FEDERAL STATE BUDGETARY
EDUCATIONAL INSTITUTION OF HIGHER EDUCATION
"AMUR STATE MEDICAL ACADEMY"
MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION

AGREED
Vice-Rector for Academic Affairs,

_____ N.V. Loskutova

April 17, 2025

Decision of the CCMC
April 17, 2025

Protocol No. 7

APPROVED
by decision of the Academic Council of the FSBEI HE Amur SMA of the Ministry of Health of the Russian Federation
April 22, 2025

Protocol No. 15

Acting Rector of the FSBEI HE Amur SMA of the Ministry of Health of the Russian Federation

_____ I.V. Zhukovets

April 22, 2025

ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

Сертификат: 50AB2242604E64520B52614FA420034A
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Действителен: с 15.04.2025 до 09.07.2026

EDUCATIONAL PROGRAM

discipline "NORMAL PHISIOLOGY"

Specialty: 31.05.01 General Medicine
Course: 2
Semester: 3-4
Total hours: 252 hrs.
Total credits: 7 credit units
Control form: examination, 4 semester

Blagoveshchensk, 2025

The educational program of the discipline is designed in accordance with the requirements of the Federal State Educational Standard of Higher Education - specialist in specialty 31.05.01 General Medicine, approved by order of the Ministry of Education and Science of Russia dated 08/12/2020 No. 988 (registered with the Ministry of Justice of Russia on 08/26/2020 No. 59493), BPEP HE (2021).

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APPROVED at the meeting of the Department of Physiology and Pathophysiology, Protocol No. 8 dated March 27, 2025

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Conclusion of the Expert Commission on the review of the Educational Programs: Protocol No. 2 dated April 16, 2025

Expert of the expert commission,
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APPROVED at the meeting of the CMC No. 1: Protocol No. 7 dated April 16, 2025.
Chairman of the CMC No. 1
Holder of the Advanced Doctorate in Medical Sciences,
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AGREED: Dean of the Faculty of Medicine,
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April 22, 2025_____ N.G. Brush

1. EXPLANATORY NOTE

1.1.Characteristics of the discipline

Normal physiology as a science about the vital activity of a healthy person and the physiological foundations of a healthy lifestyle is the methodological foundation of medicine, mainly its preventive direction, as well as the scientific basis for diagnosing health and predicting the functional activity of the human body.

Being the final academic discipline in the section of preclinical medical and biological education, the stage of basic training of students, physiology is organically connected with biology, biophysics, chemistry, biochemistry, anatomy, histology and embryology, on the one hand, and with pathological physiology, pharmacology and propaedeutic clinical disciplines, on the other hand. Physiology integratively covers all levels of studying the vital activity of the organism - molecular, cellular, tissue, organ, organismic and population. Modern human physiology reserves for itself the study of the dynamics of the main processes of vital activity of the human organism, the most complex mechanisms and types of regulation of all vital processes occurring in the organism at all levels of vital activity, based on the materialistic worldview and thereby developing this fundamental scientific principle.

1.2. Purpose and objectives of the discipline.

Objective: To develop students' systemic knowledge about the vital functions of the whole organism and its individual parts, about the basic patterns of functioning of physiological functions and the mechanisms of their regulation in interaction with each other and with environmental factors, about the physiological foundations of clinical and physiological research methods used in functional diagnostics and in the study of human integrative activity, about the physiological foundations of a healthy lifestyle.

Learning objectives of the discipline:

- developing students’ skills in analyzing the functions of the whole organism from the perspective of integral physiology, analytical methodology and the fundamentals of holistic medicine;
- developing in students a systematic approach to understanding the physiological mechanisms underlying interaction with environmental factors and the implementation of adaptive strategies of the human and animal body for the implementation of normal functions of the human body from the perspective of the concept of functional systems;
- students study the methods and principles of research into the assessment of the state of the body's regulatory and homeostatic systems in an experiment, taking into account their applicability in clinical practice;
- students study the patterns of functioning of various systems of the human body and the characteristics of intersystem interactions in the context of performing targeted activities from the standpoint of the theory of adaptation;
- teaching students methods of assessing the functional state of a person, the state of regulatory and homeostatic factors in various types of targeted activities;
- students study the role of higher nervous activity in the regulation of human physiological functions and the targeted management of the body's reserve capabilities under normal and pathological conditions;
- familiarizing students with the basic principles of modeling physiological processes and existing computer models (including biofeedback) for the study and targeted management of the visceral functions of the body;
- developing students' basic clinical thinking based on an analysis of the nature and structure of interorgan and intersystem relationships from the perspective of integrated physiology for the future practical activities of a physician.

1.3. The place of the discipline in the structure of the main professional educational program of higher education:

The discipline "Normal Physiology" belongs to Block B 1. Basic part.
The total workload is 252 hours (7 credit units). Of these, 144 hours are classroom hours, 72 hours are allocated for independent work of students. The form of control is an exam.

The main sections of the discipline studied:

1) general physiology,
2) private physiology,
3) Integrative Physiology.

1.4. Requirements for students

To study the discipline, knowledge, skills and abilities formed by previous disciplines/practices are required:
Latin
***Knowledge* :** Basic medical and pharmaceutical terminology in Latin.
Skills: be able to apply knowledge for communication and obtaining information from medical literature.
Professional foreign language
Knowledge: Basic medical and pharmaceutical terminology in a foreign language.
***Skills* :** be able to apply knowledge for communication and obtaining information from foreign sources.
History of Medicine
Knowledge: outstanding figures in medicine and health care, Nobel laureates, outstanding medical discoveries in the field of physiology, the influence of humanistic ideas on medicine.
Skills: be able to competently and independently present and analyze the contribution of domestic scientists to the development of physiology.
Philosophy
Knowledge: methods and techniques of philosophical analysis of problems; forms and methods of scientific knowledge, their evolution; basic patterns and trends in the development of the world historical process; laws of dialectical materialism in medicine.
Skills: be able to competently and independently express, analyze the forms and methods of scientific knowledge and the laws of dialectical materialism in medicine.
Histology, embryology, cytology
Knowledge: embryogenesis, structure and function of tissues, organs and body systems.
Skills: be able to draw cells of various tissues of the body, show their main organelles, work with a light microscope taking into account safety regulations.
Physics, mathematics . Medical informatics.
Knowledge: mathematical methods for solving intellectual problems and their application in medicine; theoretical foundations of computer science, collection, storage, search, processing, transformation, distribution of information in medical and biological systems, use of information computer systems in medicine; principles of operation and design of equipment used in physiology and medicine, the basics of physical and mathematical laws that are reflected in physiology.
Skills: be able to use educational, scientific, popular science literature, a personal computer, the Internet for professional activities, work with equipment taking into account safety regulations **.**
Chemistry. Bioinorganic and biophysical chemistry in medicine
Knowledge : the chemical and biological essence of the processes occurring in a living organism at the molecular and cellular levels.
Skills : be able to analyze the contribution of chemical processes to the functioning of the body's physiological systems.

Biochemistry. Bioorganic chemistry in medicine
Knowledge: structure and biochemical properties of the main classes of biologically important compounds, the main metabolic pathways of their transformation; the role of cell membranes and their transport systems in metabolism.
Skills: be able to analyze the contribution of biochemical processes to the functioning of the body's physiological systems, interpret the results of the most common laboratory diagnostic methods to identify disorders in the body's physiological systems.
Biology
Knowledge: laws of genetics, its importance for medicine; patterns of heredity and variability in individual development as the basis for understanding the pathogenesis and etiology of hereditary and multifactorial diseases; biosphere and ecology, bioecological diseases.
Skills: be able to analyze the patterns of heredity and variability in the development of the body's physiological systems.
Anatomy
Knowledge: Anatomical and physiological features of various organs and systems of the body.
Skills: be able to analyze the structure and establish a connection between the structural features and functions of various organs and systems of the body.

1.5. Interdisciplinary links with subsequent disciplines

No. p /p	Name of subsequent disciplines	Section numbers of this discipline, necessary for studying subsequent disciplines		
		1.	2.	3.
1	Propaedeutics of internal diseases	+	+	+
2	Pharmacology	+	+	+
3	Clinical pharmacology	+	+	+
4	Pathophysiology, clinical pathophysiology	+	+	+
5	Pathological anatomy, clinical pathological anatomy	+	+	+
6	General surgery	+	+	+
7	Public health and healthcare, health economics	+	+	+
8	Otorhinolaryngology	+	+	+
9	Faculty therapy	+	+	+
10	Neurology, neurosurgery	+	+	+
11	Obstetrics and gynecology	+	+	+
12	Psychiatry, medical psychology	+	+	+
13	Faculty surgery, urology	+	+	+
14	Infectious diseases	+	+	+
15	Dermatovenereology	+	+	+
16	Traumatology orthopedics	+	+	+
17	Hospital surgery, pediatric surgery	+	+	+
18	Anesthesiology, resuscitation, intensive care	+	+	+
19	Hospital therapy, endocrinology	+	+	+
20	Medical rehabilitation	+	+	+

21	Oncology, radiation therapy	+	+	+
22	Phthisiology	+	+	+
23	Outpatient therapy	+	+	+
24	Forensic medicine	+	+	+
25	Dentistry	+	+	+
26	Pediatrics	+	+	+
27	Hygiene	+	+	+
28	Physical culture	+	+	+

1.6. Requirements for the results of mastering the discipline

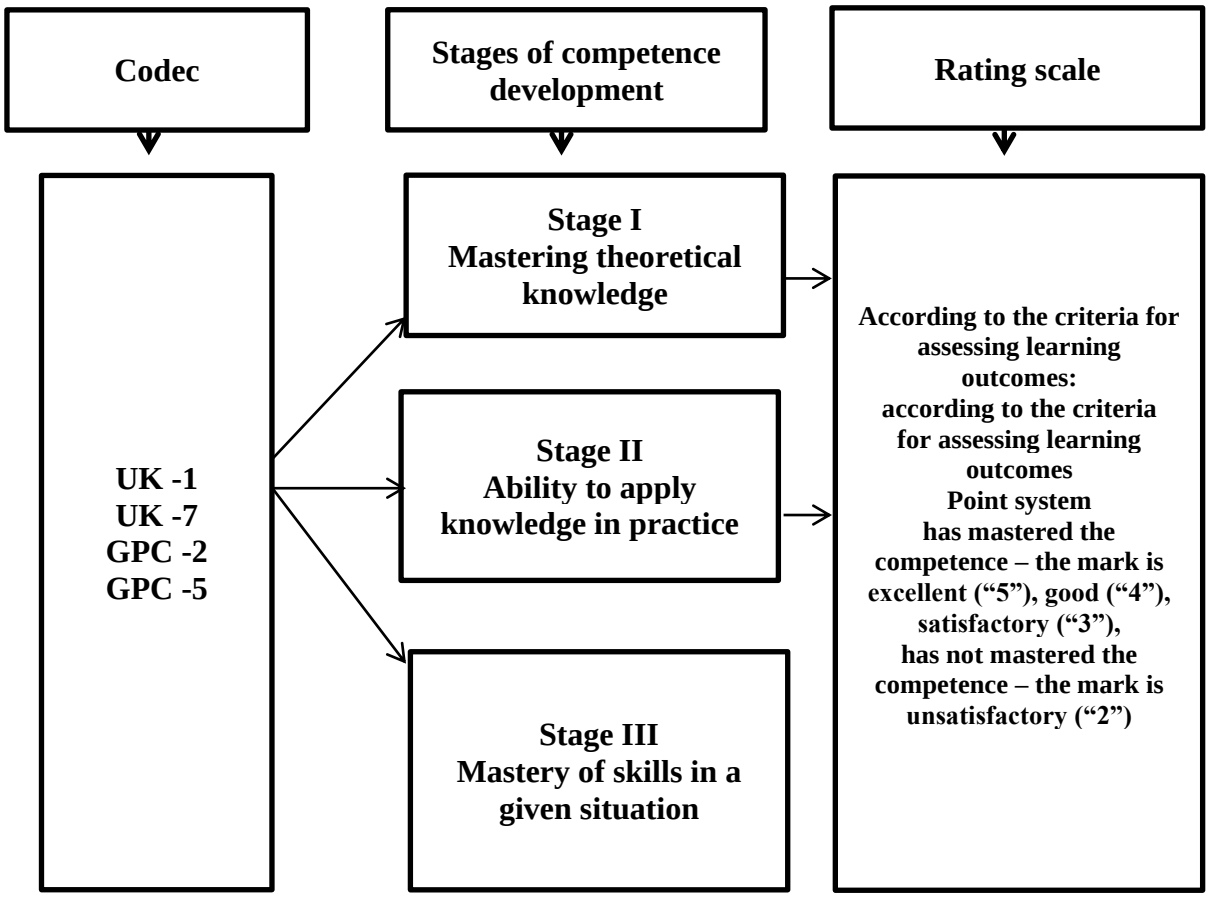
The study of the discipline "Normal Physiology" is aimed at the formation/improvement of the following competencies: universal (UC), general professional (GPC)

