and modern science. Physiological correlates of attention The concept of motivation. Classification of motivations. Concept of the mechanism of their occurrence. The role of the hypothalamus and cerebral cortex in this process. The concept of emotion. Types of emotions. An idea of the mechanism of their occurrence. The role of various brain structures in the formation of emotional states. The importance of emotions for organizing behavior. The concept of memory. Types of memory. Understanding the mechanisms of short-term and long-term memory. The concept of thinking. Types of thinking. The role of various brain structures in the implementation of the thinking process. Abstract thinking development in human ontogenesis. The concept of speech. Types of speech and speech functions. Understanding the mechanisms of speech, functional asymmetry of the cerebral cortex associated with the development of speech in humans. The concept of consciousness. The concept of sub- and superconsciousness, their relationship with consciousness. Introduction to physiological and psychophysiological methods of studying mental functions. The concept of purposeful behavior. Analysis of components of the functional system of a behavioral act.
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5.2. Discipline sections, labor intensity by type of academic work

№	Name of the discipline section	Types of activities (in hours)					
		E	L	LW	PW	ISW	total
1	2		3	4	5	6	7

1	Introduction to the subject. Physiology of excitable tissues		4		15	10	29
2	General and private neurophysiology. The autonomic nervous system		4		15	13	32
3	Physiology of the endocrine system		2		6	8	16
4	Physiology of the blood system		4		9	7	20
5	Physiology of the cardiovascular system		4		11	7	22
6	Respiratory physiology		4		8	5	17
7	Physiology of digestion		6		14	8	28
8	Physiology of metabolism and energy		1		4	6	11
9	Physiology of nutrition and thermoregulation		1		4	6	11
10	Physiology of the excretory system		4		6	8	18
11	Physiology of analyzers		6		14	6	26
12	Physiology of Higher nervous activity (HNA)		4		10	8	22
13	Intermediate assesment (exam) (E)	36					36
Total:		36	44		116	92	288

5.3. Thematic plan of lectures

Section number	Lecture topics	Number of hours per semester	
		III	IV
1	Introduction to physiology. Physiology of excitable tissues. Bioelectric phenomena in tissues.	2	
	Nerve fibers. Myoneural synapse. Muscle physiology. The mechanism of muscle contraction. Indicators of muscle physical activity (strength, work, and muscle fatigue).	2	
2	General physiology of the central nervous system. Neuron, reflex, reflex arc. Excitation and inhibition in the central nervous system. Private physiology of the central nervous system. The role of various parts of the central nervous system in the regulation of muscle tone and phasic movements.	2	
	Physiology of the autonomic nervous system.	2	
3	Physiology of the endocrine glands. Hypothalamic-pituitary system.	2	
4	Physiology of the blood system. Blood types.	2	
	Blood coagulation and anticoagulation systems	2	
5	Physiology of the cardiovascular system. Clinical and physiological methods of heart research.	2	
	Total in third semester:	16	
6	Hemodynamics. Regulation of systemic circulation.		2
	Physiology of respiration. Essence and value. External respiration, respiratory volumes. Mechanisms of inhalation and exhalation. The pleural cavity.		2
7	Gas transport by blood, alveolar-capillary barrier. Regulation of respiration. Features of breathing in different conditions.		2
	Physiology of digestion, essence and meaning. The role of I. P. Pavlov in the study of digestion. Digestive and non-digestive functions. Digestion in the oral cavity.		2
	Digestion in the stomach. Mechanism of evacuation of food from the stomach.		2

	Digestion in the duodenum 12, jejunum and ileum.		
	Banded and parietal digestion (Ugolev). Digestion in the large intestine. The role of colon microflora. Absorption in the gastrointestinal tract.		2
8,9	Physiology of metabolism and energy. Plastic and energy value of proteins, fats, carbohydrates. Physiology of rational nutrition. Thermoregulation (physical, chemical).		2
10	Physiology of the excretory system. Renal and extrarenal pathways of excretion. Nephron. Mechanisms of urination: glomerular filtration.		2
	Mechanisms of urination: tubular reabsorption and secretion. Regulation of kidney function.		2
11	Physiology of sensory systems. Pavlov's theory of analyzers. Receptors and their classification. Physiology of tactile, temperature, olfactory, motor and taste analyzers. Pain analyzer, classification of pain.		2
	Visual analyzer. Optical system of the eye. Refractive error, their correction. Retinal physiology, photoreceptors. Theories of color perception.		2
	Auditory and vestibular analyzers. Structure of the auditory analyzer. The mechanism of sound perception. The concept of a visceral analyzer.		2
12	Higher nervous activity (HNA). Physiology of the cerebral cortex. Electroencephalography (EEG), clinical significance of cortical rhythms. The role of I. P. Pavlov in the study of HNA. Architectonics of a behavioral act according to Anokhin.		2
	HNA. Cortical inhibition, its types. Types of HNA according to Hippocrates and Pavlov. Sleep, types, phases, and mechanisms of sleep. Dreams. Features of HNA in humans. The doctrine of I and II signal systems by Pavlov. Functional asymmetry of the major hemispheres.		2
	Total for the fourth semester:		28
	total		44

5.4. Thematic plan of practical classes

Section number	Name of practical training topics	Forms of control		Number of hours per sem.	
		current* *	intermediate* *	III	IV
1	PC1. Introductory lesson.	T, ZS		3	
	Excitable tissues, excitability parameters. Galvani and Matteucci's experiments.	T, ZS		3	
	Laws of irritation and conduction of arousal. Myoneural synapse.	T, ZS, Pr		3	
	Muscle physiology: types of muscle contraction, tetanus. Dynamometry in humans.	T, ZS, Pr		3	
	Final lesson: "Physiology of excitable tissues".		T, S	3	
2	Analysis of the reflex arc. Determination of reflex time according to the Turk. Basic properties of nerve centers. Torm-infection in the central nervous system. Experiments of Sechenov and Golts.	T, ZS, Pr		3	
	Physiology of the spinal cord, spinal shock, tendon reflexes in humans. Tonic reflexes. Tests for detection of static and dynamic ataxia.	T, ZS, Pr		3	

