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MINISTRY OF SCIENCE AND HIGHER EDUCATION

RUSSIAN FEDERATION

Federal State Autonomous Educational Institution of Higher Education

NORTH-CAUCASUS FEDERAL UNIVERSITY

APPROVED

Assoc. Prof. Kubanov S.I.

PhD in Medical Sciences

Dean

Faculty of Medicine and Biology

COURSE OUTLINE OF THE DISCIPLINE (MODULE)

«Normal physiology»

Name of the discipline (module)

- Specialty: 31.05.01 General Medicine
- Mode of training: Full-time
- Year of commencement of studies: 2026
- Delivered in Semester 3-4

Developed by:

Professor of the Department of Physiology and Pathology
position

Belyaev N. G.
full name

Professor of the Department of Physiology and Pathology
position

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Stavropol 2026

1. Aim and Objectives of Mastering the Discipline (Module)

- Aim of mastering the discipline: familiarization of students with the basic laws of vital activity of the whole organism, the principles of functioning of individual organs and systems, forms and mechanisms of regulation physiological functions, factors that ensure the interaction of the body with the environment and the formation of adaptive mechanisms, methods of studying physiological functions.

- Objectives of mastering the discipline:
 - ✓ familiarization with the main stages of the formation of physiology as an independent science;
 - ✓ studying the contribution of domestic and foreign scientists to the development of physiology as an independent science;
 - ✓ familiarization with the basic principles of the functioning of individual organs and systems;
 - ✓ study of forms and mechanisms of regulation of physiological functions;
 - ✓ gaining knowledge about the factors of the body 's interaction with the environment;
 - ✓ mastering the skills and methods of obtaining quantitative and qualitative physiological indicators of the activity of various organs and systems normally;
 - ✓ familiarization with classical and modern methods of studying physiological functions;
 - ✓ formation of the fundamentals of physiological thinking among students based on the analysis of the nature and structure of inter-organ and intersystem relations from the perspective of integral physiology for the future practical work of a medical doctor.

2. Place of the Discipline (Module) in the Structure of the Training (educational) Program

The discipline «Normal physiology» belongs to the compulsory part.

3. List of Potential Learning Outcomes for the Discipline (Module), Correlated with the Outcomes of Mastering the Educational Program

Code and definition of the competence	Code and definition of the indicator	Planned learning outcomes for the discipline (module) describing the stages of competency and indicator development
GPC-5. Capable of assessing morphofunctional, physiological states and pathological processes in the human body to solve professional tasks.	ID-1 GPC-5 Assesses morphofunctional and physiological states and processes in the human body at individual, group, and population levels to solve professional tasks.	Formation of clinical thinking
	ID-2 GPC-5 Identifies pathological states and processes in the human body to solve professional tasks	

4. Volume of the Academic Discipline (Module) and Control *

Volume of classes: Total: <u>6</u> ECTS credits, <u>216</u> academic hours.	Full-time type of study, in academic hours
Face-to-face work	102
Lectures / including practical training	34
Laboratory works / including practical training	68
Independent work	78
Forms of control	
Examination	36

* The discipline (module) provides for the use of e-learning and remote learning technologies (unless otherwise set by the educational standard).

5. Content of the Discipline (Module), Structured by Topics (Sections) with an Indication of the Hours and Types of Classes

#	Section (topic) of the discipline and brief content	Competencies and indicators to be developed	Full-time training				Forms of current control of academic progress
			Contact work of students with the teacher / of them practical skills training, hours			Independent work, hours	
			Lectures	Practical classes	Laboratory work		
	3th semester						
1.	Historical stages of the formation of physiology as an independent science. 1. Normal physiology is an experimental science. 2. Main stages of development physiology and normal physiology. 3. The contribution of foreign scientists to the development of normal physiology. 4. The role of Russian physiologists in the development of physiology and normal physiology. 5. Physiological concepts. 6. Reflex principle of nervous system activity (R., Descartes, I.Prokhazka), his development in the works of I.M.Sechenov, I.P.Pavlov, P.K.Anokhin. 7. Features of the modern period of development of normal physiology.	ID-1 GPC-5 ID-2 GPC-5			2	6	Interview (discussion)