No. p /p	Code and name of competence	Code and name of the indicator of achievement of competence
Universal competencies		
1	UC-1. Capable of carrying out a critical analysis of problematic situations based on a systems approach, developing an action strategy	AI UC 1.1 And analyzes the problem situation as a system, identifying its components and the connections between them AI UC 1.2 Identifies gaps in information needed to solve problem situations and designs processes to eliminate them .
	UC-7. Able to maintain an adequate level of physical fitness to ensure full social and professional activity	AI UC-7.1. Observes and promotes healthy lifestyle standards in various life situations and in professional activities
General professional competencies		
2	GPC -2 . Capable of conducting and monitoring the effectiveness of preventive measures and the formation of a healthy lifestyle.	AI GPC -2.2. Promotes a healthy lifestyle aimed at improving sanitary culture and preventing diseases of patients (the population); organizes events on sanitary and hygienic education and the formation of healthy lifestyle skills.
	GPC -5. Capable of assessing morpho-functional, physiological states and pre-pathological processes in the body to solve professional problems	AI GPC -5.1. Knows the functional systems of the human body, their regulation and self-regulation when interacting with the external environment in normal conditions and during pathological processes. AI GPC -5.3. Knows the indicators of the morphofunctional and physiological state of a healthy person and can measure/determine them.

1.7 . Stages of competencies formation and description of the assessment scale

Sections of the discipline and the code of the competence being formed

No. p /p	Section name	Code of the competence being formed
1	general physiology	UC-1, UC-7, GPC-2, GPC-5
2	private physiology	UC-1, UC-7, GPC-2, GPC-5
3	integrative physiology	UC-1, UC-7, GPC-2, GPC-5



1.8. Forms of training organization and types of control.

Forms of organization of student training: lectures, practical classes, seminars.

In order to implement the competence approach, along with traditional teaching methods, active and interactive forms of conducting classes are provided in the form of computer simulations, solving situational and computational problems, trainings on the formation of practical skills. In particular, when solving situational problems, an element of competition is introduced , encouraging students to more active work. A student or a group of students who are the first to offer the correct solution to the problem are encouraged by increasing the grade for the lesson.

Types of control:

- input : testing on the Moodle portal in the course "Normal Physiology" at the beginning of the training;

- current control:

- initial control is carried out during an interactive survey on questions about preparation for classes, checking the completion of written homework;

- final control: control over the implementation of practical work, solving situational and computational problems, computer simulations, checking protocols of practical classes with an explanation of the mechanism of the processes being studied, conclusions, testing.

Traditional forms of control allow checking the assimilation of the educational material by students. The ability of the student to apply his knowledge is checked by solving situational problems, predicting the results of research in the program "Physiology Simulator" and discussing the results of the conducted experimental studies, when the student must explain the results obtained and draw conclusions.

- boundary control: control acquisition of knowledge of a specific section - oral interactive survey, interview on situational tasks, test control;

- midterm assessment: oral survey, test control.

The level of a student's mastery of practical skills is assessed during the course of practical work, during final classes, including the final class on practical skills, and during the exam.

2. STRUCTURE AND CONTENT OF THE DISCIPLINE.

2.1. Scope of the discipline and types of academic work:

Types of educational work	**Total hours**	**Semesters**	
		3	**4**
Lectures	40	20	20
Practical classes (seminars)	104	52	52
Independent work of students	72	36	36
Exam	36		36
Total labor intensity in hours	**252**	**108**	**144**
Total workload in credit units	**7**	**3**	**4**

2.2. Thematic plan of lectures and their brief content

No. p /p	Lecture topics	Codes of formed competencies	Labor intensity (hours)
1	**2**	**3**	**4**
	III semester		
1.	*Fundamental concepts of physiology. General physiology of excitable tissues.* Understanding integrative and disintegrative processes in the body as a basis for clinical thinking. Health diagnostics and prognosis of the functional state and human performance. Basic physiological properties and processes in cells and tissues. Excitability, conductivity, contractility, secretory activity , automaticity . Laws of action of stimuli in homogeneous and heterogeneous systems and conduction of excitation.	UC-1.7, GPC-2.5	2
2.	*Neuromuscular physiology.* *Regulation of physiological functions of the body.* Physical and chemical mechanisms of excitation conduction in systems. Contractile function and neuromotor units. Physiological and physical properties of muscles. The concept of regulation. Types of nervous, humoral and neurohumoral regulation. Self-regulation . The principle of the nervous system, its development in the works of I. M. Sechenov, I. P. Pavlov. Reflex path. Disadvantages of reflex regulation The concept of the effectiveness and efficiency of management. Feedback afferentation , its meaning. The concept of adaptive result. Principles of reflex theory.	UC-1.7, GPC-2.5	2
3.	*Physiology of endocrine glands.* Structural and functional organization of the endocrine system. Characteristics and classification of physiologically active substances (hormones, peptides, metabolites), the concept of autocrine, paracrine and telecrine forms of regulation. The main mechanisms of hormone action. Self-regulation of the endocrine system. Reception of physiologically important substances. Relationships between nervous and humoral mechanisms of regulation of functions. *Systemic principle of regulation of physiological functions* The concept of homeostasis and homeokinesis. Self-regulatory principles of maintaining the constancy of the internal environment of the body, its physiological constants. P.K. Anokhin's doctrine of functional systems and self-regulation of functions. Cybernetic approach to regulation processes. Classification of functional systems. Scheme of the structural organization of the functional homeostatic system, system-forming factor. Regulation of functions by discrepancy and disturbance. Principles of multi-connected regulation. Feedback as one of the leading mechanisms in regulating functions. Principles of coding	UC-1.7, GPC-2.5	2

	physiological information. The importance of the theory of functional systems for physiology, biology, medicine and other disciplines. Age-related features of the formation and regulation of physiological functions. Systemogenesis.		
4.	*Excitation and inhibition in the central nervous system. The study of nerve centers.* Neuron as a structural and functional unit of the central nervous system. General plan of the nervous system structure. Brain and spinal cord. Nerve centers in the narrow and broad sense. Basic properties of nerve centers. Inhibition in the central nervous system, characteristics, classification at different levels of this process and its mechanisms. Types of inhibition at the level of the membrane, synapse, small neural circuits, organism. General principles of coordination activity of the central nervous system. Interaction of excitation and inhibition. Principles of reciprocity , feedback, common "final path", dominant. Interaction between different levels of the central nervous system in regulating functions.	UC-1.7, GPC-2.5	2
5.	*Physiology of motor activity. Mechanisms of regulation of muscle tone and movements.* Types of motor activity. Lower and higher centers of motor activity regulation. Pyramidal and extrapyramidal systems, their influence on lower motor centers. Mechanisms of muscle tone regulation at the spinal level. Brondges experiment . Supraspinal mechanisms of muscle tone regulation. Decerebrate rigidity and the mechanism of its development. Descending influences of the reticular formation (inhibitory and facilitating) on the reflex activity of the spinal cord. Participation of the reticular formation in maintaining and redistributing muscle tone. Tonic reflexes of the brainstem (R. Magnus). The role of the spinal cord, medulla oblongata and midbrain in the implementation of phasic -tonic muscle activity.	UC-1.7, GPC-2.5	2
6.	*Physiology of the autonomic nervous system.* Structural and functional features of the somatic and autonomic nervous system. Sympathetic and parasympathetic divisions of the autonomic nervous system. Principles of organization of the efferent link of autonomic reflexes. Autonomic ganglia and their functions. Preganglionic and postganglionic nerve fibers and their functional differences. Mechanism of excitation transmission in the autonomic ganglia. Mediators of the autonomic nervous system. Main types of receptive substances. Influence of the sympathetic and parasympathetic divisions of the autonomic nervous system on the innervated organs. Synergism and relative antagonism of influences. Higher and lower autonomic centers. Participation of the autonomic nervous system in the integration of functions during the formation of integral behavioral acts. Vegetative components of behavior.	UC-1.7, GPC-2.5	2
7.	*Blood as part of the internal environment of the body. Its main physical and chemical properties .* Homeostasis of formed elements of the blood. Basic functions of blood. Basic physiological constants	UC-1.7, GPC-2.5	2

	of blood. Osmotic and oncotic pressure. Hemoglobin, structure, properties, quantity in blood. Hemoglobin compounds. Color index of blood. The concept of erythron . Physiological erythrocytosis, conditions and mechanisms of its development. The concept of leUCocytosis and leUCopenia. Functions of leUCocytes. Functional system of regulation of the quantity of formed elements in the blood. Nervous and humoral mechanisms of regulation of the quantity of erythrocytes.		
8.	*Immunological properties of blood. The RASK system.* Characteristics of physiological immune systems of blood. Innate and acquired immunity. Cellular and humoral, specific and non-specific. The concept of immunization. Blood groups. The importance of knowledge about blood group affiliation. Classification and characteristics of blood groups according to the ABO system and according to Rhesus - accessories. Rules of blood transfusion. Physiology of hemostasis. The process of stopping bleeding, its stages and significance. Coagulation and anticoagulation systems of blood. Functional system of regulation of the aggregate state. Regulation of hemostasis.	UC-1.7, GPC-2.5	2
9.	*Physiology of respiration.* The importance of breathing for the body. The main stages of the breathing process. The mechanism of external respiration. Biomechanics of inhalation and exhalation. The pleural cavity, its role in the mechanism of external respiration. Elastic properties of the lungs and chest walls. Surfactants. Gas exchange in the lungs. Relative constancy of the composition of alveolar air. Tension of gases dissolved in the blood, methods of their measurement. Partial pressure of oxygen and carbon dioxide in the alveolar air. Properties of the pulmonary membrane. Diffusion capacity of the lungs. Transport of gases ($O2$, $CO2$) by blood. Hemoglobin, its forms. Dissociation of oxyhemoglobin. Content of $O2$ and $CO2$ in arterial and venous blood. Formation and dissociation of bicarbonates and carboxyhemoglobin. The importance of carbonic anhydrase. Gas exchange between blood and tissues. Structures of the central nervous system that provide respiratory periodicity. Neuronal organization of the bulbar respiratory center. Mechanisms of respiratory rhythm formation . Mechanoreceptors of the lungs, their importance in self-regulation of the frequency and depth of breathing. Hering and Breuer reflexes . Conditioned reflex and voluntary regulation of breathing. The effect of the gas composition and pH of arterial blood on the frequency and depth of respiration. Central and peripheral chemoreceptors. Their importance in ensuring gas homeostasis. Functional system of external respiration regulation. Changes in pulmonary ventilation during hypercapnia and hypoxia. Functional system of maintaining constancy of the gas composition of the blood.	UC-1.7, GPC-2.5	2
10.	*Physiological properties of the myocardium and their features. Cardiac cycle.* The importance of blood circulation for the body. General plan of the circulatory system structure. Blood circulation as a component of various functional systems that determine homeostasis. The heart, the	UC-1.7, GPC-2.5	2