	Physiology of the cerebellum, striopallid and limbic systems.	T,ZS, Pr		3	
	The autonomic nervous system. Vegetative reflexes in humans.	T,ZS, Pr		3	
3	Human endocrine system. Humoral regulation of functions. Hypothalamic-pituitary neuroendocrine system.	T,ZS, Pr		3	
	Private endocrinology. The effect of adrenaline on the pupil and isolated heart of a frog. Iodine Simole reaction.	Pr		3	
	Final lesson: "General and private neurophysiology. The autonomic nervous system". "Neurohumoral regulation of functions"		T, S	3	
4	Clinical and physiological methods of blood testing, determination of hemoglobin, ESR, counting of shaped elements.	T,ZS, Pr		3	
	Determination of blood type, Rh factor, clotting time	T,ZS, Pr		3	
	Final lesson: "Physiology of the blood system"		T, S	3	
5	Physiology of the myocardium. Features of the heart muscle. Automatics of the heart, the Stannius experience. Clinical and physiological methods of heart research: listening to tones, determining boundaries, ECG analysis.	T,ZS, Pr		3	
	Total for the third semester:			48	
	Regulation of heart activity: reflexes, influence of hormones and electrolytes.	T,ZS, Pr			2
	Regulation of hemodynamics. Pulse analysis, sphygmography.	T,ZS, Pr			2
	Factors affecting the blood pressure level. Effect of physical activity on pulse and blood pressure in a volunteer.	T,ZS, Pr			2
	Final lesson: "Physiology of the vascular system".		T, S		2
6	Physiology of external respiration. Respiratory volumes, spirometry.	T,ZS, Pr			2
	Blood gas transport, oxyhemometry. Calculation of the partial pressure of gases. Pulse oximetry.	T,ZS, Pr			2
	Regulation of respiration. Breath retention test (Stange and Gencha). Influence of physical activity (squats) on human breathing.	T,ZS, Pr			2
	Final lesson: "Respiratory physiology".		T, S		2
7	Physiology of digestion. Experimental and clinical methods of studying the physiology of digestion. Demonstration of various fistulas, gastric and duodenal probes.	T,ZS, Pr			2
	Digestion in the mouth and stomach. Determination of the digestive power of gastric juice under various conditions. Masticationography.	T,ZS, Pr			2
	Analysis of Pavlov's classic experiments: "Imaginary feeding", isolated ventricular experience.	T,ZS, Pr			2
	Pavlovian curves of gastric juice production for various food substances.	T,ZS, Pr			2
	Duodenal probing. Ultrasound of the digestive system.				
	Analysis of endoscopic methods of patient examination: esophagoscopy, gastroscopy, duodenoscopy, colonoscopy.	T,ZS, Pr			2

	rectoromanoscopy.				
	Observation of intestinal automatism and movement of esophageal cilia in frogs.	T,ZS, Pr			2
	Final lesson: "Digestive physiology".		T, S		2
8	Physiology of metabolism and energy. Calculation of basal metabolic rate based on weight, height, and age data.	T,ZS, Pr			2
	Calculation of the percentage of deviation of the patient's basal metabolic rate from the proper one. Calculation of traffic accidents. Calculation of total (gross exchange).	T,ZS, Pr			2
	Physiology of nutrition. Drawing up a daily food ration for representatives of various professional groups.	T,ZS, Pr			2
	Physiology of thermoregulation. Analysis of the temperature map of the human body surface, daily temperature fluctuations. Measurement of the patient's temperature. Final lesson: "Physiology of metabolism and energy, Food, Thermoregulation"	T,ZS, Pr			2
10	Determination of the specific gravity of urine (urometry). Extrarenal pathway of excretion (research of sweat glands according to Snykin).	T,ZS, Pr			2
	Calculation of glomerular filtration rate (Clearance). Introduction to the principle of operation of the "artificial kidney" device.	T,ZS			2
	Final lesson: "Physiology of the excretory system"		T, S		2
11	Sensorsystems. Taste testing (gustometry), olfactory testing (olfactometry), tactile sensitivity testing (esthesiometry).	T,ZS, Pr			2
	The Aristotelian experience. The Weber-Figner law. Analysis of the physiology of pain and anesthesia.	T,ZS, Pr			2
	Definition of visual acuity, definition of the field of view (perimetry).	T,ZS, Pr			2
	The Marriott experience. Study of the pupillary reflex. Determination of color perception in a patient according to Rabkin's tables Рабкина.	T,ZS, Pr			2
	Physiology of the auditory and vestibular analyzer. Determination of hearing acuity. Comparison of air and bone conduction.	T,ZS, Pr			2
	Physiology of auditory and vestibular analyzers. Adaptation of the auditory analyzer. Features of binaural hearing.	T,ZS, Pr			2
	Final lesson: "Physiology of analyzers"		T, S		2
12	HNA. Physiology of the cortex. Electroencephalography (EEG). Development of a conditioned blinking reflex in humans.	T,ZS, Pr			2
	Study of the functional system of the behavioral act according to Anokhin. Research of short-term visual and auditory memory in students.	T,ZS, Pr			2
	Determining the type of HNA (Isaac's test). Determining a person's HNA type based on the way words are grouped. Test to determine the dominant hemisphere of the brain.	T,ZS, Pr			4
	Final lesson: "Physiology of higher nervous activity"		T, S		2
Total for the fourth semester:					68
TOTAL:					122

* Forms of ongoing performance monitoring (with abbreviations): T – testing, Pr – assessment of the development of practical skills (abilities), ZS – solving cases, R – writing and defending an abstract, C – interviewing control questions, and others.

5.5. Laboratory classes are not provided by the curriculum

Separate laboratory classes are not held at the department. Practical classes include studies of certain physiological parameters of a person, reflexes on volunteers, and experiments on frogs.

5.6 . Educational and methodological support for independent work in the discipline

5.6.1. Independent work of the student in the discipline

No	Chapter disciplines	Name of works	Labo r capa city (ho ur)	Forms of control
1	2	3	4	5
1	Normal physiology as a science. Levels of organization of the human body. Unity of the organism with the external environment.	Providing classes with frogs; preparing oral reports on dynamometry, preparing for practical classes - filling in the main terms of the section in the workbook; studying educational and scientific literature; preparing for control questions on the topic of practical classes, working with electronic educational resources located at the DES DSMU (LMS.DGMU.RU)	10	R
2	Integrative functions of the central nervous system. Principles of CNS coordination activity. Plasticity of the cerebral cortex. Functional asymmetry of the cerebral hemispheres in humans.	Preparation for practical classes - filling in the main terms of the section in the workbook; studying educational and scientific literature; preparing reports with a presentation on tendon reflexes; preparing for control questions on the topic of practical classes, working with electronic educational resources hosted at the DES DSMU (LMS.DGMU.RU).	13	R, T,NW
3	Neuroendocrine system of the body. The role of neuropeptides in the regulation of physiological functions.	Preparation for practical classes - filling in the main terms of the section in the workbook; studying educational and scientific literature; preparing reports with presentations on endemic goiter, diabetes mellitus, and adrenal gland pathology; preparing for control questions on the topic of practical classes, working with electronic educational resources posted at the DES DSMU (LMS.DGMU.RU). Humoral regulation - Work in the applications "Visual Anatomy" "Anat Lab Histology" "HIV\ AIDS 3D", search for anatomical and physiological features of the endocrine glands in the prism of continuous functioning	8	R, T,NW filling out a questionnaire to identify the risk of diabetes

4	Internal environment of the body and homeostasis. Mechanisms of hemostasis and febrinolysis.	Preparation for practical classes on determining blood groups using coliclones, solving situational problems in determining blood type, filling in the main terms of the section in the workbook; preparation for control questions on the topic of practical classes, working with electronic educational resources located at the DES DSMU (LMS.DGMU.RU) Development of skills in determining the Rhesus affiliation and blood group affiliation using the virtual online training game "Blood typing".	7	R, T,NW
5	Clinical and physiological methods of heart research. Reflexes of the heart. Intra-and extra-cardial mechanisms of CVS regulation.	Independent implementation of all procedures for ECG registration with the student. Preparation for practical classes - filling out the main terms of the section in the workbook; studying educational and scientific literature; preparing for control questions on the topic of practical classes, working with electronic educational resources located at the DES DSMU (LMS.DGMU.RU)	7	R, T,NW
6	Respiration, gas exchange in lungs and tissues, atmospheric air composition, respiration regulation, mountain and caisson disease.	Preparation for practical classes – filling in the main terms of the section in the workbook; studying educational and scientific literature; solving the AC situ. tasks given in practical classes; report on spirometry; preparation for control questions on the topic of practical classes, work with electronic educational resources posted at the DES DSMU (LMS.DGMU.RU).	5	R, T,NW (introduction to the spirometry, checking the protocol, checking the terminology of the section)
7	Pavlov's role in the study of digestive physiology. Neurohumoral regulation of digestive function.	Abstract reports on Pavlov's works on digestion. Preparation for practical classes - filling out the main terms of the section in the workbook; studying educational and scientific literature; preparing for control questions on the topic of practical classes, working with electronic educational resources located at the DES DSMU (LMS.DGMU.RU)	8	R, T,NW
8	Metabolism and energy, calculation of basal metabolic rate, professional groups, basics of adequate nutrition.	Preparation for practical classes - filling in the main terms of the section in the workbook; solving situational problems on the topic, calculating the OO according to tables for family members at home; preparing for control questions on the topic of practical classes, working with electronic educational resources hosted at the DES DSMU (LMS.DGMU.RU).	6	R, T,NW (protocol verification, section terminology verification)
9	Principles of rational nutrition organization. Power	preparation for practical classes-filling in the main terms of the section in the workbook; preparation of essays on proper nutrition, drawing up a diet at home; preparation for control questions on the topic of practical classes, working with electronic educational resources posted at the DES DSMU	6	R, T,NW (dietary require-