	8. Analytical and systematic approach to the study of body functions. 9. Reliability of physiological systems - reserves of the body. 10. Periods of human body development. 11. Classical and modern research methods in the field of normal physiology. 12. The structure of the physiological laboratory, the rule of work in it. 13. Safety precautions during laboratory operation.						
2.	Physiology of cells and excitable tissues 1. Cell structure and function. 2. Structural and functional characteristics of the cell membrane. 3. Ion channels and transport of substances into the cell. 4. The history of the formation of the doctrine of animal electricity (L. Galvani, A. Volta, C. Matteucci, E. Dubois-Raymond, J. Bernstein). 5. The role of the membrane in the formation of electrical potentials. 6. Physico-chemical mechanisms of formation the potentials of rest and action.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
3.	General physiology excitable tissues. Irritants. 1. The concept of the state of physiological rest and the active state of living tissue. 2. Basic properties of living things: irritability, excitability. Irritation and irritants. Classification of stimuli and their characteristics. 3. Lability or functional mobility, depending on the type of tissue. 4. Advantages of electric current as one of the irritants of living tissue. 5. Processes of excitation and inhibition as types of responses of living tissue to irritation. 6. Specific and non-specific manifestations excitement.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	7. Objects and methods of studying arousal processes. Neuromuscular preparation of a frog as an object of study. 8. Modern ideas about the structure and function of membranes. Active and passive transport through membranes. 9. The history of discovery "animal electricity" and the development of electrophysiology (L. Galvani, A. Volta, C. Matteucci, E. Dubois-Raymond, J. Bernstein). 10. Electrical phenomena in excitable tissues. The contribution of Russian scientists (I.M. Sechenov, V. Ya. Danilevsky, N.E. Vvedensky, A.F. Samoilov, V.V. Pravdich Neminsky) in the development of electrophysiology. 11. Resting membrane potential, the mechanism of polarization of the cell membrane at rest. 12. Active and passive transport through membranes. 13 The action potential, its phases, and the ionic mechanism of membrane depolarization upon excitation. 14. Modern methods of registration of biological flows. 15. Microelectrode technology.						
4.	Physiological characteristics of excitable tissues. 1. Analysis of a single excitation wave. Changes in excitability in the arousal cycle. 2. The biological significance of periods of refractory, supernormal excitability in the adaptive activity of living entities. Methods for estimating membrane potentials. 3. Definition of the "irritation threshold" as an indicator	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>

	excitability of living tissue. Definition of subthreshold and suprathreshold (submaximal, maximum and super maximum) stimuli. 4. The laws of response formation: the law of force, the history of discovery. Classification of stimuli by force. The value of the threshold force of irritation for characterizing the property of excitability.						
5.	Study of bioelectric phenomena. 1. Action potential, the difference between action potential and resting potential. 2. Local potentials. 3. The ratio of the phases of excitability with the phases of the action potential. 4. Methods for evaluating membrane potentials. 5. Analysis of a single excitation wave. Ionic mechanisms of development the critical level of depolarization, the peak of the action potential, the subsequent phases of repolarization, negative and positive trace potentials. 6. Characteristics of phase changes in excitability in the arousal cycle. The biological significance of periods of refractoriness, supernormal excitability in the adaptive activity of living entities. 7. Definition of the "irritation threshold" as an indicator excitability of living tissue. 8. Definition of subthreshold and supra-threshold (submaximal, maximum and super-maximum) stimuli. 9. The laws of response formation. The all-or-nothing law. 10. The laws of response formation: the law of force, the history of discovery. Classification of stimuli by force. Threshold value the forces of irritation to	ID-1 GPC-5 ID-2 GPC-5				4	<i>Interview (discussion)</i>

	characterize the property of excitability. 11. The law of duration of irritation, the history of discovery. Analysis of the "strength of duration" curve. Definition of the concepts "rheobase", "useful time", "chronaxia". Chronaxy values as an indicator the response rate of the tissue. 12. The law of the irritation gradient. Accommodation tissue, biological significance. 13. The concept of lability of excitable tissues. 14. Characteristics of local non-proliferation arousal, its gradual nature. 15. Polar law. 16. Features of electrotonic and local potentials. Physiological electroton. 17. Cathodic depression by Verigo. 18. The use of electric current in medicine. 19. The physiological basis of the parabiotic process. 20. The doctrine of N.E. Vvedensky on parabiosis. Stages of parabiosis. 21. Physiological mechanisms of parabiosis development.						
6.	Types and mechanisms of regulation of functions in the body. 1. Principles and mechanisms of regulation of functions in the body. 2. Nervous regulation of functions in the body. 3. Humoral and myogenic regulation of functions in the body. 4. Types of the systemic principle of regulation of functions in the body. 5. Perturbation regulation. 6. Deviation adjustment. 7. The unity and features of regulatory mechanisms.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
7.	Nervous and humoral regulation of functions in the body. Structural and functional organization of the neuron and neuroglia.	ID-1 GPC-5 ID-2 GPC-5			2	6	<i>Interview (discussion)</i>

	1. The emergence of nervous signaling in the process of evolution of living organisms. 2. Types and mechanisms of regulation of functions in the body. 3. Features of nervous regulation of functions, its relation to humoral. 4. Humoral regulation functions in the body. 5. Adaptive role of nervous and humoral regulatory mechanisms. 6. Stages of development of the human nervous system during ontogenesis. 7. Modern methods of studying the structure and function of the nervous system. 8. Neuron as a structural and functional unit The central nervous system, its physiological properties. 9. Classification of neurons by their structure and function. 10. Functions of neurons. 11. Neuroglia. Types of glial cells. 12. Functions of neuroglia. 13. The relationship of neurons with glial cells.						
8.	Structural and functional characteristics of the nervous system. 1. The central and peripheral nervous system. 2. Functional classification of the nervous system. 3. Nerve fibers. The structure and properties of nerve fibers, their division into myelin and myelin-free. 4. The mechanism of excitation by pulpy and pulpless nerve fibers. 5. Classification of nerve fibers by the rate of excitation, their excitability and lability. 6. The laws of conducting excitation through nerves. 7. Nerve nodes, location and functions. 8. Synapse, types of synapses. Transmission mechanism excitations in the synapse.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	9. Postsynaptic inhibition. 10. Presynaptic inhibition. 11. Mediators and receptors in the central nervous system. 12. Modulators in the central nervous system.						
9.	Coordination activity of the central nervous system. The integrative role of the nervous system. 1. Coordination activity of the central nervous system. 2. General principles of coordination activities The Central nervous SYSTEM. 3. Anatomical and physiological concept of the nerve center (NC). 4. NC properties: unilaterally conducting excitation, summation of excitation, inertia, rapid fatigue, transformation rhythm, plasticity. 5. General characteristics inhibition in the central nervous system (I.M. Sechenov), its types and role. Modern concepts of central braking mechanisms. 6. The integrative role of the nervous system. 7. Reflex is the main act of nervous activity. 8. The concept of the reflex arc, its morphofunctional organization. 9. The reflex ring as the material substrate of feedbacks between controlled bodies and control centers. 10. Classification of reflexes. 11. Mediators, their synthesis, secretion, interaction with receptors. 12. Modulation of the neuron response at the presynapse level. 13. Basic principles and features of the spread of arousal in the central nervous system. 14. Convergence, divergence, unilateral conduct.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
10.	Tissue restructuring. The concept of tissue restructuring. The basis of	ID-1 GPC-5 ID-2 GPC-5	2		4	4	<i>Interview (discussion)</i>