	importance of its chambers and valve apparatus. The cardiac cycle , its structure. Automaticity of the heart. Modern concepts of the substrate, nature and gradient of automaticity . Ionic mechanisms of the occurrence of the action potential of cardiomyocytes . The relationship between excitation, excitability and contraction in different phases of the cardiac cycle . Extrasystoles. Phase analysis. Changes in pressure and blood volume in the cavities of the heart in different phases of the cardiac cycle . Systolic and minute blood volume as a quantitative result of heart activity. External manifestations of cardiac activity, their origin and research methods.		
IV semester			
11	*Physiological basis of hemodynamics.* Systemic hemodynamics. Functional classification of blood and lymphatic vessels. Basic laws of hemodynamics. Total peripheral vascular resistance. Mechanism of vascular tone formation. Factors ensuring blood movement through high- and low-pressure vessels. Blood flow velocity in different parts of the circulatory system. Complete blood circulation time. Blood pressure, its types. Factors determining blood pressure. Blood depot organs. Blood pressure, linear and volumetric blood flow velocities in different parts of the circulatory system. Regional blood circulation. Morpho-functional characteristics of the main components of the microcirculatory bed.	UC-1.7, GPC-2.5	2
12.	*Regulation of heart function and vascular tone. FUS for maintaining optimal blood pressure.* Functional system of regulation of cardiac activity. Myogenic mechanisms of regulation: Frank - Starling law, Bowditch ladder , Anrep phenomenon , chrono -inotropic dependence. Neurogenic mechanism of regulation, peripheral reflexes of the heart: receptors, reflex arcs, significance. Influence of extracardiac nerves on the heart. Reflex regulation of cardiac activity: classification, reflexogenic zones, significance. Influence of humoral factors on cardiac function. Mechanisms of regulation of vascular tone: local and central. The role of the endothelium in the regulation of vascular tone. Influence of efferent nerves and humoral factors on vessels. Vascular regulatory phenomena: autoregulation , functional and reactive hyperemia.	UC-1.7, GPC-2.5	2
13.	*Digestion is a systemic process of metabolic saturation* *Mechanisms and basic patterns of regulation of digestive functions.* Physiological bases of hunger and satiety. I. P. Pavlov's concept of the food center. Functional nutrition system. Digestion, basic principles and mechanisms of regulation. The essence of digestion. Types of digestion. Basic principles and mechanisms of digestion regulation. Phases of secretion of the main digestive glands. Methods of studying the functions of the digestive tract.	UC-1.7, GPC-2.5	2
14 .	*Metabolic basis of physiological functions.* Biological thermodynamics or bioenergetics. Laws of thermodynamics and their applicability to	UC-1.7, GPC-2.5	2

	living organisms. Energy balance of the organism and its regulation. The organism as an open thermodynamic system. Metabolism and energy between the organism and the external environment as the main conditions of life and maintenance of homeostasis. Energy balance of the organism. Accounting for energy intake and expenditure: physical calorimetry, caloric value of various substances (physical and physiological). Direct and indirect calorimetry (complete and incomplete gas analysis). Caloric coefficient of oxygen. Respiratory quotient. Basal metabolism, value, factors determining it. Specific dynamic action of food. Work metabolism. Energy expenditure of the organism during different types of work and at different ages.		
15.	*Physiology of thermoregulation. FUS, ensuring maintenance of constancy of body temperature.* Homeothermy and poikilothermy . Body temperature scheme. Constancy of the internal temperature of the body as a necessary condition for the normal course of metabolic processes. Metabolism as a source of heat generation. Centers of physical and chemical thermoregulation. Heat production and heat transfer. Functional system that ensures the maintenance of a constant internal temperature when the external temperature changes. Age-related features of thermoregulation	UC-1.7, GPC-2.5	2
16.	*Functional system of allocation and characteristics of its main elements.* Executive elements of the excretory system (kidneys, lungs, skin, digestive tract), their participation in maintaining the body's homeostasis. Skin as an excretory organ. Functions of sebaceous and sweat glands and regulation of their activity. The main processes of urine formation (glomerular filtration, tubular reabsorption and secretion). Mechanisms of glomerular filtration, composition of primary urine. Countercurrent system. Reabsorption in tubules and mechanisms of its regulation. Secretory processes in tubules. Final urine and its composition. Neurohumoral mechanisms of regulation of urine formation, the role of the nervous system and hormones (ADH, aldosterone, catecholamines, etc.). Methods of quantitative assessment of the processes of filtration, reabsorption, secretion, plasma flow and blood flow in the kidneys. The role of the kidneys in the regulation of nitrogen balance. Adaptive changes in kidney function under various environmental conditions Nervous and humoral regulation of renal blood supply. Regulation of glomerular filtration in the kidneys. The importance of arterial pressure in the vascular system of the systemic circulation, effective and ineffective filtration pressure. Regulatory importance of the tone of the afferent and efferent vessels. Obligatory and facultative reabsorption in the proximal and distal segments of the nephron. Regulation of the renal concentration mechanism. Humoral regulation of Na and water reabsorption in the kidneys.	UC-1.7, GPC-2.5	2
17 .	*General physiology of sensory systems.* The concept of sense organs, analyzers, sensory systems. I. P. Pavlov's teaching on analyzers. The importance of analyzers in understanding the world.	UC-1.7, GPC-2.5	2

	Functional organization of analyzers. Peripheral (receptor) section of analyzers. Classifications, main properties and features of receptors. Mechanism of excitation in receptors. Functions of the peripheral section of analyzers. Functional mobility. Conductive section of analyzers. Features of conduction of afferent excitations. Specific and non-specific pathways. Participation of subcortical formations in conduction and processing of afferent excitations. Cortical section of the analyzer. Localization of afferent functions. Processes of higher cortical analysis and synthesis of afferent excitations. Interaction of analyzers. Coding of information in different sections of analyzers. Adaptation of analyzers.		
18.	*Physiology of pain.* Systemic mechanisms of pain. The concept of pain. Classification of types of pain. Theories of pain. Nociceptors . Conductive section of the nociceptive analyzer. Central mechanisms of pain. Antinociceptive systems of the body. Gate theory of pain conduction. afferentation . Neurochemical mechanisms of antinociception . Opiate receptors and their ligands . Systemic concepts and biological significance of pain. Physiological bases of pain relief and anesthesia. Biological active points and the principle of reflexotherapy.	UC-1.7, GPC-2.5	2
19.	*The concept of higher functions of the brain. Functional system of a purposeful behavioral act.* Unconditioned reflexes and instincts, their classification, characteristics, significance for the adaptive activity of the organism. Conditioned reflex as a form of adaptation of animals and humans to changing conditions of existence. Patterns of formation and manifestation of conditioned reflexes. Physiological mechanisms of formation of conditioned reflexes. Their structural and functional basis. Analytical and synthetic activity of the cerebral cortex. Dynamic stereotype, its physiological essence, significance for learning and acquisition of work skills. Needs and motivations, their classification and neurophysiological mechanism of occurrence. Architecture of the integral behavioral act (P.K. Anokhin). Main stages of the functional system of behavior and their neurophysiological mechanisms. Physiology of memory and learning. Memory, its types from the standpoint of psychology and neurophysiology. Physiological classification of memory types and their mechanisms. Brain structures responsible for memory formation. Clinical neurophysiology (J. Penfield , B. Milner). Implicit and explicit memory (procedural and declarative). Types of learning (training): obligatory, optional and cognitive. Forms of behavior corresponding to these types.	UC-1.7, GPC-2.5	2
20 .	*Physiological foundations of human mental activity.* The structure of the human psyche: mental processes, mental states and mental properties. Objective methods of psychophysiological research. Electrophysiological research techniques. Electroencephalogram, its rhythms. Evoked potentials. Basic functional states of the brain. Physiological bases of hypnotic states.	UC-1.7, GPC-25	2

	Wakefulness. Neurophysiological mechanisms of activation of the cerebral cortex and maintenance of wakefulness. Emotions, their biological role. Classification. Theory of emotions. The role of brain structures in the formation of emotional states. Vegetative and motor components of emotional stress. The role of emotions in purposeful human activity. Emotional tension (emotional stress). The role of emotional stress in the occurrence of neuroses, the development of various psychosomatic diseases in humans. Types of higher nervous activity. I. P. Pavlov's doctrine of the first and second signal systems. Figurative and verbal thinking. Functional asymmetry of human mental functions. Suggestion, self-suggestion, psychotherapy.		
Total hours			**40**

2.3. Thematic plan of practical classes and their content

Topic No. p /p	**Name of the topics of practical classes**	**Contents of practical classes**	**Codes of formed competencies and indicators of their achievement**	**Types of control**	**We work hard - bone (watch)**
1	2	3	4	5	
1	Introduction to the course of normal physiology. Physiological properties and processes of excitable tissues.	**Theoretical part:** Introduction to the department. Introduction to the organization of practical classes at the department. Study of safety measures. Physiological properties of excitable tissues and corresponding processes. Laws of excitation of excitable systems. Mechanism and laws of conduction. **Practical part** Incoming test control Determination of threshold strength and threshold time by the chronoximetry method. Experiment in the program "Physiology Simulator"	UC-1. AI: 1.1, 1.2, GPC-5 ID: 5.3	Interactive survey, discussion of the results of the experiment, conclusions	3.25
2.	Physiology of the neuromuscular junction, skeletal and smooth muscles	**Theoretical part:** Physical and physiological properties of muscles. Mechanism of excitation conduction in the neuromuscular synapse. Work and strength of muscles. Types of muscle contractions. Functional features of smooth muscles. **Practical part** Electromyography.	UC-1 AI: 1.1, 1.2, GPC-5 AI:-5.3	Interactive survey, control of the practical task, discussion of the results of the experiment,	3.25