	mode. Constancy of the internal environment temperature to the body is the condition of normal metabolism.	(LMS.DGMU.RU).		ments, checking the protocol, checking the terminology of the section)
10	Renal and extrarenal mechanisms of maintaining the constancy of the internal structure. The principle of operation of the devices "Artificial kidney"	preparation for practical classes-filling in the main terms of the section in the workbook; abstract messages on methods for determining various indicators of kidney function: clearance, PAG, concentration index; preparation for control questions on the topic of practical classes, working with electronic educational resources posted at the DSMU DSMU (LMS.DGMU.RU). Physiology of excretion - Work in the applications "Visual Anatomy" "Anat Lab Histology" "HIV\ AIDS 3D", search for anatomical and physiological features of the secretion isolation system in the prism of continuous functioning.	8	R, T,NW (familiarization with hemodialysis, with an artificial kidney, checking the protocol, checking the terminology of the section)
11	The concept of the analyzer from the position of I. P. Pavlov's teaching. Receptor and generator potentials. Principles of encoding information signals in analyzers.	preparation for practical classes-filling in the main terms of the section in the workbook; abstract messages on the topics: "Refractive errors and their correction", "Color perception theory"; preparation for control questions on the topic of practical classes, working with electronic educational resources posted at the DES DSMU (LMS.DGMU.RU)	6	R, T,NW (introduction to the Foster perimeter device, checking the protocol, checking the terminology of the section)
12	HNA, types of a person's HNA. Differences between human and animal HNA. Memory, types of memory.	preparation for practical classes - filling in the main terms of the section in the workbook; Determining the types of HNA on the Eysenck test at home with family members; preparing for control questions on the topic of practical classes, working with electronic educational resources hosted at the DES DSMU (LMS.DGMU.RU). lms.dgmu.ru -digital educational environment . http://www.femb.ru/ , https://www.studentlibrary.ru/(Koncynstaint+) , https://www.rosmedlib.ru/cur_user/reg.html , https://health.ebsco.com/products/medline-with-full-text , https://pubmed.ncbi.nlm.nih.gov/ , EIE Visualization Lectures (Moodle) http://eos-dgmu.ru/ ; https://eos-dgmu.ru/course/view.php?id=25 ; comp. of the program "Virtual physiology", Computer analysis of data using the computer program SPSS, Statistica, Pubmed, virtual atlases on anatomy and physiology, bloog normphys;	8	R, T,NW (protocol verification, section terminology verification)

		Working with Internet resources: Yandex. Telebridge, Teams, Mind, Moodle.		
TOTAL:			92	
13	Preparing for the exam	Repetition and consolidation of the studied material (work with lecture material, educational literature); formulation of questions; pre-examination individual and group consultations with the teacher.	24	
14	Conducting the exam		12	

5.6.2. Subject of abstract works

№	Chapter	Competencies / Achievement Indicators - достижения	Topic
1	1	GPC-5 / AI-1	Nobel laureates in Physiology and their contribution to science
2	1	GPC-5 / AI-1	Cell physiology. Cell membrane, its structure and functions. Types of transport across membranes. Classification of ion channels.
3	1	GPC-5 / AI-1	The concept of synapse. Classification of synapses and mediators. Nature of Exciting postsynaptic potential and Inhibitory postsynaptic potential
4	1	GPC-5 / AI-1	Muscle physiology. Motor units. Electromyography.
5	2	GPC-5 / AI-1	The concept of the nerve center in a broad and narrow sense. Physiological properties of nerve centers.
6	2	GPC-5 / AI-1	The value of inhibition in the central nervous system. History of braking discovery. Modern interpretation of the braking process.
7	2	GPC-5 / AI-1	The autonomic nervous system and its functions. The main types of mediators and receptors. Autonomic reflexes in humans and their clinical significance.
8	3	GPC-5 / AI-1	The endocrine system. Classification of biologically active substances. Stress, mechanisms. Hans Selye's role in the development of the stress theory.
9	4	GPC-5 / AI-1	Types of blood group systems and their characteristics. Basic and additional agglutinogens.
10	4	GPC-5 / AI-1	Determination of blood groups and Rh factor. Coliclonal.
11	4	GPC-5 / AI-1	A functional system that ensures the maintenance of the liquid state of blood (RASC - regulation of the aggregate state of blood).

5.6.3. Guidelines for students on mastering the discipline

(appendix No. 3, training manual for practical classes for students in 2 parts).

Part # 1: Physiology of excitable tissues. General and private neurophysiology, physiology of the endocrine system, physiology of the blood system. Physiology of the cardiovascular system.

Part # 2: Respiratory physiology. Physiology of digestion. Physiology of metabolism and energy. Physiology of nutrition and thermoregulation. Physiology of excretion. Physiology of synthesis and analyzer systems. Physiology of higher nervous activity.

Authors of teaching aids: employees of the department.

6. Assessment tools for current and mid-term academic performance monitoring and intermediate certification based on the results of mastering the discipline