	tissue restructuring: hyperplasia, regeneration and accommodation. Compensation mechanisms. Hypertrophy is the most common morphological manifestation of compensation. Hypertrophy of the heart. Hypertrophy of the stomach or intestinal wall. Hypertrophy of the bladder wall. Sclerosis. The concept and classification of sclerosis.						
11.	Structural and functional characteristics of departments The Central nervous SYSTEM. 1. Structural and functional characteristics of the spinal cord. 2. Somatic reflexes of the spinal cord. 3. Motor systems of the brainstem and cranial nerves. 4. The medulla oblongata and the bridge, their participation in the processes of self-regulation of functions. The centers of the medulla oblongata. 5. Integrative systems of the brain stem. 6. Cerebellar functions Violation of motor function in case of damage to the cerebellum in humans. 7. Physiology of the midbrain, its reflex activity. Decerebration rigidity and the mechanism of its occurrence. The role of the medulla and medulla oblongata in the regulation of muscle tone. 8. Reticular formation the brain stem. Ascending activating influences on the cerebral cortex (G.Megun, D.Moruzzi). 9. Physiology of the intermediate brain. The thalamus and its functions. 10. Hypothalamus. Characteristics of the main nuclear groups. The hypothalamus is involved in the regulation of autonomic	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	functions and in the formation of emotions and motivations. 11. Functions of the basal nuclei. 12. The limbic system. 13. Neural organization of the new cortex. Corticalization functions. 14. Fields and shares (zones) KBP. Sensory and motor "Homunculus" according to Penfield.						
12.	Somatic and autonomic nervous system. 1. Functional features of the ANS. 2. The somatic nervous system. Reflex arc. 3. The autonomic nervous system (ANS) is a system of autonomous regulation of functions. 4. The arcs of the autonomic reflex. 5. The centers of the ANS. 6. Interaction between the departments of the ANS. 7. The importance of the cerebral cortex in the regulation of autonomic functions.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
13.	Somatic and autonomic nervous system. 1. Somatic nervous system, its functional purpose. 2. Reflex arc of the somatic nervous system. 3. The general plan of the building of the ANS. Functional features of the ANS. Arch of the autonomic reflex. VNS centers. 4. Comparative characteristics of the sympathetic and parasympathetic divisions ANS, their synergism and relative antagonism influences. The biological significance of parasympathetic calving of the ANS. 5. The structure and function of the autonomic ganglia. 6. Mediator mechanisms of transmission of impulses in the autonomic nervous system.	ID-1 GPC-5 ID-2 GPC-5			2	6	<i>Interview (discussion)</i>

	7. Vegetative reflexes, their difference from somatic reflexes. 8. Vegetative innervation of organs and tissues. 9. The role of W. Cannon's research in the formation of the doctrine of homeostasis. 10. D.A. Orbeli's teaching on the adaptive and trophic role of the sympathetic department of the ANS. 11. The metasympathetic nervous system, as a truly autonomous nervous system. 12. Interaction between the departments of the ANS. 13. The importance of the bark of large hemispheres in the regulation of autonomic functions.						
14.	Physiology of the endocrine system. 1. Neurohumoral regulation of functions and its significance for adaptation of the body to the conditions of existence. 2. The endocrine system. 3. Classification of hormones. 4. Mechanisms of action of hormones. 5. General characteristics and classification of glands. 6. Regulation of secretory activity of endocrine glands. 7. Hypothalamic hormones and the pituitary gland. 8. Peripheral glands and their hormones. 9. The role of negative feedback in the self-regulation of the endocrine glands.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
15.	Physiology of the endocrine system 1. Define the concepts of "endocrine system" and "hormone". 2. What is the difference between hormones and other biologically active substances? 3. What is the chemical structure of hormones? 4. Pituitary gland. Structure and hormonal function.	ID-1 GPC-5 ID-2 GPC-5			2	4	<i>Interview (discussion)</i>