		Dynamometry. Experiment in the program "Physiology Simulator"		conclusions	
3.	Final lesson "General physiology of excitable tissues"	**Theoretical part:** Checking the assimilation of competencies " General physiology of excitable tissues" **Practical part** testing solving situational problems	UC-1 AI: 1.1, 1.2, GPC-5 ID: 5.3	Testing, frontal survey, interactive survey, situational task interview	3.25
4.	The main types, principles, mechanisms and levels of regulation of physiological functions	**Theoretical part:** Reflex and systemic principles of regulation. Classification of reflexes. Reflex arc. Cybernetic principles of regulation by discrepancy and deviation. Schematic diagram of the homeostatic functional system. **Practical part** Conjunctival conditioned and unconditioned reflexes (illustration of the principles of regulation by discord and disturbance). Study of the activity of the functional system of regulation of gas homeostasis of the body during various functional tests that deviate the gas constants of the blood.	UC-1 AI: 1.1, 1.2, GPC-5 AI: 5.1, 5.3	Interactive survey, discussion of the results of the experiment, conclusions	3.25
5.	Physiology of the nerve center.	**Theoretical part:** Physiology of the neuron. The concept of a nerve center in a broad and narrow sense. Physiological properties of nerve centers. Inhibition: types, mechanisms, meaning. Principles of coordination of the work of nerve centers. **Practical part** Temporal summation in sensory nerve centers. Work in the program "Physiology Simulator". Associated inhibition in sensitive cortical centers of different projection localization. Removal of the inhibitory effect on spinal tendon extensor reflexes.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, control over the execution of tendon reflexes, discussion of the experimental results, conclusions	3.25
6.	Physiology of motor activity	**Theoretical part:** Types and importance of motor activity. Spinal and supraspinal mechanisms of maintaining muscle tone. Functional features of the pyramidal and extrapyramidal systems. Decerebrate rigidity. **Practical part**	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2	Interactive survey, control over the execution of tendon	3.25

		Observation of some motor reflexes in humans. Inducing various postural (tonic) reflexes in a rabbit.	AI: 2.2, GPC-5 AI: 5.3	reflexes, discussion of the experimental results, conclusions	
7.	Physiology of the autonomic nervous system	**Theoretical part:** Comparative characteristics of the somatic and autonomic nervous system. Sympathetic and parasympathetic divisions of the ANS, their adaptive and trophic role. Higher and lower centers of the ANS. **Practical part** Adaptive pupillary response to light (direct and friendly). Pupil response to pain stimulation. Working in the program "Physiology Simulator"	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, discussion of the results of the experiment, conclusions	3.25
8	Final lesson "Physiology of the central nervous system"	**Theoretical part:** Testing the acquisition of competencies based on the topic "Physiology of the central nervous system" **Practical part** Testing Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, frontal poll interactive survey , situational task interview	3.25
9.	Physiology of endocrine glands	**Theoretical part:** General characteristics of humoral regulation. Classification of hormones. Physiological effects of hormones. Mechanisms of regulation of the amount of hormones in the human body **Practical part** Testing Working in the program "Physiology Simulator"	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Testing, interactive survey, discussion of the results of the experiment, conclusions	3.25
10.	Erythrocyte and leUCocyte systems of blood	**Theoretical part:** Blood functions. Blood system. Blood groups: AB 0 system , Rhesus system. Leucocyte functions. Physiological leucocytosis.	UC-1 AI: 1.1, 1.2, UC-7	Interactive survey, control of the practical	3.25

		Practical part Determination of the number of erythrocytes in 1 liter of blood. Determination of the number of leucocytes in 1 liter of blood. Determination of blood group according to the AB0 system. Determination of the Rh factor of blood.	AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	task, discussion of the results of the experiment, conclusions	
11 .	Physicochemical properties of blood	**Theoretical part:** Hemoglobin, its types, functions. Color index. ESR as an integral indicator of homeostasis. Vascular- platelet and coagulation hemostasis. Anticoagulant system. **Practical part** Determination of the amount of hemoglobin in the blood by the Sali method . Calculation of the color index of blood. Determination of bleeding duration by the DUCe method . Determination of coagulation time by the Sukhov method. Determination of erythrocyte sedimentation rate.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25
12.	External respiration	**Theoretical part:** Respiratory system. External respiration. Tidal volumes and capacities. Mechanism of inhalation and exhalation. Alveolar ventilation. **Practical part:** Spirometry. Spirography. Pneumotachometry . Peak flowmetry . Working in the program "Physiology Simulator"	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25
13.	Regulation of breathing	**Theoretical part:** Structural organization of the respiratory center. Mechanisms of rhythm formation : interneuronal , intercentral , reflex. Humoral mechanisms of respiratory regulation. **Practical part** Study of mechanisms of changes in pulmonary ventilation during physical exertion. Study of mechanisms of influence of changes in blood gas composition on external respiration parameters. Respiratory functional tests for assessment of human reserve capacities.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25

14.	Final lesson "Physiology of the blood system" and "Physiology of respiration".	**Theoretical part:** Testing the acquisition of competencies based on the studied topics “Physiology of the blood system” and “Physiology of respiration”. **Practical part** Testing Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, Frontal survey, interactive survey , situational task interview	3.25
15	Physiological properties of the cardiac muscle .	**Theoretical part:** Physiological properties of the working myocardium and atypical myocardium. Automaticity , its substrate. AP of the pacemaker, working cardiomyocyte . Extrasystole. Cardiac cycle and its phases. **Practical part:** Stannius's experiment . Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, discussion of the results of the experiment, conclusions, interview on situational tasks	3.25
16	Regulation of cardiac activity	**Theoretical part:** Intracardiac and extracardiac mechanisms of regulation of cardiac activity. Reflex and humoral mechanisms of regulation. **Practical part:** Danini-Ashner oculocardiac reflex . The influence of body position on heart rate.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, discussion of the results of the experiment, conclusions	3.25
17	Methods of studying cardiac activity	**Theoretical part:** The essence of the ECG method. The origin of the ECG elements. The information value of the ECG method. Heart sounds, their origin. Research methods, information value. Principles of methods for determining SV, MBV. **Practical part:** Registration and analysis of electrocardiogram. Listening to heart sounds. Introduction to Phonocardiography	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25

18	Physiology of blood vessels. Blood pressure and mechanisms of its regulation.	**Theoretical part:** Factors determining blood flow through vessels. Types of blood pressure, factors determining its optimal value. Basal vascular tone. Mechanisms regulating vascular tone. Vasomotor center. **Practical part:** Measurement of blood pressure according to Korotkov and Riva- Rocchi . Working in the Physiology Simulator program. Study of the effect of physical activity on blood pressure and pulse rate	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25
19	Final lesson "Physiology of blood circulation"	**Theoretical part:** Checking the assimilation of competencies based on the studied topics "Physiology of blood circulation" **Practical part:** Testing Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, frontal survey, interactive survey , interview on situational tasks	3.25
20	Digestion in the mouth and stomach.	**Theoretical part:** The nature and significance of digestion. Methods of studying the secretory function of the salivary glands and stomach. Digestion in the oral cavity and stomach. Functional nutrition system. **Practical part:** Study of the secretory activity of the salivary glands at rest and under the influence of various stimuli. Study of the absorptive function of the stomach and the excretory function of the salivary glands	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, discussion of the results of the experiment, conclusions	3.25
21	Digestion in the intestine. Motor activity and absorption functions of the digestive tract	**Theoretical part:** Chewing, swallowing. Types of motility of the stomach, small and large intestines. Vomiting. The act of defecation. Mechanisms regulating the motor activity of the digestive tract. Absorption of substances in the intestine. The role of the liver and pancreas in digestion. **Practical part:** The effect of bile on fats. Solving situational problems.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.3	Interactive survey, discussion of experimental results, conclusions, educational film, solution of	3.25

		Demonstration of the video film “Motor function of the digestive tract.		situational problems.	
22	Metabolic basis of physiological functions.	**Theoretical part:** Plastic and energetic role of nutrients. Basal metabolism. General energy metabolism . Energy expenditure during different types of work. Methods of determination of energy expenditure. Physiological norms of nutrition. Regulation of metabolism and energy. **Practical part:** Calculation of energy expenditure based on indirect respiratory calorimetry data. Calculation of daily energy balance	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, discussion of results of calculation tasks, conclusions	3.25
23	Excretory function of the kidneys and methods of its study	**Theoretical part:** Pathways of excretion of metabolic products from the body. Modern theory of urine formation . Regulation of kidney activity. Method of quantitative assessment of filtration, reabsorption, secretion, plasma and blood flow. Functional urination system. **Practical part:** Working in the program "Physiology Simulator" Solving situational and computational problems.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, discussion of experimental results, calculation tasks, conclusions	3.25
24	Final lesson (seminar) "Physiology of digestion, metabolism and energy, excretion and thermoregulation"	**Theoretical part:** Checking the assimilation of competencies based on the studied topics "Physiology of digestion, metabolism and energy, excretion and thermoregulation" **Practical part:** Testing Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, interactive survey , interview on situational tasks	3.25
25	General properties and patterns of functioning of sensory systems (analyzers). Physiology of the	**Theoretical part:** I.P. Pavlov's teaching on analyzers. Functional properties of analyzers. Functions of the optical system of the eye. Theories of light perception. Conductive and cortical sections of the visual analyzer. Adaptation of the visual analyzer. **Practical part:**	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2,	Interactive survey, control of the practical task, discussion of the results of the experiment,	3.25

	visual analyzer.	Determination of visual acuity. Determination of visual fields (perimetry). Study of color vision.	GPC-5 AI: 5.1, 5.3	conclusions	
26	Physiology of auditory, vestibular and cutaneous analyzers	**Theoretical part:** Structure and functions of the auditory, vestibular, cutaneous analyzers. Physiology of pain. Antinociceptive systems of the brain. **Practical part:** Study of air and bone conduction. Study of the features of binocular hearing. Study of the body's autonomic reactions to pain.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, control of the practical task, discussion of the results of the experiment, conclusions	3.25
27	Final lesson (seminar) "Physiology of sensory systems (analyzers)".	**Theoretical part:** Testing the acquisition of competencies based on the studied topics “Physiology of sensory systems (analyzers)”. **Practical part:** Testing. Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, interactive survey , interview on situational tasks	3.25
28	Innate and acquired forms of behavior.	**Theoretical part:** The structure of a holistic behavioral act from the standpoint of TFS. Innate forms of behavior. Learning, its types. Conditioned reflexes, inhibition of conditioned reflexes. The idea of a dynamic stereotype. **Practical part:** Demonstration of experimental methods for studying higher nervous activity in small laboratory animals and recording of experiments on studying search activity in a problem chamber . The influence of the goal on the result of the activity.	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Interactive survey, discussion of the results of the experiment, conclusions, educational film	3.25
29	Physiological foundations of higher mental functions of man.	**Theoretical part:** The doctrine of the 1st and 2nd signal systems. Typological features of the higher nervous activity. Needs, motivations, emotions. Speech, speech functions. Sleep and its physiological mechanisms. Memory, its types,	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1,	interactive survey, discussion of the results of the	3.25

		physiological mechanisms. Thinking. **Practical part:** Tapping test. Study of personality psychotype using testing method. Study of short-term memory capacity	GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	experiment, conclusions.	
30	Final lesson "Physiology of higher nervous activity".	**Theoretical part:** Checking the assimilation of competencies based on the studied topics "Physiology of higher nervous activity" **Practical part** Testing Solving situational problems	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing, interactive survey , interview on situational tasks	3.25
31	Final lesson on practical skills.	**Practical part** Checking the acquisition of competencies (monitoring the acquisition of practical skills in written form).	GPC-5 AI: 5.1, 5.3	Frontal survey, interview based on results	3.25
32	Pre-exam testing	**Practical part** Checking the acquisition of competencies (testing).	UC-1 AI: 1.1, 1.2, UC-7 AI: 7.1, GPC-2 AI: 2.2, GPC-5 AI: 5.1, 5.3	Testing	3.25

2.4. Interactive forms of learning

In order to activate students' cognitive activity, **interactive teaching methods** (interactive surveys, computer simulations, discussions, work in small groups, computer testing with elements of training, etc.), participation in the work of the psychophysiological laboratory, educational and research and scientific research work of the department, and the scientific circle of the department are widely used in practical classes.