6.1. Current and final performance monitoring

6.1.1. A list of competencies with an indication of the stages of formation in the process of

mastering the discipline's work program

Competence code/Achievement indicator/достижений			
GPC-5 / AI-1	ability to assess morphofunctional, physiological conditions and pathological processes in the human body for solving professional problems.		
<i>Section number</i>	<i>Controlled competencies/Progress indicator</i>	<i>Name of the discipline section</i>	<i>Evaluation tools</i>
<i>Current (TC) and frontier (RC) control</i>			
1	GPC-5 / AI-1	Normal physiology as a science. Levels of organization of the human body. Unity of the organism with the external environment.	TC: T, Pr, ZS RC: S, T, ZS
2	GPC-5 / AI-1	Integrative functions of the central nervous system. Principles of CNS coordination activity. Plasticity of the cerebral cortex. Functional asymmetry of the cerebral hemispheres in humans.	TC: T, Pr, ZS RC: S, T, ZS
3	GPC-5 / AI-1	Neuroendocrine system of the body. The role of neuropeptides in the regulation of physiological functions.	TC: T, Pr, ZS RC: S, T, ZS
4	GPC-5 / AI-1	Internal environment of the body and homeostasis. Mechanisms of hemostasis and fibrinolysis.	TC: T, Pr, ZS RC: S, T, ZS
5	GPC-5 / AI-1	Clinical and physiological methods of heart research. Reflexes of the heart. Intra- and extracardial mechanisms of CVS regulation.	TC: T, Pr, ZS RC: S, T, ZS
6	GPC-5 / AI-1	Respiration, gas exchange in lungs and tissues, atmospheric air composition, respiration regulation, mountain and caisson disease.	TC: T, Pr, ZS RC: S, T, ZS
7	GPC-5 / AI-1	Pavlov's role in the study of digestive physiology. Neurohumoral regulation of digestive function.	TC: T, Pr, ZS RC: S, T, ZS
8	GPC-5 / AI-1	Metabolism and energy, calculation of basal metabolic rate, professional groups, basics of adequate nutrition.	TC: T, Pr, ZS RC: S, T, ZS
9	GPC-5 / AI-1	Principles of rational nutrition organization. Power mode. Constancy of the internal environment temperature to the body is the condition of normal metabolism.	TC: T, Pr, ZS RC: S, T, ZS
10	GPC-5 / AI-1	Renal and extrarenal mechanisms of maintaining the constancy of the internal structure. The principle of operation of the devices "Artificial kidney".	TC: T, Pr, ZS RC: S, T, ZS
11	GPC-5 / AI-1	The concept of the analyzer from the position of I. P. Pavlov's teaching. Receptor and generator potentials. Principles of encoding information signals in analyzers.	TC: T, Pr, ZS RC: S, T, ZS
12	GPC-5 / AI-1	HNA. types of a person's HNA. Differences between human and animal HNA. Memory, types	TC: T, Pr, ZS RC: S, T, ZS

		of memory.	
GPC-5 / AI-1		Normal Physiology Exam	Tests and / or oral ticket interviews in person online.

6.1.2. Examples of assessment tools for current and mid-term performance monitoring

INTERVIEW ON CONTROL ISSUES AND SITUATIONAL TASKS (GPC-5 / AI-1)

Section #1. General physiology of excitable tissues: control questions (GPC-5 / AI-1)

1. What is excitability, and which tissues are considered excitable? General properties of excitability: excitability threshold, rheobase, useful time, chronaxia, lability.
2. Refractoriness and its phases.
3. Nature of the membrane potential (resting potential). Selective permeability of the cell membrane in the occurrence of membrane potential.
4. Nature of excitation, phases of the action potential.
5. Structure and functions of the neuromuscular synapse.

Section 4. Physiology of the blood system: situational tasks (GPC-5 / AI-1)

1. A woman (35 years old) complained about acute abdominal pain. The pain is constant and increases while moving and walking. Palpation shows local soreness in the right iliac region. There was an increase in body temperature to 38 C. In blood tests: Hb-110 g / l; leukocytes-14,000 in 1 μ l; ESR – 14 mm/h. What blood changes does the patient have? What is the left shift of the leukocyte formula?
2. An athlete participating in a marathon race in Death Valley (USA) at an air temperature of 50 C, after 1 hour of running, had a blood test. What blood homeostatic parameters might have changed and why?
3. In situations that are accompanied by increased activity of the sympathetic part of the autonomic nervous system, for example, in case of danger, pain, emotional stress (stress), blood clotting increases. What is the biological meaning of increasing blood clotting in stressful situations? What are the negative consequences of increased clotting under emotional stress?

Terminology (glossary) by topic or section of the discipline (see the training manual for practical classes)

Criteria for evaluating current and mid-term performance monitoring (interview for control questions, including glossary and situational tasks)

"Unsatisfactory":

Knowledge: the student does not know the material or has not mastered a significant part of the program material within the scope of the questions posed, is not able to independently identify the main points in the studied material of the discipline, does not know the terminology.

Skills: the student is not able to apply the existing knowledge in interpreting physiological parameters, specific situations, and solving situational problems.

"Satisfactory"

Knowledge: the student has mastered the main content of the discipline's material, but has gaps: knowledge that is not systematic on the topic or section of the discipline. The material is presented in fragments, inconsistently, and confuses individual terms.

Skills: the student has difficulties in presenting the material on the topic or section of the discipline: it is inconsistent and not systematized. It is difficult to apply the knowledge needed to solve individual situational problems, while explaining specific concepts and situations.

"Good"

Knowledge: the student is able to independently identify the main points in the studied material. Shows knowledge of the program material on the topic or section of the discipline. Gives the correct answer, but allows minor errors and omissions when reproducing the studied material, defining concepts, and inaccuracies in using terminology.

Skills: the student is able to use the acquired knowledge in interpreting physiological parameters in a modified situation, observes the basic rules of oral speech culture, and correctly uses terminology.

"Excellent"

Knowledge: the student independently identifies the main points in the studied material and is able to give a complete description of the main ideas of the developed material of the discipline. Knows the glossary on the topic or section of the discipline.

Skills: the student is able to make a complete and correct answer based on the material studied, highlight the main points, independently confirm the answer when solving situational problems, independently and argumentatively make analysis, generalizations and conclusions. Establish interdisciplinary (based on previously acquired knowledge) and intra-subject connections, creatively apply the acquired knowledge to solve physiological problems. Consistently, clearly, concretely, reasonably and accurately presents the training material: gives the answer in a logical sequence using the accepted terminology, draws its own conclusions, formulates the exact definition and interpretation of the basic concepts and rules. Can independently use visual aids, reference materials, textbooks, additional literature, primary sources, physiological devices and medical instruments on the topic or section of the discipline.

PRACTICAL SKILLS

Section #5. Physiology of the cardiovascular system

Codes of controlled competencies GPC-5/AI-1 ("own").

1. Clinical and physiological methods of CVS research.

1.1. Human pulse research.

1.2. Measurement of human blood pressure.

Criteria for evaluating current and mid-term performance monitoring

"Unsatisfactory": the student does not have practical skills in studying physiological functions on this topic or section of physiology.

"Satisfactory": the student has basic practical skills on the topic or section of the discipline, but performs them only with outside help, makes mistakes and inaccuracies when performing independently, using terminology.

"Good": the student has sufficient skill in working with tools, reproducing experiments on a live object, but performs using the manual for practical classes.

"Excellent": the student has the ability to demonstrate a physiological experiment and methods of clinical research of human physiological functions, shows a deep and complete mastery of skills related to the topic or section of the discipline.

TESTING

EXAMPLE!

CURRENT PERFORMANCE MONITORING – TESTS

Codes of controlled competencies GPC-5/AI-1

Section No.4. Physiology of the blood system

1. To determine the erythrocyte sedimentation rate, the following reagent is used:
!0.5% sodium chloride solution
!3% acetic acid solution
!1.7% hydrochloric acid solution
+ !5% sodium citrate solution

2. To determine hemoglobin using the Sali method, the following reagent is used:
!3% acetic acid solution
!3.5% sodium chloride solution
!3.7% sodium citric acid solution
+ !0.1N hydrochloric acid solution

3. To count white blood cells in the Goryaev counting chamber, blood is diluted:
!with an isotonic solution of sodium chloride
!0.15% hydrochloric acid solution
!3.5% sodium citric acid solution
+ !5% acetic acid solution with methylene blue

4. Determination of the amount of hemoglobin in the blood is performed using:
!Goryaev's cameras

- !celloscope
- !the Panchenkov device
- + !photoelectrocolorimeter, Sali hemometer

Section 12. Physiology of HNA (GPC-5 / AI-1: "know")

5. The idea of the reflex nature of the activity of the higher parts of the brain was first put forward by:
 - !I. P. Pavlov
 - !P. K. Anokhin
 - + !I. M. Sechenov
6. In the functional system of behavior (according to P. K. Anokhin), severe toothache forms:
 - !orientation reflex
 - !making a decision
 - !result acceptor
 - + !dominant motivation
7. In the functional system of behavior (according to P. K. Anokhin), after afferent synthesis, the stage begins:
 - !sustainable performance
 - !alarmis
 - !paradoxical
 - + !making a decision

Criteria for evaluating the border control of academic performance (testing):

- "excellent": 91-100%
- "good": 76-90%
- "satisfactory": 61-75%
- "unsatisfactory": 61%

6.2. Intermediate assessment based on the results of mastering the discipline

6.2.1. Forms of intermediate assessment -exam IV semester: testing and oral interview or oral interview

6.2.2. Procedure for conducting intermediate assessment in stages 1 and/or 2:

face-to-face: testing and an interview or an interview.

in on-line mode: testing and interviewing or interviewing.