	5. The role of the hypothalamus in regulating pituitary functions. Hypothalamic neurosecretion. 6. Peripheral endocrine glands. 7. Mechanisms of action of hormones. 8. Mechanisms of direct and reverse connections in regulation of endocrine glands. 9. The unity of nervous and hormonal regulation of functions and its significance for adaptation of the body to the conditions of existence. 10. The systemic principle of regulation of body functions.						
16.	Physiology of the endocrine system. 1. The thyroid gland. The importance of thyroid hormones. Calcitonin. 2. Parathyroid glands. The role of parathyroid hormone and its interaction with calcitonin and vitamin D in the regulation of calcium metabolism. 3. The adrenal gland cortex. Mineralocorticoids, glucocorticoids, androgens and estrogens, their role in the body. 4. Enteric endocrine system. 5. Endocrine function of the pancreas. Insulin, glucagon. 6. Endocrine function of the sex glands. 7. Sex hormones of the male body. 8. Sex hormones of the female body. 9. Stress, its biological meaning. Stages of the general adaptation syndrome. 10. Sexual differentiation and puberty of a person.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
17.	Muscle Physiology. 1. Types of muscle tissue. 2. Structural and functional characteristics of skeletal muscle. 3. Neuromotor motor unit (NME).	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>

	4. The mechanism of skeletal muscle contraction. 5. Types of muscle contractions. 6. Energy of muscle contraction. 7. Indicators of physical activity of muscles and muscle fatigue. 8. Structural and functional features of smooth muscles.						
18.	Structural and functional characteristics of muscles. 1. Structural and functional characteristics of smooth and cardiac muscle tissue. 2. Structural and functional characteristics of skeletal muscle. 3. The concept of a neuromotor unit. 4. Microstructure of skeletal muscle fiber. 5. The mechanism of muscle contraction. 6. Myoneural synapse, its structure and mechanism of transmission of excitation. 7. Chemistry and energy muscle contraction. 8. Modes (Types) of muscle contraction: isotonic, isometric, auxotonic. 9. Tetanus and its types: smooth, jagged; optimal and Pessimistic. 10. General characteristics of muscle strength. 11. What is the essence of the law of average loads? 12. Features of the structure and functioning of smooth muscles. 13. Spinal reflexes.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
19.	Muscle Physiology. 1. The role of the spinal cord in the regulation of the musculoskeletal system and vegetative functions of the body. 2. Determination of the mechanical work of muscles. 3. What is the difference between internal and external muscle function? 4. Ways to determine the work of muscles in humans.	ID-1 GPC-5 ID-2 GPC-5			2	4	<i>Interview (discussion)</i>

	Dynamometry. Determination of the strength of muscle contraction hands. 5. Definition of standing force. 6. Factors that ensure muscle strength. 7. The physiological mechanism of muscle strength development. 8. The concept of working muscle hypertrophy. 9. The concept of muscle fatigue, phases of fatigue and their characteristics. 10. "Humoral theories" of muscle fatigue. 11. The significance of the works of I.M. Sechenov and I.P. Pavlov for the development of the doctrine of fatigue. 12. Modern understanding of the factors that cause fatigue. 13. The concept of muscle endurance, factors of its development.						
20.	Physiology of sensory systems 1. The concept of the sensory system and the "analyzer" from the standpoint of the teachings of I.P. Pavlov. 2. Classification of sensory systems. 3. Structural and functional organization of the sensory system. 4. Structural and functional characteristics of sensory receptors. 5. Mechanism of excitation in the receptor. 6. Adaptation of receptors. 7. The concept of connectome.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
21.	Physiology of sensory systems 1. I.P. Pavlov's teaching about analyzers. 2. Methods of study analyzers. 3. The role of analyzers in cognition of the surrounding world. 4. Receptors. Classification, functional properties and features of receptors.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	5. The concept of mono- and polymodality of neurons, the mechanism of interaction sensor systems. 6. General properties and patterns of receptor activity. 7. Encoding of information in various departments of sensory systems.						
22.	Visual sensory system. 1. Visual sensory system. Characteristics of the visual analyzer. The receptor system. 2. The structure of the eye. 3. The structure of the retina. Various functions of retinal cells. 4. Photochemical processes on the retina under the action of light 5. Physiological mechanisms color vision. 6. The conductive part of the visual analyzer. Features of the intersection of the visual pathways. 7. Adaptation and accommodation. 8. Binocular vision. Visual acuity and perimeter.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
23.	Auditory sensory system. 1. The structure of the auditory analyzer. Research methods of the auditory sensory system. 2. Sound-trapping and sound-conducting devices. 3. Mechanisms of sound transmission and perception. 4. The mechanism of occurrence the receptor potential in the hair cells of the spiral ganglion. 5. Theory of sound perception (G.Helmholtz, G.Bekeshi). 6. Electrical phenomena in the cochlea. 7. Factors determining the sensitivity of the auditory analyzer. 8. Bone and air conduction 9. Spatial localization of sound. Binaural hearing. 10. Age-related features of the auditory analyzer.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
24.	1. The gustatory sensory system.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