№ p /p	Topic of the practical lesson	Trudoem - bone in hours	Interactive form of learning	Labor intensity - bone per minute, in % of the lesson
1	2	3	4	5
1	Introduction to the course of normal physiology. Physiological properties and processes of excitable tissues.	3.25	Interactive survey. Computer simulations.	90 minutes (2 hours) / 62%
2	Physiology of the neuromuscular junction, skeletal and smooth muscles	3.25	Interactive survey. Computer simulations.	90 minutes (2 hours) / 62%
3	Final lesson "General physiology of excitable tissues"	3.25	Computer testing, interactive survey	60 min (1.33 hours)/ 41%
4	The main types, principles, mechanisms and levels of regulation of physiological functions	3.25	Interactive survey. Small group method.	90 minutes (2 hours) / 62%
5	Physiology of the nerve center.	3.25	Interactive survey. Computer simulations.	90 minutes (2 hours) / 62%
6	Physiology of motor activity	3.25	Interactive survey. Small group method.	65 minutes (1.4 hours) / 44%
7	Physiology of the autonomic nervous system	3.25	Interactive survey. Small group method.	90 minutes (2 hours) / 62%
8	Final lesson "Regulation of body functions. Physiology of the central nervous system."	3.25	Computer testing, interactive survey	60 min (1.33 hours) / 41%
9	Physiology of endocrine glands	3.25	Interactive survey. Computer simulations. Computer testing	120 min (2.67 hours)/ 82%
10	Erythrocyte and leUCocyte systems of blood	3.25	Interactive survey. Small group method	90 minutes (2 hours) /62%
11	Physicochemical properties of blood	3.25	Interactive survey. Small group method	90 minutes (2 hours) /62%
12	External respiration	3.25	Computer simulations Interactive survey. Small group method	120 min (2.67 hours)/82%
13	Regulation of breathing	3.25	Interactive survey Computer simulations Small group method	120 min (2.67 hours)/82%
14	Final lesson "Physiology of the blood system" and "Physiology of respiration".	3.25	Computer testing Interactive survey	120 min (2.67 hours)/82%

15	Physiological properties of the heart muscle. Methods of studying the activity of the heart	3.25	Interactive survey Small group method	90 minutes (2 hours) /62%
16	Regulation of cardiac activity	3.25	Small group method. Interactive survey	90 minutes (2 hours) /62%
17	Methods of studying cardiac activity	3.25	Interactive survey. Small group method	90 minutes (2 hours) /62%
18	Physiology of blood vessels. Blood pressure and mechanisms of its regulation.	3.25	Small group method. Interactive survey	90 minutes (2 hours) /62%
19	Final lesson "Physiology of blood circulation"	3.25	Interactive survey. Computer testing	120 min (2.67 hours)/82%
20	Digestion in the mouth and stomach.	3.25	Interactive survey Small group method	100 min (2.2 hours)/ 68%
21	Digestion in the intestine. Motor activity and absorption functions of the digestive tract	3.25	Interactive survey. Small group method. Working with educational film	90 minutes (2 hours) /62%
22	Metabolic basis of physiological functions.	3.25	Interactive survey. Small group method	120 min (2.67 hours)/82%
23	Excretory function of the kidneys and methods of its study	3.25	Interactive survey. Computer simulations. Small group method.	120 min (2.67 hours)/82%
24	Final lesson (seminar) "Physiology of digestion, metabolism and energy, excretion and thermoregulation"	3.25	Interactive survey. Computer testing	120 min (2.67 hours)/82%
25	General properties and patterns of functioning of sensory systems (analyzers). Physiology of the visual analyzer.	3.25	Interactive survey. Small group method	90 minutes (2 hours) /62%
26	Physiology of auditory, vestibular and cutaneous analyzers	3.25	Interactive survey. Small group method	120 min (2.67 hours)/82%
27	Final lesson "Physiology of sensory systems (analyzers)".	3.25	Computer testing. Interactive survey	120 min (2.67 hours)/82%
28	Innate and acquired forms of behavior.	3.25	Interactive survey. Work in the psychophysiological laboratory. Work with an educational film	60 min (1.33 hours)/ 41%
29	Physiological foundations of higher mental functions of man.	3.25	Interactive survey	60 min (1.33 hours)/ 41%
30	Final lesson "Physiology of higher nervous activity".	3.25	Computer testing, interactive survey	120 min (2.67 hours)/82%
31	Final lesson on practical skills.	3.25	Interactive conversation	120 min (2.67 hours)/82%
32	Pre-exam testing	3.25	Computer testing	120 min (2.67 hours)/82%

2.5. Criteria for assessing students' knowledge

The basis for determining the level of knowledge, skills, and abilities are the assessment criteria:

- completeness and correctness:
- correct, precise answer;
- correct but incomplete or imprecise answer;
- incorrect answer;
- no answer.

When assigning marks, the classification of errors and their quality are taken into account:

- gross errors;
- similar errors;
- minor errors;
- shortcomings.

- **Criteria for assessing learning outcomes**

No. p /p	**Topic of the practical lesson**	**Theoretical part**	**Practical part**	**Overall rating**
1-32	All practical classes	2-5	2-5	2-5
	Credit lesson		2-5	2-5
Average score		**2-5**		

- ***Rating scales for ongoing knowledge control***

The success of students in mastering the discipline "Normal Physiology", practical skills and abilities is characterized by a qualitative assessment and is assessed on a five-point scale: "5" - excellent, "4" - good, "3" - satisfactory, "unsatisfactory". The conversion of the mark into a point scale is carried out according to the following scheme:

Success rate	Mark on a 5-point scale
90-100%	"5"
80-89%	"4"
70-79%	"3"
Below 70%	"2"

- ***Working off disciplinary debts.***

If a student misses a class for a valid reason, he/she has the right to make it up and receive the maximum grade provided for by the course work program for that class. A valid reason must be documented.

If a student misses a class for an unjustified reason or receives a "2" mark for all activities in the class, he/she is required to make it up. In this case, the mark received for all activities is multiplied by 0.8.

If a student is excused from a class at the request of the dean's office (participation in sports, cultural and other events), then he is given a grade of "5" for this class, provided that he submits a report on the completion of mandatory extracurricular independent work on the topic of the missed class.

Assessment criteria for midterm assessment

1. Test control in the Moodle system
2. In-person testing.
3. Answers to exam questions.

Criteria for final assessment (midterm assessment)

Excellent – for the depth and completeness of mastery of the content of the educational material, in which the student easily navigates, for the ability to combine theoretical questions with practical ones , express and justify their judgments, and present an answer competently and logically; when testing, allows up to 10% of erroneous answers. Practical skills and abilities provided for by the working program of the discipline are fully mastered.

Good – the student has fully mastered the educational material, is oriented in it, and correctly states the answer, but the content and form have some inaccuracies; during testing, allows up to 20% of erroneous answers. Has mastered all the practical skills and abilities provided for by the discipline program, but allows some inaccuracies.

Satisfactory – the student has mastered the knowledge and understanding of the main provisions of the educational material, but presents it incompletely, inconsistently, does not know how to express and substantiate his/her judgments; allows up to 30 5 wrong answers during testing. Has only some practical skills and abilities.

Unsatisfactory – the student has fragmented and unsystematic knowledge, is unable to distinguish between the main and the secondary, makes mistakes in defining concepts, distorts their meaning, presents the material in a disorderly and uncertain manner, and makes more than 30% of erroneous answers during testing. Performs practical skills and abilities with gross errors.

Based on the results of different assessments, an average grade is given in favor of the student.

A student can claim to receive an “excellent” grade automatically if he/she has won a prize in disciplinary or interdisciplinary Olympiads (university, regional) and has an average grade for the current academic performance of at least 4.8. A student can refuse the “automatic” grade and take the exam together with the group on a general basis.

2.6. Independent work of students: in-class and out-of-class.

Independent classroom work of students.

The organization of independent classroom work of students is carried out with the help of methodological instructions for students, which contain educational goals, a list of the main theoretical questions for study, a list of practical work and the methodology for conducting it, instructions for the presentation of the results obtained, their discussion and conclusions, assignments for self-control with standard answers, a list of recommended literature.

From $^{1/4}$ to $^{1/2}$ of the practical lesson time is allocated for independent work of students: conducting research, recording results, discussing them, formulating conclusions, completing individual assignments. The preparatory stage, or the formation of an approximate basis for actions, begins with students outside of class time when preparing for a practical or seminar lesson, and is completed during the lesson. All subsequent stages are carried out during the lesson. The stage of materialized actions (solving situational problems) is carried out independently. The teacher, if necessary, provides consultation, provides assistance and simultaneously monitors the quality of students' knowledge and their ability to apply existing knowledge to solve assigned problems.

Extracurricular independent work of students.

No. p /p	**Topic of the practical lesson (seminar)**	**Time to prepare students to class**	**Forms of extracurricular independent work**	
			Mandatory and the same for all students	**At the student's choice**
1.	Introduction to the course of normal physiology.	2	Reading a text (textbook, lecture, additional literature), solving tests	Making notes on the topic

	Physiological properties and processes of excitable tissues			
2.	Physiology of the neuromuscular junction, skeletal and smooth muscles	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
3.	Final lesson (seminar) on the section "General physiology of excitable tissues"	3	Reading a text (textbook, lecture, additional literature); solving tests	Preparing a presentation for a seminar (1. Problems of fatigue 2. The theory of parabiosis), drawing up a summary on the topic
4.	The main types, principles, mechanisms and levels of regulation of physiological functions	2	Reading a text (textbook, lecture, additional literature); completing written homework; solving tests	Making notes on the topic
5.	Physiology of the nerve center.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
6.	Physiology of motor activity	2	Reading a text (textbook, lecture, additional literature); completing written homework; solving tests	Making notes on the topic
7.	Physiology of the autonomic nervous system	2	Reading a text (textbook, lecture, additional literature); completing written homework; solving tests	Making notes on the topic
8 .	Final lesson (seminar) on the sections "Regulation of body functions. Physiology of the central nervous system.	3	Reading a text (textbook, lecture, additional literature); solving tests, watching a film on the department's Moodle page	Preparing reports for presentation in class (1. Cybernetics and the central nervous system, 2. The influence of the cortex on vegetative functions), drawing up notes on the topic
9.	Physiology of endocrine glands.	3	Reading a text (textbook, lecture, additional literature); solving tests, completing written homework.	Preparing messages for a presentation in class (1. Regulation of calcium levels in the blood. 2. Regulation of glucose levels in the blood), video presentations , studying tables on the department's Moodle page ; Drawing up notes

				on the topic
10.	Erythrocyte and leUCocyte systems of blood	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic, viewing the material on the department's Moodle page
11.	Physicochemical properties of blood	2	Reading a text (textbook, lecture, additional literature); solving tests, watching a film on the department's Moodle page	Making notes on the topic
12.	External respiration	2	Reading a text (textbook, lecture, additional literature); solving tests, watching a film on the department's Moodle page	Completing written homework
13.	Regulation of breathing	2	Reading a text (textbook, lecture, additional literature, solving tests	Making notes on the topic
14.	Final lesson (seminar) on the sections “Physiology of the blood system” and physiology of respiration”.	3	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic, preparing a report for a presentation at a seminar (1. Donation is an honorable duty of a citizen. 2. Artificial blood)
15.	Physiological properties of the heart muscle. Single cycle of cardiac activity.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
16	Regulation of cardiac activity	2	Reading a text (textbook, lecture, additional literature); solving tests; completing written homework	Making notes on the topic
17.	Methods of studying cardiac activity	2	Reading a text (textbook, lecture, additional literature); solving tests, completing written homework	Making notes on topics, preparing a report for a speech (1. Echocardiography as a modern research method. 2. Heart transplantation and its alternative)
18	Physiology of blood vessels. Blood pressure and mechanisms of its regulation.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
19	Final lesson (seminar) on the	3	Reading a text (textbook, lecture, additional	Making notes on the topic