6.2.3. Examples of questions for preparing for the exam (interview) in normal physiology for I-I year students of the Faculty of Medicine

Codes of controlled competencies: GPC-5/AI-1

1. What is excitability, and which tissues are considered excitable? General properties of excitability: excitability threshold, rheobase, useful time, chronaxia, lability.
2. Nature of the membrane potential (resting potential). Selective permeability of the cell membrane in the occurrence of membrane potential.
3. Features of hormonal regulation of functions. Types and mechanisms of action of hormones. Classification of hormones by chemical structure.

4. Thyroid gland. The role of its hormones in regulating the growth and development of the body.
5. Blood buffer systems, their role in maintaining blood pH.
6. Factors that make up the elastic traction of the lung (ETL).
7. Intra-thoracic negative pressure, role in the breathing process.
8. Glomerular filtration. Composition of primary urine.
9. Processes of reabsorption and secretion in the tubular apparatus of the nephron. Formation of final urine. Quantity and composition.
10. I. P. Pavlov's teaching on conditioned reflexes. General characteristics and properties of conditioned reflexes. Rules of education and methods of developing conditioned reflexes. Classification of conditioned reflexes.
11. Mechanism of conditioned reflex formation. Modern ideas about the mechanism of closing a temporary connection. The role of the dominant in the mechanisms of closing the temporal connection. Stages of conditioned reflex formation. Types of classical conditioned reflexes: food, defensive, motor, and vegetative. Second- and higher-order conditioned reflexes.

6.2.4. Test-paper examples

 MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION Federal State Budgetary Educational Institution of Higher Education Dagestan State Medical University	
Exam ticket No. in the discipline "Normal physiology" for 2nd-year specialty students, training area - "Medical business"	
1. Excitability and excitable tissues. Power and time parameters of excitability. 2. Hormones of the adrenal glands (cortical and cerebral layers). 3. Factors that make up the elastic traction of the lung (ETL). Intra-thoracic negative pressure, role in the breathing process. 4. Determination of the time of the Turk reflex in a spinal frog.	
The ticket was compiled by PhD, Assoc. Nurmagomedova H. A. Approved at the meeting of the Department of Normal Physiology " " 20_ , record " " Head of the Department, Professor _____ R. M. Ragimov	

6.2.5. The system of assessment of the results of mastering the discipline, description of assessment scales and grading

The assessment system includes an exam

Evaluation indicators	Rating scale			
	"unsatisfactory" (basic level not reached)	"satisfactory" (basic level)	"good" (average level)	"excellent" (high or advanced level)
Competence code/Achievement Indicator- GPC-5/AI-1				
To know	The student is not able to independently identify the main points in the studied	The student has mastered the main content of the discipline's material, but	The student is able to independently identify the main points in the studied material. Knows the basic ideas	The student shows a deep knowledge of the material, independently highlights

	material of the discipline. Does not know the main content of the discipline's material and terminology.	has unsystematic knowledge about the main provisions in the studied material, confuses individual terms	of the training material, and terminology.	the main points, shows a deep knowledge and understanding of physiological processes.
Be able to	The student does not know how to state the main provisions of the educational material.	The student is able to present the main material of the discipline, but has difficulties in interpreting individual physiological processes and solving situational problems.	The student can independently present the main material of the textbook, use knowledge to generalize the educational material and interpret physiological constants in solving situational problems.	The student is able to logically consistently and in detail present all the material, independently make a conclusion about the physiological processes occurring in the human body, freely solves situational problems.
Posses	The student doesn't own the skill.	The student has the basic material and skills, is able to perform physiological experiments and clinical research methods, but at the suggestion of the teacher.	The student has knowledge of all the studied program material and basic skills, is able to perform physiological experiments and clinical research methods, but allows minor inaccuracies in the reproduction.	The student has a deep knowledge of the material, all the skills, independently and accurately performs physiological experiments and clinical research methods.

• **Criteria for evaluating intermediate performance monitoring (testing):**

- "excellent": 85-100%
- "good": 70-84%
- "satisfactory": 50-69%
- "unsatisfactory": 50%

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

7.1. Basic literature

Printed publications:

No	Publications	Number of copies in the library
1	Normal physiology.: textbook/ edited by V.M.Smirnov.-3rd ed., reprint, and additional – Moscow: PC "Academy" – 2010. /ISBN 978-5-7695-8029-1	200
2	Normal physiology.: textbook/ ed. acad. K.V. Sudakov M. : GEOTAR – Media, 2015. - ISBN 5-8948-294-1	103
3	Normal physiology.: textbook/edited by L.Z. Tel, N.A. Aghajanyan. Moscow, Litterra, 2015. - ISBN 978-5-4235-0167-9.	500

Electronic publications:

1	Normal physiology [Electronic resource]: textbook / edited by L. Z. Tel, N. A. Aghajanyan - Moscow: Litterra, 2015. - http://www.studmedlib.ru/book/ISBN9785423501679.html
2	Normal physiology [Electronic resource]: textbook / edited by B. I. Tkachenko. - 3rd ed., corrected and expanded. Moscow: GEOTAR-Media Publ., 2016. http://www.studmedlib.ru/book/ISBN9785970436646.html
3	Normal physiology. Tkachenko B. I.-Moscow: GEOTAR-Media, 2016. http://www.studmedlib.ru/book/ISBN9785970436646.html .
4	Nozdracheva, A. D., Maslyukov P. M. Normal physiology: textbook. - Moscow: GEOTAR-Media, 2021. - 1088 p. - ISBN 978-5-9704-5974-4. - Text: electronic // EBS "Student's Consultant": [website]. - URL: https://www.studentlibrary.ru/book/ISBN9785970459744.html

7.2. Additional literature

Printed publications:

No	Publications	Number of copies in the library or department
1	Atlas of Physiology / A. G. Kamkin, M. S. Kiseleva, in 2 volumes. Volume 1. - Moscow: GEOTAR-Media Publ., 2012, 402 p. / ISBN 978-5-9704-1596-2-1596-2	15
2	Atlas of Physiology / A. G. Kamkin, M. S. Kiseleva, in 2 volumes. Volume 2. - Moscow: GEOTAR-Media Publ., 2012, 474 p. / ISBN 978-5-9704-1594-8-1594-8.	15
3	Human physiology. Atlas of dynamic schemes: a textbook / ed. Sudakov K. V., - 22nd ed., corrected and expanded. - Moscow: GEOTAR-Media Publ., 2015, 416 p. / ISBN 978-5-9704-3234-1-19704-3234-1	1
4	Training manual for practical classes for students in two parts. Part 1. / CPI of DSMU. - Makhachkala. - 2023. - 106 p.	360
5	Workshop on normal physiology. A guide to practical classes for students in two parts. Part 2. - DSMU PC. - Makhachkala. - 2024. - 118 p.	300
6	Guide to practical exercises in normal physiology: a textbook for students of higher professional education / edited by S. M. Budyina, V. M. Smirnov. - Moscow: Akademiya, 2011. - 439 p. / ISBN 978-5-7695-8029-1	395
7	Physiology. Textbook for dental faculties of medical universities. Edited by V. M. Smirnov, V. G. Zalov, and M. A. Medvedev. 3rd edition. Moscow: MIA, 2020. / ISBN 978-5-9986-9408-9	150

Electronic publications:

No	Publications
1	2
1	Normal physiology [Electronic resource]: textbook / V. P. Degtyarev, N. D. Sorokina-Moscow: GEOTAR-Media, 2016. http://www.studmedlib.ru/book/ISBN9785970435472.html
2	Normal physiology: textbook / ed. by K. V. Sudakov. Moscow: GEOTAR-Media Publ., 2015. http://www.studmedlib.ru/book/ISBN9785970435281.html

3	Human physiology: Atlas of Dynamic Schemes [Electronic resource]: textbook / K. V. Sudakov, V. V. Andrianov, Yu. E. Vagin, I. I. Kiselev. - 2nd ed., ispr. and add. Moskva: GEOTAR-Media Publ., 2015. - http://www.studmedlib.ru/book/ISBN9785970432341.html
4	ELS of a medical university (Student's consultant) http://www.studmedlib.ru -access mode: by username and password.
5	Normal physiology [Electronic resource]: textbook / V. P. Degtyarev, N. D. Sorokina-Moscow: GEOTAR-Media, 2016. http://www.studmedlib.ru/book/ISBN9785970435472.html (spoken text)/
6	Degtyar, V. P. Normal physiology: textbook / Under the editorship of V. P. Degtyarev-Moscow: GEOTAR-Media, 2016. - Text: electronic // ELS "Student's Consultant": [website]. - URL: https://www.studentlibrary.ru/book/KP-2016-01.html
7	Sudakov K. V. Normalnaya fiziologiya: uchebnik [Normal physiology: textbook]. - Moscow: GEOTAR-Media, 2015. - 880 p. - ISBN 978-5-9704-3528-1. - Text: electronic // EBS "Student's Consultant": [website]. - URL: https://www.studentlibrary.ru/book/ISBN9785970435281.html

7.3. Resources of the Internet information and telecommunications network

№	Resource name
1	Electronic library: library of dissertations: website / Russian State Library. Moscow: RGB Publ., 2003. http://diss.rsl.ru/?lang=ru : http://diss.rsl.ru/?lang=ru Text: electronic
2	Government of the Russian Federation: official website. - Moscow. - Updated throughout the day. - URL: http://government.ru ; http://government.ru - - Text: electronic.

- 1) EIES (Moodle) lms.dgmu.ru -digital educational environment (<http://eos-dgmu.ru>; <https://eos-dgmu.ru/course/view.php?id=25>);
- 2) Virtual Physiology programs;
- 3) computer analysis of data using the computer program SPSS, Statistica,
- 4) A free resource on biomedicine and life sciences to improve health-Pubmed - <https://pubmed.ncbi.nlm.nih.gov/>,
- 5) Federal Electronic Medical Library <http://www.femb.ru/>,
- 6) EBS "Student's consultant" <https://www.studentlibrary.ru/> (Consultant+),
- 7) electronic medical information and educational system, or library "Doctor's consultant": http://www.rosmedlib.ru/cur_user/reg.htm#cur_user,
- 8) EES skills development <https://health.ebsco.com/products/medline-with-full-text>
- 9) Elibrary
- 10) Pubmed

7.4 Information technology

When studying the discipline, a general package of documents and Internet materials are used, providing ample opportunities for improving university training in normal physiology in order to master the skills of educational activities. The standard features of most programs are the implementation of the didactic principle of visibility in teaching; their use allows students to apply various methods to solve an educational problem.

Teaching methods using information technologies.

Methods of teaching using information technologies used in classes in the discipline "Normal Physiology" include:

- computer testing;
- demonstration of multimedia materials, including videos, audio-video lectures,
- list of search engines (the moodle platform moodle. dgm.ru.ru)
- a list of encyclopedia sites.
- list of software:
 1. Microsoft Windows 7 Professional operating system.
 2. Microsoft Windows 10 Pro operating system (on new computers).
 3. Application software packages:
Microsoft Office Professional Plus 2007 Microsoft Office Professional Plus 2010
Microsoft Office Professional Plus 2013
Microsoft Office Standard 2013
Microsoft Office Standard 2016 as part of: Microsoft Word 2007 (2010, 2013, 2016), Microsoft Excel 2007 (2010, 2013, 2016), Microsoft Power Point 2007 (2010, 2013, 2016).

List of information reference systems:

1. Electronic information and educational environment of DSMU. URL: <http://eos-dgm.ru>
<https://eos-dgm.ru/course/view.php?id=25>
2. Student's consultant: electronic library system. URL: <http://www.studentlibrary.ru>
3. Doctor's consultant: electronic library system. URL: <http://www.rosmedlib.ru>
4. Federal Electronic Medical Library (FEMB). URL: <http://femb/scsml.rssi.ru>
5. Scientific electronic library eLibrary. URL: <https://www.elibrary.ru/defaultx.asp>
6. Medical reference and information system. <http://www.medinfo.ru/>

8. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE

No. p / p	Type of room, its number (classroom, laboratory, computer lab, etc.) indicating the address (location) of the building, clinical base, structure, room, area of the room, its purpose (for independent work, conducting practical classes, current control, intermediate assessment, e-learning, lectures, etc.)	Equipment name
1	Halls No. 2 and No. 3 at I. A. Aliyev Street, Bio-building and Morpho-building hall - for lectures. For practical classes: study rooms (auditoriums) of the department (2nd-3rd floors of the bio-building, I. A. Aliyev str.): No. 3 (area^{24m2}, seats-21, study tables-10, marker board - 1 pc., hanger-1 pc.; bookcase-1 pc.; wardrobe - 1 pc.; teacher's table-1 pc.; teacher's chair-1 pc.) No. 213 (area^{40m2}, seats-19, study tables-8, marker board - 1 pc., hanger-1 pc., teaching table-1 pc., office upholstered chairs IZO-1 pc.; bookcase-1 pc., wardrobe - 1 pc.; air conditioning-1 pc.; computer-1 pc.; washbasin - 1 pc.) No. 209 (area^{72m2}, seats-19, study tables-8, teaching desk-1 pc., office upholstered chairs-1 pc.; marker board-1 pc., hanger-1 pc., bookcase - 1 pc., wardrobe - 1 pc., washbasin - 1 pc.) No. 210 (area^{16m2}, seats-20, study tables-8, marker board-1 pc., teaching table-1 pc., IZO office upholstered chairs-1 pc., hanger-1 pc., washbasin-1 pc.) No. 211 (area^{10m2}, seats-18, study tables-7, teaching desk-1 pc., IZO office upholstered chairs-1 pc., marker board - 1 pc., clock-1 pc., hanger - 1 pc., washbasin - 1 pc.) No. 217 (area^{17m2}, seats-18, study tables-9, marker board - 1 pc., teaching table-1 pc., office upholstered chairs IZO-1 pc.; hanger-1 pc., washbasin-1 pc.) No. 214 (area^{35m2}, seats-19, study tables-9, marker board-1 pc., teaching table-1 pc., office upholstered chairs-1 pc., bookcase - 1 pc., wardrobe - 1 pc., hanger-1 pc., washbasin - 1 pc.) No. 312 (area^{25m2}, seats-17, study tables-8, marker board-1 pc., teaching table-1 pc., office upholstered chairs-1 pc., wardrobe-1 pc., hanger-1 pc., washbasin-1 pc.) No. 313 (area^{35m2}, seats-18, study tables-9, marker board - 1 pc., teaching table-1 pc., office upholstered chairs IZO-1 pc., portrait - 1 pc., hanger-2 pcs., bookcase-1 pc., wardrobe - 1 pc., washbasin - 1 pc.) - Office of the head of the department No. 218 (area^{35m2}, set of cabinet furniture - 1 pc., roller blinds - 1 pc., chairs-9 pcs., armchair-3 pc., wardrobe-2 pcs., sofa-1 pc., washbasin-1 pc., screen-1 pc.); - Study room and SRS classes (3rd floor of the bio-building) No. 99 (area^{57m2}, chairs-20 pcs., study tables-12, banners-15 pcs., bookcase-1 pc., wardrobe - 2 pcs., teacher's table-1 pc., office upholstered chairs-1 pc., screen, marker board-1 pc.)	For lectures: laptop "ASUS" - 2 pcs., projector "ACER", "BENQ", "Overhead" projector - 1. For official use: 1. Personal computers (without printers) - 3 pcs.; 2. Canon FC-128 copier - 1 pc.; 3. HP LJ-1 laser printer - 1 pc.; 4. KYOCERA MFP - 1 pc.; 5. GENIUS scanner - 1 pc.; 6. Refrigerator - 3 pcs. For practical training and SRS: distiller - 1 pc.; lake frogs for physiological experiments; Galvanic tweezers - 6 pcs.; laboratory couch-1; Goryaev's camera - 8 pcs.; Panchenko's tripod - 10 pcs.; Salt's hemometer - 10 pcs.; melangers for erythrocytes - 6 pcs., for leukocytes - 15 pcs.; microscopes - 12 pcs.; sets of sets of colicines - 5 pcs.; electrocardiographs (ECG): EK 12 T - 01 - 3 pcs.; EK 1 T-1/3 (Axion) - 1 pc.; water spirometer - 4 pcs.; microprocessor spiograph SMP21/01 - 2 pcs.; pulse oximeter - 6 pcs.; fistulas - 10 pcs.; probes: gastric - 3 pcs., duodenal - 2 pcs.; floor scales - 2 pcs.; height meter - 4 pcs.; tonometers - 11 pcs.;

Training laboratory-No. 215 (2nd floors of the bio-building, A. Aliyev str. 1) (area of 18m ² , seats-6, laboratory table-1, computer table-1 pc., desktop - 2 pcs., wardrobe-six-door - 1 pc., wall clock-1 pc., washbasin-1 pc.). - Experimental laboratory-auditorium No. 100 (3rd floor of the bio-building, A. Aliyev str. 1) (area-15m ² , microtome-1 pc., laboratory tables-3 pcs., chair-2 pcs.) Scientific laboratory (2nd floor of the bio-building, A. Aliyev str. 1) - room No. 4 (area-11m ² , medical couch-1 pc., wardrobe-3 pcs., screen-1 pc.) Assistant's room-room No. 5 (2nd floors of the bio-building, A. Aliyev str. 1) (area 13m ² , seats-5, study tables-4, washbasin - 1 pc., wardrobe-2 pcs.) Docent's office No. 217 (2nd floors of the bio-building, 1 A. Aliyev str.). (area of 18m ² , seats-8, desk-3 pcs., washbasin-1 pc., wardrobe - 1 pc., wardrobe-2 pcs.) Preparatorskaya No. 216 (2nd floors of the bio-building, A. Aliyev str. 1) (area 13m ² , washbasin-2 pcs., cabinet-2 pcs.) Bathroom-room No. 6 (2nd floors of the bio-building, A. Aliyev str. 1) (area 3m ² , washbasin - 1 pc.).	phonendoscope - 6 pcs.; neurological hammer - 6 pcs.; dynamometers: hand - 7 pcs. and backbone - 3 pcs.; urometer - 5 pcs.; portable dialyzer for the Artificial Kidney device - 4 pcs.; olfactometer - 2 pcs.; compass for esthesiometry - 5 pcs.; a set of solutions for conducting gustometry - 6; Sivtsev tables - 10 pcs.; Foster perimeters - 4 pcs.; Rabkin table - 2 pcs.; a set of tuning forks - 1 pc.; individual tuning forks - 6 pcs.; a shield for the development of a conditioned reflex in humans - 4 pcs.; laboratory utensils for practical training (test tubes, glasses, flasks, cylinders, test tube stands, pipettes, buckets, etc.); magnifying glasses - 2 pcs.
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9. PERSONNEL PROVISION OF DISCIPLINE. Information about the personnel necessary for the implementation of the educational process

No	Teacher's full name	Terms of employment (permanent, internal part-time employee, external moonlighter, on a tenor-basis)	Current position	Education (educational institution graduated from, year)	The level of education, the name of the specialty according to the diploma, the name of the assigned qualification	General experience work	Experience of practical work in the field of the educational program in specialized organizations with an indication of the period of work and position
1	Ragimov R. M.	perm.	Head of the Department, prof. Doctor of Medical Sciences	Higher education, DSMI, 1986	medical doctor	48	39/8
2	Bilalova R.R.,	perm.	PhD, Associate Professor	Higher education, DSMI, 1967	medical doctor	59	56
3	Abdullaeva N. M.	ext. moonlighter	PhD, Associate Professor	Higher education, 2000	biologist, teacher of biology, chemistry	26	26/19
5	Suleymanova R. G.	perm.	Candidate of Medical Sciences, acting assoc. prof.	Higher education, DSMIA, 2002	doctor, gen. medicine	22	22

In practical classes, the teacher devotes more time to oral conversation, consultation on the topic of classes.

- ✓ The department has magnifying glasses, and on the DSMU (DES) website there are voiced lectures intended for visually impaired students.

2) for the disabled, persons with hearing disabilities:

- On the website of the department there is a text with illustrations on the sections of the discipline "Normal Physiology", which can be used by students with hearing loss.
 - Students with hearing disabilities can use teaching aids with detailed descriptions of practical work.
- 3) for disabled people and persons with disabilities who have disorders of the musculoskeletal system:
- The department organizes remote practical classes, and also for such students on the 1st floor of the bio-building (DSMU scientific library) a special room is allocated, where the teacher-physiologist conducts classes.