1.1. General morphological and functional characteristics. 1.2. Receptors of the gustatory sensory system. Taste buds, taste buds. Types of taste buds of the tongue. 1.3. The mechanism of taste reception and perception. Methods of studying the gustatory sensory system. 2. The olfactory sensory system. 2.1. Morphofunctional characteristics of the departments of the olfactory sensory system. 2.2. The mechanism of smell reception and perception. 2.3. Research methods. 3. Tactile and temperature sensor systems. 3.1. Classification of tactile receptors, their structural features functional differences. Research methods of the tactile sensory system. 3.2. Classification of thermoreceptors. Methods of studying the temperature sensor system. 4. Nociceptive sensory system. 4.1. The concept of pain (nociception). The functions of pain. Classification of pain. 4.2. Morphofunctional characteristics of the departments of the pain sensory system. 4.3. Theories of pain. The pain is like the integrative reaction of the body to the damaging effects of an irritant. 4.4. Components of the pain response. 4.5. The concept of the antinociceptive system (ANTS). Components, functions, and levels of ANTS. Neurochemical and neurophysiological mechanisms of ANTS. 4.6. The concept of pain threshold. Algometry.						
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25.	Physiology of higher nervous activity. Types of temperaments and GNI. 1. The history of the formation of the doctrine of temperament and GNI. 2. The role of I.P. Pavlov's works in the formation of the doctrine of GNI. 3. Conditioned reflexes, their classification. 4. Mechanisms of conditioned reflexes formation. 5. Conditioned reflex inhibition, its types and mechanisms of development. 6. Pavlovian types of GNI. 7. 1 and 2 alarm systems. 8. Memory. Types of memory. 9. Mechanisms of memory formation.	ID-1 GPC-5 ID-2 GPC-5	2				<i>Interview (discussion)</i>
26.	Physiology of higher nervous activity. 1. The development of I.P. Pavlov's ideas about the mechanisms of formation of temporary connections. 2. The conditions necessary for the development of a conditioned reflex. Modern ideas about the convergent nature of closure of conditional connections (P.K. Anokhin). 3. Reflex ring. 4. Conditioned reflex as a form adaptations of animals and humans to changing conditions. 5. Orientation reflex, its physiological features and biological significance. 6. Inhibition of conditioned reflexes. 7. Imprinting as a special form behaviors. The manifestation of the "imprinting" reaction in representatives of various classes of vertebrates and humans. 8. Dynamic stereotype. The concept of a dynamic stereotype, its physiological essence, meaning. 9. The role of dynamic stereotype in the formation of habits and work skills.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	10.The dynamic stereotype, as a basis of formation motor skills in difficult coordinated sports. 11. Breaking the dynamic stereotype.						
27.	Physiology of higher nervous activity. Memory. 1. Memory. Classification of types of memory. 2. Iconic, short-term, working, and long-term memory. 3. Mechanisms of memory formation. 4. The role of individual brain structures in memory formation. 5. Age-related memory dynamics. 6. The impact of motivation on volume short-term memory. 7. Modern recommendations for increasing the amount of memory and the strength of memorization. 8. Mnemonics.	ID-1 GPC-5 ID-2 GPC-5			4	4	<i>Interview (discussion)</i>
	TOTAL in 3 Semester		18		36	54	
1.	Blood Physiology: 1. Blood as the internal environment of the body. 2. Blood composition and functions. 3. Plasma, its composition. 4. Characteristics of the shaped elements of blood. 5. Blood groups as manifestations of the immune specificity of the body. Types of group systems blood type (ABO, Rhesus affiliation). Their importance for obstetric and surgical practice. 6.The hemostasis system (vascular-platelet hemostasis).	ID-1 GPC-5 ID-2 GPC-5	2		2	2	<i>Interview (discussion)</i>
2.	Physiology of immunity: 1. Non -specific defense mechanisms (humoral protection, cellular protection) 2. Specific defense mechanisms (T- immune system, B- immune system). 3. Characteristics of the immune response to antigens.	ID-1 GPC-5 ID-2 GPC-5	2		2	2	<i>Interview (discussion)</i>
3.	Physiology of the heart: 1. Structure and functions, properties of the heart muscle.	ID-1 GPC-5 ID-2 GPC-5	2		4	2	<i>Interview (discussion)</i>

	2. The conduction system of the heart, phases of cardiac contractions. 3. Intra- and extracardial mechanisms of regulation of cardiac activity. Cardiac reflexes. 4. Heart function indicators. 5. External manifestations of heart activity (electrical, sound, mechanical). 6. Methods of recording electrical manifestations of cardiac activity. Fundamentals of normal ECG analysis. 7. Research methods sound manifestations of heart activity (auscultation, phonocardiography). The origin of heart tones, their types and places of best listening.						
4.	Physiology of the vascular system: 1. Functional classification of vessels. 2. The laws of hemodynamics 3. Hemodynamics of arteries and capillaries. 4. Hemodynamics through the veins. 5. Mechanisms of vascular tone regulation. Nervous, humoral and myogenic regulation of vascular tone. 6. Vasomotor center (VDC). Peripheral and central influences on the activity of SDC neurons. 7. Peripheral blood pressure indicators blood circulation (blood pressure, linear and volumetric blood flow velocity, time blood circulation). 8. Concepts of systolic, diastolic, pulse, and mean arterial pressure pressure. Factors determining the value of blood pressure. 9. Microcirculation and its role in mechanisms of fluid exchange and various substances between blood and tissues. 10. Research methods arterial and venous pulse.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>