	section "Physiology of blood circulation"		literature); solving tests	
20.	Digestion in the oral cavity and stomach	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
21.	Digestion in the intestine. Motor activity and absorption functions of the digestive tract	2	Reading a text (textbook, lecture, additional literature); solving tests, completing written homework	Making notes on the topic
22.	Metabolic basis of physiological functions.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
23.	Excretory function of the kidneys and methods of its study	3	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic, watching films on the department's Moodle page
24.	Final lesson (seminar) on the sections “Physiology of digestion, metabolism and energy, excretion and thermoregulation"	3	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic, preparing a report for presentation at a seminar (1. Artificial kidney. 2. Proper nutrition as the basis of health)
25.	General properties and patterns of functioning of sensory systems (analyzers). Physiology of the visual analyzer.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
26.	Physiology of auditory, vestibular and cutaneous analyzers	2	Reading a text (textbook, lecture, additional literature); completing written homework; solving tests	Making notes on the topic
27.	Final lesson (seminar) on the section "Physiology of sensory systems (analyzers)".	3	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic, preparing a report for presentation at a seminar (1. Features of the visceral analyzer. 2. Physiology of the vomeronasal organ)
28.	Innate and acquired forms of behavior.	2	Reading a text (textbook, lecture, additional literature); solving tests	Making notes on the topic
29.	Physiological foundations of higher mental functions of man.	2	Reading a text (textbook, lecture, additional literature), solving tests	Making notes on the topic , studying materials on the department's Moodle

				page
30.	Final lesson (seminar) on the section "Physiology of higher nervous activity".	3	Reading a text (textbook, lecture, additional literature); solving tests	Completing written homework, Preparing a report for a presentation at a seminar (1. R. Sperry's contribution to the study of the brain. 2. Somnology as a modern science)
31	Practical Skills Test	3	Reading a text (textbook, lecture, methodological instructions, additional literature)	
32	Pre-exam testing	**2**	Reading a text (textbook, lecture, methodological instructions, additional literature)	
Total labor intensity (in hours)			**72**	

2.7. Research (project) work.

Students are given the opportunity to participate in the research work of the Department of Physiology “Experimental studies of physiological mechanisms of behavioral (rapid) adaptation in the conditions of a dynamically changing anthropogenic environment.”

Areas of work:

- mastering experimental methods for studying the behavior of laboratory animals;
- statistical processing of experimental results;
- collection and analysis of modern literature on physiological mechanisms of behavioral adaptation and other current issues of physiology.

The results of the work are reported at :

- meeting of the circle on normal physiology;
- the final student conference of the academy;
- student conference in foreign languages.

3. EDUCATIONAL, METHODOLOGICAL, MATERIAL, TECHNICAL AND INFORMATION SUPPORT OF THE DISCIPLINE:

3.1. Basic literature

1. Nozdrachev , A. D. Normal physiology : textbook / A. D. Nozdrachev , P. M. Maslyukov. - Moscow : GEOTAR-Media , 2023. - 1088 p . - ISBN 978-5-9704-7492-1. - Text : electronic // Electronic Library System "Student Consultant": [site]. - URL : https : // www.studentlibrary.ru/book/ISBN9785970474921.html (date accessed: 07.11.2024). - Access mode : by subscription.
2. Normal Physiology : in 2 volumes. Volume 1: textbook / edited by M. M. Lapkin, A. V. Kotov, V. I. Torshin . - Moscow : GEOTAR-Media , 2023. - 560 p. - ISBN 978-5-9704-7875-2 , DOI: 10.33029/9704-7875-2-NF1-2023-1-560. - The electronic version is available on the website of the Electronic Library System "Student Consultant" : [site]. URL: https://www.studentlibrary.ru/book/ISBN9785970478752.html (date of access: 07.11.2024). - Access mode: by subscription. - Text: electronic
3. Normal Physiology: in 2 volumes. Volume 2 : textbook / edited by M. M. Lapkin, A. V. Kotov, V. I. Torshin . - Moscow : GEOTAR-Media , 2023. - 544 p. - ISBN 978-5-9704-7876-9, DOI: 10.33029/9704-7876-9-NF2-2023-1-544. - The electronic version is

available on the website of the Electronic Library System "Student Consultant" : [site]. URL: https://www.studentlibrary.ru/book/ISBN9785970478769.html (date of access: 07.11.2024). - Access mode: by subscription. - Text: electronic

3.2 Further reading

1. Normal Physiology. Guide to Practical Classes / S. S. Pertsov, N. D. Sorokina, V. P. Degtyarev [et al.]. - Moscow: GEOTAR-Media , 2024. - 400 p. - ISBN 978-5-9704-8247-6, DOI: 10.33029/9704-8247-6-NPH-2024-1-400. - Electronic version is available on the website of the Electronic Library System "Student Consultant" : [site]. URL: https://www.studentlibrary.ru/book/ISBN9785970482476.html (date accessed: 10/29/2024). - Access mode: by subscription. - Text: electronic
2. Human anatomy and physiology. Illustrated textbook / edited by I. V. Gaivoronsky . - Moscow: GEOTAR-Media , 2025. - 672 p. - ISBN 978-5-9704-8833-1. -Text: electronic // Electronic Library System "Student Consultant": [website]. - URL: https://www.studentlibrary.ru/book/ISBN9785970488331.html (accessed: 09/06/2024). - Access mode: by subscription.
3. Sudakov, K. V. Human physiology. Atlas of dynamic schemes: a textbook / K. V. Sudakov [et al.]; edited by K. V. Sudakov. - 2nd ed. , corr . and add. - Moscow: GEOTAR-Media , 2020. - 416 p .: ill. - 416 p. - ISBN 978-5-9704-5880-8. - Text : electronic // Electronic Library System "Student Consultant": [website]. - URL : https :// www.studentlibrary.ru / book /ISBN9785970458808.html (accessed: 08.11.2024). - Access mode : by subscription.
4. Physiology of the sphincter-valve apparatus of the digestive system: a teaching aid / compiled by S. N. Tsybusov [et al.]. - Nizhny Novgorod : Lobachevsky State University of Nizhny Novgorod, 2022. - 38 p. - Text : electronic // Lan: electronic library system. - URL: https://e.lanbook.com/book/283175 (accessed: 12.12.2022). - Access mode: for authorized users.
5. Physiology of the cardiovascular system and respiration: a teaching aid / compiled by A. V. Deryugina , M. A. Shabalin. - Nizhny Novgorod : NNSU named after N. I. Lobachevsky, 2021. - 47 p. - Text: electronic // Lan : electronic library system. - URL: https://e.lanbook.com/book/191670 (date of access: 12.12.2022). - Access mode: for authorized users.
6. Deriugina , A. V. Electrophysiology. Physiology of excitable tissues: a teaching aid / A. V. Deriugina , M. A. Shabalin. - Nizhny Novgorod : NNSU named after N. I. Lobachevsky, 2020. - 80 p. - Text : electronic // Lan: electronic library system. - URL: https://e.lanbook.com/book/191666 (date of access: 12.12.2022). - Access mode: for authorized users.
7. Degtyarev, V. P. Normal Physiology. Typical Test Tasks : A Tutorial / edited by V. P. Degtyarev. - Moscow: GEOTAR-Media , 2020. - 528 p. - ISBN 978-5-9704-5280-6. - Text : electronic // Electronic Library System "Student Consultant": [website]. - URL : HYPERLINK "https://www.studentlibrary.ru/book/ISBN9785970452806.html"https : // www.studentlibrary.ru/book/ISBN9785970452806.html (accessed: 08.11.2024). - Access mode : by subscription.
8. Physiology of nerves and muscles. Physiology of the central nervous system : a teaching aid / compiled by A. V. Deryugina , M. A. Shabalin. - Nizhny Novgorod : NNSU named after N. I. Lobachevsky, 2019. - 41 p. - Text : electronic // Lan: electronic library system. - URL: https://e.lanbook.com/book/144823 (date of access: 12.12.2022). - Access mode: for authorized users.

3.3. Educational and methodological support for the discipline, prepared by the department staff

1. Grigoriev N.R. Higher functions of the brain and the basics of behavioral physiology. (Selected lectures). Textbook. - Blagoveshchensk, 2006.

2. Grigoriev N.R. Physiology of respiration. P. 50 – 72. Chapter from the book by S.S. Tseluyko et al. “Respiratory system”. Study guide. Blagoveshchensk, 2011. – 126 p.
3. Dorovskikh V.A., Batalova T.A., Sergievich A.A., Urazova G.E. " Glucocorticoids : from theory to practice." Blagoveshchensk, 2007.
4. Dorovskikh V.A., Batalova T.A., Sergievich A.A., Urazova G.E. "Nitrogen oxide in chemistry, biology and medicine." Blagoveshchensk, 2008.
5. "Methods of studying physiological functions" (Study manual). N.R. Grigoriev, G.E. Cherbikova, E.F. Kirichenko. Blagoveshchensk, 2006, 2010.
6. Course "Normal Physiology" on the Moodle portal https://educ-amursma.ru/course/view.php?id=135
7. Methodological instructions for students for practical classes in sections:

6.1. "Physiology of excitable tissues and physiology of the central nervous system"
6.2. "Physiology of respiration and physiology of the blood system"
6.3. "Physiology of blood circulation"
6.4. "Physiology of metabolism and energy, digestion and excretion."
6.5. "Physiology of sensory systems (analyzers) and physiology of higher nervous activity"

Multimedia materials, electronic library

1. Computer program "Physiology Simulator".
2. Multimedia materials on electronic media:
1. "Physiology of the nerve cell
2. “Physiology of the central nervous system”
3. "Physiology of the autonomic nervous system"
4. "Physiology of motivations and emotions"
5. "Physiology of excretion"
6. "Physiology of thermoregulation"
7. "Methodology of operations on the organs of the digestive tract"
8. "Motor function of the digestive tract"
9. Demonstration of experiments on studying the cognitive abilities of rats in a problem chamber.

Electronic library:

1. Lectures for students. 2nd year. Physiology.
2. Orlov R.S., Nozdrachev A.D. Normal Physiology (supplement to the textbook). Moscow, 2006.
3. Physiology with the basics of morphology. / Comp. K.V. Sudakov. Moscow, Publishing House "Russian Doctor", 2005.
1. Modern course of classical physiology. / Ed. Yu.V. Natochina , V.A. TkachUC. – M., GOETAR – Media, 2007.