12.3. Education of students and persons with disabilities can be organized jointly.

12.4. List of educational and methodological support for independent work of students in the discipline. Educational and methodical materials for independent work of students with disabilities and persons with disabilities are provided in forms adapted to the limitations of their health and perception of information:

Categories of students	Forms
With hearing disorders	printed form; lectures and methodological developments. -in the form of an electronic document; DES-DSMU (Lms.dgmu.ru.) and to the website of the department in the form of a presentation
With visual impairment	-in the form of an electronic document; DES-DSMU (lms.dgmu.ru), and on the website of the department of lectures and practical classes with voice-over. - oral conversation
With musculoskeletal disorders	-in printed form; lectures and methodological developments at the at the DES DSMU (lms.dgmu.ru)

- ✓ In practical classes, the teacher devotes more time to oral conversation, consultation on the topic of classes.
 - ✓ The department has magnifying glasses, and on the DSMU (DES) website there are voiced lectures intended for visually impaired students.
- 2) for the disabled, persons with hearing disabilities:
- On the website of the department there is a text with illustrations on the sections of the discipline "Normal Physiology", which can be used by students with hearing loss.
 - Students with hearing disabilities can use teaching aids with detailed descriptions of practical work.
- 3) for disabled people and persons with disabilities who have disorders of the musculoskeletal system:
- The department organizes remote practical classes, and also for such students on the 1st floor of the bio-building (DSMU scientific library) a special room is allocated, where the teacher-physiologist conducts classes.

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Categories of students	Forms
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With visual impairment	-in the form of an electronic document; DES-DSMU (lms.dgmu.ru), and on the website of the department of lectures and practical classes with voice-over. - oral conversation
With musculoskeletal disorders	in printed form; lectures and methodological developments at the at the DES DSMU (lms.dgmu.ru)

12.5. Evaluation Environment Fund for intermediate assesment of students in the discipline

12.5.1. List of assessment funds related to the planned results of the development of the educational program for students with disabilities

Category of students	Types of assessment tools	Forms of monitoring and evaluation of learning outcomes
With hearing impairment	Tests, Online testing	Mainly written exam form
With visual impairment	Interview, Online interview	Mainly oral examination (individually)
With a violation of the musculoskeletal	Solving remote tasks, control questions, a conversation in the form a videoconference	Organization of control in the DSP-DSMU (fms.dgmu.ru)

12.5.2. Methodological materials defining the procedures for assessing knowledge, skills, abilities and experience of activities that characterize the stages of competence formation

The procedure for assessing the learning outcomes of persons with disabilities and persons with disabilities provides for the use of technical means necessary for them due to their individual characteristics.

The procedure for evaluating the results of training of disabled people and persons with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For people with visual impairments:

- in printed form with an enlarged font.
- in the form of an electronic document;
- in the form of an audio file.

For people with hearing loss:

- in printed form.
- in the form of a video file
- in the form of an electronic document.

For people with musculoskeletal disorders;

- in printed form.
- in the form of an electronic document;
- in the form of an audio-video file.

When conducting the procedure for evaluating the learning outcomes of disabled people and persons with disabilities in the discipline (module), the following additional requirements are met, depending on the individual characteristics of students:

1. Instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing, and, if possible, orally using the services of a sign language interpreter).
2. An accessible form for submitting tasks of assessment tools (in printed form, in printed form in an enlarged font, in the form of an electronic document, tasks are read out by the assistant, tasks are provided using sign language translation (if possible)).

3. An accessible form for providing answers to tasks (written on paper, a set of answers in the personal account, using the services of an assistant, orally). If necessary, for students with disabilities and disabled people, the procedure for evaluating the results of training in a discipline (or module) can be carried out in several stages.

The procedure for evaluating the learning outcomes of disabled people and persons with disabilities is allowed using distance learning technologies.

12.6. List of basic and additional educational literature required for mastering the discipline for disabled people and persons with disabilities

Basic literature

Printed publications:

Number	of copies	Number in the library
1	Normal physiology.: textbook / edited by V.M. Smirnov. - 3rd ed., reprint. and ext. - M.: PC "Academy" - 2010. ISBN 978-5-7695-8029-1	376
2	Normal physiology.: textbook / edited by L. Z. Tet [et al.]; edited by L. Z. Tet, N. A. Aghajanyan. - M.: Littera, 2015. - 768 p. : ill. - ISBN 978-5-4235-0167-9.	500

Electronic publications:

1	Sudakov K. V., Normal physiology [Electronic resource]: textbook / ed. by K. V. Sudakov. - Moscow: GEOTAR-Media, 2015. - 880 p. - ISBN 978-5-9704-3528-1 - Access mode: http://www.studmedlib.ru/book/ISBN9785970435281.html Authors: Sudakov K. V., Andrianov V. V., Vagin Yu. E., Dzhebrailova T. D., Kiselev I. I., Umryukhin P. E. (voiced text)
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2	Degtyarev V. P., Normal physiology [Electronic resource]: textbook / V. P. Degtyarev, N. D. Sorokina-Moscow: GEOTAR-Media, 2016. - 480 p. - ISBN 978-5-9704-3547-2-Access mode: http://www.studmedlib.ru/book/ISBN9785970435472.html (spoken text)
3	Normal physiology. Tkachenko B. I.-Moscow: GEOTAR-Media, 2016. http://www.studmedlib.ru/book/ISBN9785970436646.html .
4	Normal physiology. https://www.rosmedlib.ru/book/ISBN9785970416624.html (available on 18.11.2021). - Access mode: by subscription.

Additional literature

Printed publications:

№	Publication	Number of copies
	Educational and methodical manual for practical classes for students in two parts, Part 1. / PC of DSMU. - Makhachkala. - 2023. - 106 p	360
	Practicum on normal physiology. A guide to practical classes for students in two parts. Part 2. / - DSMU PC. - Makhachkala. - 2024. - 418 p	300

Electronic publications:

№	
1	1
1	2
	Normal physiology: textbook / V. P. Degtyarev, N. D. Sorokina-Moscow: GEOTAR-Media, 2016. - http://www.studmedlib.ru/book/ISBN9785970435472.html (spoken text)
2	.Degtyarev V. P., Sorokina N. D. Normal physiology [Electronic resource]: textbook / V. P. Degtyarev, N. D. Sorokina-Moscow: GEOTAR-Media, 2016. http://www.studmedlib.ru/book/ISBN9785970435472.html (spoken text)/

12.7. Guidelines for students with disabilities to master the discipline

Individual work is of great importance for the development of the discipline by disabled people and persons with disabilities. Individual work means two forms of interaction with the teacher: individual educational work (consultations), i.e. additional explanation of the educational material and in-depth study

of the material with those students who are interested in it, which are an important factor that contributes to the individualization of training and the establishment of educational contact between the teacher and the disabled student or students disabilities.

12.8. Description of the material and technical base necessary for the implementation of the educational process in the discipline (see above)

Mastering the discipline by disabled people and persons with disabilities is carried out using general and special-purpose training tools: voiced lectures are available (<https://eos-dgmu.ru/mod/url/view.php?id=10437>; <https://eos-dgmu.ru/mod/url/view.php?id=10636>) and textbooks (<http://www.studmedlib.ru/book/ISBN9785970435281.html>; <http://www.studmedlib.ru/book/ISBN9785970435472.html>), etc.

13. SHEET FOR MAKING CHANGES TO THE WORK PROGRAM

Changes to the work program are made on the basis of orders and regulations of the Rector, as well as on the basis of decisions on improving the educational and methodological support of the discipline, approved at the appropriate level (decision of the Academic Council), the Central Coordination and Methodological Council and registered in the list of changes.

Work Program Change Registration Sheet

The list of additions and changes made to the work program of the discipline	WP updated at the meeting of the department		
	Date	Number of the minutes of the meetings of the department	Signature of the head of the department

Makhachkala, 2026