	Measurement methods arterial blood pressure.						
5.	Physiology of respiration: 1. Structural and functional characteristics of the respiratory system. 2. The main stages of the breathing process. External breathing. Mechanisms of inhalation and exhalation. 3. Gas exchange and transport of gases. The oxyhemoglobin dissociation curve. The concept of blood oxygen capacity. 4. Lung volumes and capacities. Reserve capabilities of the respiratory system. 5. Anatomical, physiological and functional dead spaces. Ventilation and perfusion coefficients, their significance in clinical practice. 6. Regulation of breathing (structural and functional organization of the respiratory system respiratory self-regulation, neurohumoral organization the intensity of breathing). 7. Protective respiratory reflexes. The mechanism of the newborn's first inhalation. 8. Breathing at high and low barometric pressure. Breathing under conditions of physical activity. Assessment of the minute volume of breathing. 9. Spirometry, spirometry.	ID-1 GPC-5 ID-2 GPC-5	2		4	2	<i>Interview (discussion)</i>
6.	Physiology of digestion: 1. Digestion, its meaning. Types of digestion. 2. Features of regulation of digestive tract functions. Neurohumoral mechanisms of hunger and satiety. 3. Digestion in the oral cavity. Setting up the activity of various parts of the digestive tract by afferent influences from the receptors of the oral cavity. 4. Salivation and salivation. Nervous and humoral mechanisms of regulation of	ID-1 GPC-5 ID-2 GPC-5	2		4	2	<i>Interview (discussion)</i>

	these processes. Phases of salivation, salivation reflex, adaptive character salivation. Swallowing, its phases and mechanisms. 5. Digestion in 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. 6. Motor activity of the stomach. Nervous and humoral factors affecting the motor and evacuation functions of the stomach. 7. Meaning and role digestion in the duodenum. Functions of the pancreas. Quantity, composition and properties of pancreatic juice. Enzymes pancreatic juice secreted in the active state and in the form of zymogens. Mechanisms of regulation of pancreatic secretion. 8. Digestive and non-digestive functions of the liver. Bile, its quantity, composition, value for digestion. 9. Meaning and role digestion in the small intestine. The mechanism of education intestinal juice. Quantity, properties, and enzymatic composition of intestinal juice. Regulation of separation intestinal juice. 10. Oral and membranous digestion, their interrelation and severity in various parts of the gastrointestinal tract. Intracellular digestion. 11. Motor activity of the small and large intestine, its features, significance, mechanisms of regulation. 12. Digestive features in the colon, the value of microflora. 13. Suction of products hydrolysis in various parts of the digestive tract, its mechanisms.						
7.	Physiology of metabolism and nutrition.	ID-1 GPC-5 ID-2 GPC-5	2		4	2	<i>Interview (discussion)</i>

	1. Metabolism as the main condition for ensuring vital activity and preservation of homeostasis. 2. Plastic and energetic role of nutrients. Processes of assimilation and dissimilation of substances. 3. Metabolism of proteins, fats and carbohydrates. 4. Regulation of metabolism. 5. Physiology of nutrition. Mode power supply. 6. The caloric value of various nutrients. Methods of direct and indirect calorimetry. 7. Daily metabolism and its components. Basic exchange, terms of definition the main exchange rate, the factors influencing its value. 8. The magnitude of the labor exchange in different types of labor.						
8.	Physiology of thermoregulation. 1. The concept of thermoregulation. Body temperature. 2. Heat production and heat transfer. 3. The constant temperature of the internal environment of the body as a necessary condition for the normal course of metabolic processes. 4. Regulation of body temperature. A functional system that ensures the constant temperature of the body's internal environment. 5. Body temperature chart, its daily fluctuations. 6. Thermoregulation in conditions of intense muscular activity. 7. Adaptation of the thermoregulation system to different temperature conditions of the environment.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
9.	Physiology of the excretory system. 1. General characteristics organs of excretion. 2. The kidney is the main organ of excretion.	ID-1 GPC-5 ID-2 GPC-5	2		2	2	<i>Interview (discussion)</i>

	3. Structural and functional characteristics of the kidney. 4 The nephron is the structural and functional unit of the kidney. The mechanism of glomerular filtration and its regulation. 5. Formation of primary and secondary urine. The concept of threshold and non-threshold substances. 6. Regulation of urination. 7. Understanding the homeostatic functions of the kidneys (regulation of fluid volume, osmotic pressure, acid-base balance, amount of inorganic and organic substances, blood pressure, hematopoiesis). 8. The mechanism of urination, its regulation.						
10.	General patterns of adaptation to environmental factors. 1. The concept of adaptation, disadaptation and maladaptation. 2. Stages and mechanisms of adaptation. 3. The doctrine of G.Selye on the adaptation syndrome. 4. Supercompensation. 5. Methods of prevention and correction of maladaptive disorders.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
11.	Analytical and synthetic activity of the cerebral cortex. Types of GNI and temperament. 1. I.P. Pavlov's teaching on the First II about human signaling systems. 2. The concept of thinking. Types of thinking. The role of various brain structures in the realization of the thinking process. The development of abstract thinking in human ontogenesis. 3. The role of Hippocrates' works in understanding personality traits and temperament types. 4. Temperament types and types GNI.	ID-1 GPC-5 ID-2 GPC-5	2		2	2	<i>Interview (discussion)</i>