Electronic student library: http:// studentlibrary.ru /ru/index.html

1. Modern course of classical physiology. Selected lectures. Edited by Yu. V. Natochin , V. A. TkachUC. - M.: GOETAR-Media, 2007. – 384 p. - ISBN 978-5-9704-0495-9 – Access mode: http:// studentlibrary.ru /book/ISBN9785970404959.html
2. Sudakov K.V., Andrianov V.V., Vagin Yu.E., Kiselev I.I. Human Physiology: Atlas of Dynamic Systems. / Edited by K.V. Sudakov. 2009. – 416 p. - ISBN 978-5-9704-1394-4 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970413944.html
3. R.S. Orlov, A.D. Nozdrachev . Normal Physiology / M., 2010. – 832 p. - ISBN 978-5-9704-1662-4 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970416624.html
4. Normal Physiology: textbook. / Edited by K.V. Sudakov. 2012. – 880 p. - ISBN 978-5-9704-1965-6 .- Access mode: https://www.studentlibrary.ru/book/ISBN9785970419656.html

5. Normal Physiology : textbook / S.M. Budylina [et al.]; edited by V.P. Degtyarev, S.M. Budylina . - M .: GEOTAR-Media, 2012. - ISBN 978-5-9704-2144-4 . Access mode: http:// studentlibrary.ru /book/ISBN9785970421444.html .
6. Physiology: a guide to experimental work: textbook . n individual / edited by A. G. Kamkin, I. S. Kiseleva. - M .: GEOTAR-Media, 2011. - 384 p.: ill - ISBN 978-5-9704-1777-5 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970417775.html
7. Atlas of Physiology. In two volumes. Volume 1: study guide / Kamkin A.G., Kiseleva I.S. - M .: GEOTAR-Media, 2013. - 408 p. - ISBN 978-5-9704-2418-6 . - Access mode: http:// studentlibrary.ru /book/ISBN9785970424186.html
8. Atlas of Physiology. In two volumes. Volume 2: study guide / Kamkin A.G., Kiseleva I.S. - M .: GEOTAR-Media, 2013. - 448 p. - ISBN 978-5-9704-2419-3 . Access mode: http:/ studentlibrary.ru u/book/ISBN9785970424193.html
9. Normal Physiology: textbook. / Ed. B.I. Tkachenko. - M.: GOETAR - Media, 2014. - 688 p. - ISBN 978-5-9704-2861-0 . –Access mode: http:// studentlibrary.ru /book/ISBN9785970428610.html
10. Normal Physiology. Typical Test Tasks: Study Guide / edited by V.P. Degtyarev. - M.: GOETAR - Media, 2014. – 672 p. - ISBN 978-5-9704-2932-7 . - Access mode: http:// studentlibrary.ru /book/ISBN9785970429327.html
11. Normal Physiology: textbook. / Edited by K.V. Sudakov. - M.: GOETAR - Media, 2015. - 880 p. - ISBN 978-5-9704-3528-1 – Access mode: http:// studentlibrary.ru /book/ISBN9785970435281.html
12. Normal physiology with a course in physiology of the maxillofacial region: textbook / Ed. by V.P. Degtyarev, S.M. Budylina . - M .: GEOTAR-Media, 2015. - 848 p. - ISBN 978-5-9704-3351-5 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970433515.html
13. Normal Physiology: textbook. / Edited by L.Z. Tel, N.A. Agadzhanyan . – M.: Litterra , 2015. – 768 p. - ISBN 978-5-4235-0167-9 . – Access mode: http:// studentlibrary.ru /book/ISBN9785423501679.html
14. Sudakov K.V., Andrianov V.V., Vagin Yu.E., Kiselev I.I. Human Physiology: Atlas of Dynamic Systems. / Ed. by K.V. Sudakov. Moscow: GEOTAR-Media, 2015. – 416 p. - ISBN 978-5-9704-3234-1 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970432341.html
15. Normal Physiology : textbook / V.B.Brin [et al.]; edited by B.I. Tkachenko. - 3rd ed., corrected . and add. - M.: GEOTAR-Media, 2016. - 688 p.: ill. - ISBN 978-5-9704-3664-6 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970436646.html
16. Normal Physiology : textbook / V. P. Degtyarev, N. D. Sorokina. - M .: GEOTAR-Media, 2016. - 480 p.: ill. - ISBN 978-5-9704-3547-2 . – Access mode: http:// studentlibrary.ru /book/ISBN9785970435472.html

3.4. Equipment used for the educational process.

1. Computer complex Bio pac Student Lab – 1 pc.
2. Multimedia projector – 1 pc.
3. Personal computers – 13 pcs.
4. Laptops – 2 pcs.
5. Behavioural testing chamber – 1
6. Raised Plus Maze – 1 pc.
7. Henderson installation – 1 pc.

8. Open Field Installation - 1 pc.
9. Microscopes – 10 pcs.
10. Neurological hammers - 12 pcs.
11. Tuning forks – 12 pcs.
12. Tonometers – 11 pcs.
13. Stethoscopes – 11 pcs.
14. Electrocardiographs – 5 pcs.
15. Pneumotachometers – 2 pcs.
16. Peak flow meters – 3 pcs.
17. Spirograph – 1 pc.
18. Spirometers - 4 pcs.
19. Perimeter – 1 pc.
20. Deadlift dynamometer – 1 pc.
21. Wrist dynamometer – 1 pc.
22. Laboratory glass - miscellaneous

Visual aids: 1. Educational stands "Digestion",
"Higher nervous activity"
"Physiology of blood circulation and respiration"
"Basic physiological constants"
"Domestic physiologists"
"Foreign Physiologists"
"Pain. Physiology of pain relief",
"Educational and methodological work".
2. Educational tables – 240.

3.5 Professional databases, information and reference systems, electronic educational resources

Resource name	Resource Description	Access	Resource address
Electronic library systems			
"Student consultant. Electronic library of the medical university"	For students and teachers of medical and pharmaceutical universities. Provides access to electronic versions of textbooks, teaching aids and periodicals.	Remote access after registration under the university profile	https://www.studentlibrary.ru/
Reference and information system " MedBaseGeotar ".	The reference and information system " MedBaseGeotar " is intended for practicing medical specialists, researchers, teachers, postgraduate students, residents, senior students, and healthcare managers for the rapid search, selection, and reading of medical literature necessary for work in a single data source.	Remote access after registration under the university profile	https://mbasegeotar.ru/pages/index.html
EBS « Bookup »	Large medical library - information and educational platform for the joint use of electronic educational, educational and methodological publications of medical universities of Russia and the CIS countries	Remote access after registration under the university profile	https://www.books-up.ru/
EBS "Lan"	Network electronic library of medical universities - an electronic database of educational and scientific works on medical topics, created for the purpose of implementing network forms of professional educational programs, open access to educational materials for partner universities	Remote access after registration under the university profile	https://e.lanbook.com/
Scientific electronic library " CyberLeninka "	CyberLeninka is a scientific electronic library built on the paradigm of open science (Open Science), the main objectives of which are the	free access	https://cyberleninka.ru/

	popularization of science and scientific activity, public control over the quality of scientific publications, the development of interdisciplinary research, a modern institute of scientific review, increasing the citation of Russian science and building a knowledge infrastructure. Contains more than 2.3 million scientific articles.		
Oxford Medicine Online	A collection of Oxford medical publications, bringing together over 350 titles into a single, cross- searchable resource . P ublications include The Oxford Handbook of Clinical Medicine and The Oxford Textbook of Medicine , the electronic versions of which are constantly updated.	free access	http://www.oxfordmedicine.com
Human Biology Knowledge Base	Reference information on physiology , cell biology , genetics , biochemistry , immunology , pathology . (Resource of the Institute of Molecular Genetics of the Russian Academy of Sciences .)	free access	http://humbio.ru/
Medical online library	Free reference books, encyclopedias, books, monographs, abstracts, English-language literature, tests.	free access	https://www.medlib.ru/library/library/books
Information systems			
Clinical Guidelines Rubricator	A resource of the Russian Ministry of Health that contains clinical recommendations developed and approved by medical professional non-profit organizations of the Russian Federation, as well as methodological guidelines, nomenclatures and other reference materials.	link to download the application	https://cr.minzdrav.gov.ru/#!/
Federal Electronic Medical Library (FEMB)	The Federal Electronic Medical Library is part of the unified state information system in the field of healthcare as a reference system **. The** Federal Electronic Medical Library was created on the basis of the funds of the Central Scientific Medical Library named after I.M. Sechenov.	free access	https://femb.ru/
Russian Medical Association	Professional Internet resource. Objective: to promote effective professional activity of medical personnel. Contains the charter, personnel, structure, rules of entry, information about the Russian Medical Union.	with free access	http://www.rmass.ru/
Web-medicine	The site presents a catalog of professional medical resources, including links to the most authoritative subject sites, journals, societies, as well as useful documents and programs. The site is intended for doctors, students, employees of medical universities and scientific institutions.	with free access	http: // webmed.irkutsk.ru /
Databases			
World Health Organization	The site contains news, statistics on countries that are members of the World Health Organization, fact sheets, reports, WHO publications and much more.	free access	http://www.who.int/ru/
Ministry of Science and Higher Education of the Russian Federation	The website of the Ministry of Science and Higher Education of the Russian Federation contains news, newsletters, reports, publications and much more	free access	http://www.minobrnauki.gov.ru
Ministry of Education of the Russian Federation	The website of the Ministry of Education of the Russian Federation contains news, newsletters, reports, publications and much more	free access	https://edu.gov.ru/

Federal portal "Russian education"	A single window for access to educational resources. This portal provides access to textbooks on all areas of medicine and health care.	free access	http: // www . edu.ru /
Polpred.com	Electronic library system Business media. Media Review	free access	https://polpred.com/news
Bibliographic databases			
Database "Russian Medicine"	It is created in the Central Scientific and Methodological Library and covers the entire collection, starting from 1988. The database contains bibliographic descriptions of articles from domestic journals and collections, dissertations and their abstracts, as well as domestic and foreign books, collections of institute proceedings, conference materials, etc. Thematically, the database covers all areas of medicine and related areas of biology, biophysics, biochemistry, psychology, etc.	free access	https://rucml.ru/
PubMed	Text base medical and biological publications in English. The PubMed database is an electronic search engine with free access to 30 million publications from 4,800 indexed journals on medical topics. The database contains articles published from 1960 to the present day, including information from MEDLINE, PreMEDLINE , NLM. Each year, the portal is replenished with more than 500 thousand new works.	free access	https :// pubmed . ncbi . nlm . nih . gov /
eLIBRARY.RU	eLIBRARY.RU platform provides electronic versions of more than 2,000 Russian scientific and technical journals, including more than 1,000 open access journals.	Full functionality of the site is available after registration	http://elibrary.ru/defaultx.asp
Electronic library of dissertations (RSL)	Currently, the Electronic Library of Dissertations of the Russian State Library contains more than 919,000 full texts of dissertations and abstracts.	free access	http://diss.rsl.ru/?menu=disscatalog/
Medline .r u	Medical and biological portal for specialists. Biomedical journal.	with free access	https://journal.scbmt.ru/jour/index
Official Internet portal of legal information	The single official state information and legal resource in Russia	free access	http://pravo.gov.ru/

3.6. Licensed and freely distributed software used in the educational process

List of software (commercial software products)

No. p / p	List of software (commercial software products)	Details of supporting documents
1.	Operating system MSWindows 7 Pro	License number 48381779
2.	Operating system MSWindows 10 Pro	AGREEMENT No. UT-368 dated 09.21.2021
3 .	MS Office	License number: 43234783, 67810502, 67580703, 64399692, 62795141, 61350919
4.	Kaspersky Endpoint Security for business – Standard Russian	Agreement No. 7 AA dated 02/07/2025