	5. Type matching temperament according to Hippocrates and types of GNI according to Pavlov. 6. Genotypic characteristics of GNI types and temperament. 7. Genotype and phenotype. Genotypic features and phenotype formation. 8. Conditions and mechanisms of human phenotype – character formation.						
12.	The physiological basis of behavior. 1. The physiological basis of behavior. 2. The concept of the functional system of the body as the universal scheme of behavioral reactions (P.K. Anokhin). 3. The meaning of the dominant motivation in the formation of a functional behavior system. 4. The importance of memory and motivation in dominant behavior. 5. The impact of the goal on the result of the activity. 6. The influence of situational afference on the result of activity. 7. Innate behaviors (unconditioned reflexes and instincts) and their significance for adaptive activity. 8. Behavioral deviations.	ID-1 GPC-5 ID-2 GPC-5			2	2	<i>Interview (discussion)</i>
	TOTAL in 4 Semester		16		32	24	
	TOTAL		34		68	78	

6. Assessment Tools Fund for the Discipline (Module)

The assessment tools fund (ATF) for the discipline (module) « Normal physiology » is based on the list of competencies to be mastered, indicating the stages of their formation in the process of mastering the discipline (module). The ATF provides an objective control over the achievement of the planned learning outcomes. The ATF includes:

- A description of indicators and criteria for evaluating competencies at various stages of their formation, a description of evaluation scales;
- Methodological materials determining the procedures for evaluating knowledge, skills, abilities and (or) work experience characterizing the stages of competency formation;
- Standard control tasks and other materials necessary for assessing knowledge, skills, and the level of mastery of the formed competencies in the process of mastering the discipline (module).

The ATF is an appendix to this discipline (module) program.

7. Methodological Guidelines for Students on Mastering the Discipline

When starting work, each student must take into account the following provisions.

The discipline (module) is structured on a thematic principle; each topic represents a logically completed section.

The lecture material is dedicated to the consideration of key, basic provisions of the courses and the clarification of learning tasks assigned for the independent work of students.

Laboratory works are aimed at gaining practical experience in the relevant subject area.

The independent work of students is aimed at the independent study of additional material, preparation for practical and laboratory classes, as well as the execution of all types of independent work.

In order to successfully master the discipline, it is important to complete all types of independent work employing the recommended sources of information.

8. Educational, Methodological, and Informational Support for the Discipline

8.1. List of Main and Additional Literature Required for Mastering the Discipline (Module)

8.1.1. List of Main Literature:

1. Dorokhov Ye., Karpova A., Semiletova V. Normal physiology. Textbook. - Moscow: GEOTAR-MEDIA, 2021. – 512 p.

2. Normal physiology. Textbook. Editor K.V. Sudakov. - Moscow: GEOTAR-MEDIA, 2022. – 728 p.

3. Selected Normal Physiology: учебное пособие на русском и английском языках / М. М. Лапкин, Е. А. Трутнева. – Moscow: GEOTAR-Media, 2021. - 544 p.

8.1.2. List of Additional Literature:

1. Normal physiology: textbook / В.В. Зинчук, О.А. Балбатун, С.Д. Орехов; под ред. В.В. Зинчука. - Minsk: Higher School, 2020. - 496 p.

8.2. List of Educational and Methodological Support for the Independent Work of Students in the Discipline (Module)

1. Butova O.A. et al., Laboratory workshop on the discipline "Human Physiology ". Stavropol: NCFU, 2007. 262 p.

2. Lisova I.M. Educational and methodical manual: Methodological guidelines for the performance of laboratory work in the discipline "Human Physiology". Stavropol: NCFU, 2018. 25 p.

3. Belyaev N.G. Methodological guidelines on the discipline "Normal physiology" for students of specialty 05/31/01 Medical practice [Electronic version], Stavropol: NCFU (electronic version)

8.3. List of Resources of the Information and Telecommunications Network **Internet Required for Mastering the Discipline (Module)**

1. <http://rudoctor.net/> - Medical Portal
2. <http://www.e-reading.club/> - Large Online Library
3. <http://www.pubmed.com/> - database of full-text articles on medicine
4. <http://www.spravocnikpolekarstvam.ru/> - free online reference guide
5. <https://dic.academic.ru/> - Dictionaries and encyclopedias
6. <https://www.rmj.ru/> - Russian Medical Journal
7. <https://www.studentlibrary.ru/> - EBS "Student Consultant"

9. List of Information Technologies Employed through the Discipline (Module), Including a List of Software and Information Reference Systems

When delivering lectures, computer equipment and demonstrations of multimedia presentation materials are used. In seminars and practical classes, students deliver presentations prepared by them during the hours of independent work.

Information Reference Systems:

Information-reference and information-legal systems used in the study of the discipline:

1.	The official website of the library of the FGAOU IN NCFU Access mode: http://catalog.ncstu.ru/catalog
2.	Electronic library system "University Library Online" - www.biblioclub.ru (Agreement No. 50-04/19 on the provision of information services from 13.05.2019)
3.	Electronic library system "IPRbooks" (LICENSE AGREEMENT No. 5168/19 dated 05/13/2019 for the provision of access to the electronic library system IPRbooks. Organization: IP Ar Media Company, LLC)
4.	"eLIBRARY.RU": [Scientific Electronic Library]. – URL: http://elibrary.ru
5.	The GARANT information reference system.roo // Access mode: http://www.garant.ru/
6.	Legal reference system Russian legislation and judicial practice in freely available - http://www.pravo.ru/
7.	Информационная справочная система КонсультантПлюс. // Режим доступа: http://www.consultant.ru

Software:

1.	Alt Workstation 10
2.	Alt Workstation K
3.	Alt Server
4.	Office software package – P7-Office

10. Description of the Material and Technical Resources Required for the Educational Process for the Discipline (Module)

Lecture classes	A classroom equipped with multimedia equipment and technical training facilities.
Laboratory classes	23-313: The laboratory is equipped with equipment and technical training facilities: educational furniture for 30 seats, a magnetic marker board, a projector, a computer with the necessary set of licensed software. Medical height meter SH-8053; Physiological couch; Bicycle ergometer; Exercise bike; Cardio PC/E bicycle ergometric stress system; Scales.
Independent work	A room for the independent work of students, equipped with computer hardware with the capability to connect to the Internet network and provide access to the electronic information and educational environment of the university.

11. Specific Features of Mastering the Discipline (Module) by Persons with Disabilities

Students with disabilities shall be provided with special textbooks, teaching aids, and didactic materials, special technical training facilities for collective and individual use, the services of an assistant (helper) providing the necessary technical assistance to the students, as well as the services of sign language interpreters and tactile sign language interpreters.

The mastery of the discipline (module) by students with disabilities may be organized jointly with other students, as well as in separate groups.

Mastering the discipline (module) by students with disabilities is to be carried out taking into account the peculiarities of psychophysical development, individual capabilities, and health status.

In order to ensure the accessibility of higher education under the educational program for persons with disabilities, the following is provided during the mastery of the discipline (module):

- 1) for persons with visual impairments:
 - the presence of an assistant offering the student the necessary technical assistance, taking into account individual features (help taking the workplace, moving around, reading and formatting the task, including writing under dictation),
 - written tasks, as well as instructions on the procedure for their execution, are formatted in an enlarged font,
 - special textbooks, teaching aids, and didactic materials (having a large font or audio files), individual uniform lighting of at least 300 lux,if necessary, a magnifying device is provided to the student to complete the task;
- 2) for persons with hearing impairments:
 - the presence of an assistant providing the student with the necessary technical assistance, taking into account individual characteristics (helps to take a workplace, move around, read and format the task, including writing with dictation),
 - the availability of sound-amplifying equipment for collective use is ensured; if necessary, sound-amplifying equipment for individual use is provided to the student;
 - provision with proper sound means of reproducing information is ensured;
- 3) for persons with musculoskeletal disorders (including severe motor function impairments of the upper limbs or the absence of upper limbs):
 - written tasks are performed on a computer with specialized software or are dictated to an assistant;
 - at the request of the student, tasks may be performed verbally.

12. Specific Features of Implementing the Discipline with the Use of Distance Learning Technologies and E-Learning

Subject to Part 1 of Article 16 of the Federal Law of December 29, 2012, No. 273-FZ On Education in the Russian Federation, e-learning shall be viewed as the arrangement of educational activities employing information contained in databases and used in the implementation of educational programs, as well as information technologies, technical means, and information and telecommunication networks that ensure the processing and transmission of the specified information via communication lines, and the interaction of students and pedagogical workers.

Remote (distance) learning technologies are understood as educational technologies implemented mainly with the use of information and telecommunication networks during the indirect (at a distance) interaction of students and pedagogical workers.

The implementation of the discipline may be carried out with distance learning technologies and e-learning in full or in part. The components of the Educational And Methodological Complex (EMC) of the discipline (working program of the discipline, assessment and methodological materials, forms of attestation) implemented with the use of distance learning technologies and e-learning contain an indication of their use.

When arranging educational activities with distance learning technologies and e-learning, asynchronous and synchronous methods of interaction between participants in educational relations via the information and telecommunications network Internet may be offered.

When using distance learning technologies and e-learning, the schedule for the discipline shall indicate: methods of interaction among participants in educational relations via the information and telecommunications network Internet (VCC – videoconferencing, ET – electronic testing); links to the electronic information and educational environment of NCFU, to educational

platforms and resources of other organizations to which open access is provided via the information and telecommunications network Internet; for synchronous learning – the time of online classes and instructors; for asynchronous learning – the authors of online courses.

When arranging intermediate attestation with distance learning technologies and e-learning, the Methodological Recommendations on the use of technical means ensuring the objective reliability of results when conducting intermediate and state final attestation for higher education educational programs – Bachelor's Degree programs, Specialist's Degree programs, and Master's Degree programs with distance learning technologies are used (Letter of the Ministry of Science and Higher Education of Russia dated December 7, 2020, # MN-19/1573-AN On sending methodological recommendations).

The implementation of the discipline with the use of e-learning and distance learning technologies is carried out using the electronic information and educational environment of NCFU, to which students are provided access via the information and telecommunications network Internet, or using the resources of other organizations, including platforms providing services for videoconferencing, online meetings, and distance learning (MTS-Link), as well as using the capabilities of social networks to carry out communication between students and instructors.

The educational and methodological support for a discipline shall be ensured with e-learning and distance learning technologies includes the working program presented in electronic form, educational and methodological manuals or a course of lectures, methodological guidelines for performing various types of educational activities of students provided for by the discipline, and other educational and methodological materials posted in the information and educational environment of NCFU.