	Edition . 50-99 Node 1 year Educational Renewal License	
5.	1C Accounting and 1C Salary	LICENSE AGREEMENT 612/L dated 02.02.2022 (additional licenses)
6.	PROF University	LICENSE AGREEMENT No. KrTsB-004537 dated 12/19/2023
7.	PROF Library	LICENSE AGREEMENT No. 2281 dated 11.11.2020
8.	Consultant Plus	Contract No. 41AA dated 12/27/2024
9.	Contour .Tolk	Agreement No. K213753/24 dated 13.08.2024
10.	E-learning environment 3KL(Russian Moodle)	Agreement No. 1362.5 dated November 20, 2024
11.	Astra Linux Common Edition	Agreement No. 142 A dated September 21, 2021
12.	Information system "Plans"	Agreement No. 2873-24 dated June 28, 2024
13.	1C: Document Management	Agreement No. 2191 dated 10/15/2020
14.	R7-Office	Agreement No. 2 KS dated 12/18/2020
15.	License "OS ROSA CHROME workstation"	Agreement No. 88A dated 08/22/2024
16.	Alt Virtualization Server 10 (for secondary specialized and higher professional education)	Agreement No. 14AK dated 09/27/2024
17.	Dr.Web Desktop Security Suite Comprehensive protection + Control Center for 12 months.	Agreement No. 8 dated October 21, 2024
18.	Software "Schedule for educational institutions"	Agreement No. 82A dated July 30, 2024

List of freely distributed software

No. p / p	List of freely distributed software	Links to license agreement
1.	Browser " Yandex "	Freely distributed License agreement for the use of Yandex Browser programs https://yandex.ru/legal/browser_agreement/
2.	Yandex.Telemost	Freely distributed License Agreement for the Use of Programs https://yandex.ru/legal/telemost_mobile_agreement/
3.	Dr.Web CureIt !	Freely distributed License Agreement: https://st.drweb.com/static/new-www/files/license_CureIt_ru.pdf
4.	OpenOffice	Freely distributed License: http://www.gnu.org/copyleft/lesser.html
5.	LibreOffice	Freely distributed License: https://ru.libreoffice.org/about-us/license/
6.	VK Calls	Freely distributed https://vk.com/license
7.	Kaspersky Free Antivirus	Freely distributed https://products.s.kaspersky-labs.com/homeuser/Kaspersky4Win2021/21.16.6.467/english-0.207.0/3830343439337c44454c7c4e554c4c/kis_eula_en-in.txt

3.7. Resources of the information and telecommunications network "Internet"

1) the page "Normal Physiology" on the Moodle portal https://educ-amursma.ru/course/view.php?id=884
2) Электронный адрес библиотеки https://amurgma.ru/ Амурской ГМА obuchenie/biblioteki/biblioteka-amurskoy-gma/
3) https://www.brainfacts.org/
4) the department page on the academy website https://amurgma.ru/obuchenie/kafedry/teoreticheskie/fiziologiya-i-patofiziologiya/
5) the department page on the closed part of the site https://amurgma.ru/zakrytaya-chast-sayta/2-kurs/

4. ASSESSMENT TOOLS FUND

4.1. Test tasks for current and final control

Incoming inspection

Conducted in the Moodle system
https://educ-amursma.ru/mod/quiz/view.php?id=3173
number of questions - 51

Current control

Conducted in the Moodle system
Muscle Physiology https://educ-amursma.ru/mod/quiz/view.php?id=21200
number of questions - 18
Regulation of body functions
https://educ-amursma.ru/mod/quiz/view.php?id=18573
number of questions - 36
Properties of nerve centers
https://educ-amursma.ru/mod/quiz/view.php?id=18869
number of questions – 35
Physiology of motor activity
https://educ-amursma.ru/mod/quiz/view.php?id=21199
number of questions – 28
Physiology of the autonomic nervous system
https://educ-amursma.ru/mod/quiz/view.php?id=19086
number of questions – 11
Physiology of endocrine glands
https://educ-amursma.ru/mod/quiz/view.php?id=19284
number of questions – 42
Erythrocyte and leUCocyte systems of blood
https://educ-amursma.ru/mod/quiz/view.php?id=19518
number of questions – 60
Physicochemical properties of blood
https://educ-amursma.ru/mod/quiz/view.php?id=19583
number of questions – 46
External respiration
https://educ-amursma.ru/mod/quiz/view.php?id=19697
number of questions – 55
Regulation of breathing
https://educ-amursma.ru/mod/quiz/view.php?id=19848
number of questions – 62
Myocardium. Cardiac cycle
https://educ-amursma.ru/mod/quiz/view.php?id=20004
number of questions – 64
Regulation of the heart
https://educ-amursma.ru/mod/quiz/view.php?id=20069
number of questions – 31
Methods of studying cardiac activity
https://educ-amursma.ru/mod/quiz/view.php?id=20142
number of questions – 26
Physiology of blood vessels. Blood pressure
https://educ-amursma.ru/mod/quiz/view.php?id=20192
number of questions – 54
Digestion in the mouth and stomach
https://educ-amursma.ru/mod/quiz/view.php?id=20833

number of questions – 52

Digestion in the intestine. Motor and absorption functions

https://educ-amursma.ru/mod/quiz/view.php?id=13400

number of questions 40

Metabolic bases of physiological functions

https://educ-amursma.ru/mod/quiz/view.php?id=13722

number of questions – 49

Excretory function of the kidneys

https://educ-amursma.ru/mod/quiz/view.php?id=13731

number of questions – 69

General properties and patterns of functioning of sensory systems (analyzers). Physiology of the visual analyzer.

https://educ-amursma.ru/mod/quiz/view.php?id=14688

number of questions – 73

Physiology of auditory, vestibular, cutaneous analyzers

https://educ-amursma.ru/mod/quiz/view.php?id=14790

number of questions – 61

Innate and acquired forms of behavior

https://educ-amursma.ru/mod/quiz/view.php?id=14797

number of questions – 78

Physiological bases of human mental functions

https://educ-amursma.ru/mod/quiz/view.php?id=14798

number of questions – 96

Border control

Conducted in the Moodle system

Physiology of excitable tissues, CNS

https://educ-amursma.ru/mod/quiz/view.php?id=4658

number of questions – 155

Physiology of blood. Physiology of respiration.

https://educ-amursma.ru/mod/quiz/view.php?id=5396

number of questions - 131

Circulation

https://educ-amursma.ru/mod/quiz/view.php?id=7136

number of questions – 163

Final test "Physiology of digestion, metabolism and energy, excretion"

https://educ-amursma.ru/mod/quiz/view.php?id=14396

number of questions – 127

Final "Physiology of analyzers"

https://educ-amursma.ru/mod/quiz/view.php?id=14414

number of questions – 175

Final "Physiology of Higher Nervous Activity"

https://educ-amursma.ru/mod/quiz/view.php?id=14449

number of questions – 160

Final testing

https://educ-amursma.ru/mod/quiz/view.php?id=8718

number of questions – 434

Conducted in the Moodle system

4.2. Situational tasks, exercises, etc.

Problem 1. A suprathreshold stimulus was applied to the frog's heart during systole. Will an extra heartbeat occur or not? Why?

Standard answer: An extra heartbeat will not occur, since the heart is in a state of absolute refractoriness throughout the systole .

Problem 2. A simulated feeding experiment is performed on a hungry esophagotomized dog. What will determine the duration of the meal under these conditions?

Sample answer: Since the animal does not become satiated, the duration of the meal will be determined by how quickly the dog's chewing muscles become fatigued.

Problem 3. An experimental animal has decreased diuresis. At the same time, its blood was found to have a vasoconstrictive effect. Explain the mechanism by which low diuresis occurs.

Sample answer. The hormone vasopressin (ADH) has both a vasoconstrictor and reabsorbing effect in high concentrations. Consequently, the animal has increased secretion of this hormone by the posterior pituitary gland.

Full set of tasks – see appraisal fund of the current certification

4.3. List of practical skills that a student should possess after mastering the discipline.

List of basic clinical and physiological methods to be mastered by students at the KNOWLEDGE level

1. Determination of osmotic resistance of erythrocytes.
2. Technique of blood collection.
3. Determination of hematocrit.
5. Determination of blood clotting time and bleeding cessation.
6. Electrocardiography.
7. Phonocardiography.
9. Phase analysis of the cardiac cycle.
10. Determination of blood circulation time.
11. Cardiac output study.
12. Sphygmography.
13. Determination of the pulse wave propagation velocity.
14. Blood method of recording blood pressure.
15. Plethysmography.
16. Rheography.
17. Thermometry.
18. Spirometry.
19. Study of gastrointestinal tract motility.
20. Study of digestion and absorption in the gastrointestinal tract.
21. Methods for studying salivation in animals and humans.
22. Study of human energy expenditure.
23. Principles of preparing food rations.
24. Methods for quantitative assessment of urine formation mechanisms (clearance of various substances).
25. Methods for assessing the functions of human endocrine glands.
26. Stereotactic method.
27. Electroencephalography.
28. Audiometry.
29. Study of taste sensitivity.
30. Esthesiometry .
31. Electromyography.
32. Chronaximetry.
33. Methodology for developing conditioned reflexes.
34. Testing human psychological properties.

List of physiological techniques to be mastered by students at the SKILL level

1. Clinical blood test:
   1.1. Determination of hemoglobin.
   1.2. Red blood cell count.
   1.3. Leucocyte count.
   1.4. Determination of blood groups in the AB0 system.
   1.5. Determination of the Rh factor of blood.
   1.6. Determination of ESR.
2. Palpation of the pulse rate.
3. Determination of blood pressure by indirect method.
4. Analysis of the electrocardiogram of a healthy person.
5. Spirometry.
6. Pneumotachometry .
7. Dynamometry.
8. Study of proprioceptive reflexes.
9. Determination of visual acuity.
10. Perimetry.
11. Study of color vision.
12. Weber and Rinne auditory tests
13. Study of binaural hearing.
14. Listening to heart sounds
15. Determination of blood clotting time and bleeding duration
16. Study of pupillary response to light.

4.4. List of examination questions

Section 1. General physiology.

1. The role of I.M. Sechenov and I.P. Pavlov in the creation of materialistic foundations in physiology. The principle of nervism.
2. The concept of the norm and health. Physiology as a scientific basis for diagnosing health and predicting the functional state and performance of the body.
3. Levels of regulation of functions. Types and mechanisms of regulation. The concept of self-regulation .
4. Reflex principle of the nervous system activity. History of the development of the doctrine of the reflex. Philosophical principles of the reflex theory. Definition of the reflex. Structural basis of the reflex, characteristics of its components.
5. The doctrine of P.K. Anokhin on functional systems and self-regulation of functions. Classification of functional systems. Basic diagram of a homeostatic functional system and analysis of its elements.
6. Age-related features of formation and regulation of physiological functions. Systemogenesis .
7. Types of humoral regulation, characteristics and classification of physiologically and biologically active substances. The relationship between nervous and humoral mechanisms of regulation.
8. The concept of homeostasis and homeokinesis . Principles of self-regulation of the constancy of the internal environment of the body.
9. Structure and functions of excitable membranes. Ion channels of membranes. Ion gradients of the cell, mechanisms of their formation.
10. Irritability, excitability as the basis of tissue reaction to irritation. Irritants, their types and characteristics. Other physiological properties of excitable tissues.

11. Membrane potentials, their classification. Resting potential and the mechanism of its occurrence.
12. Action potential, its phases and biophysical mechanisms of origin.
13. Excitability. Excitability measures. Electrophysiological mechanisms of excitability changes. Relationship of excitability phases with action potential phases.
14. Laws of irritation of excitable tissues.
15. Mechanism of excitation conduction along myelinated and unmyelinated nerve fibers. Functional classification of nerve fibers. Laws of excitation conduction along various excitable tissues.
16. Structure and classification of synapses. Mechanism of excitation transmission in synapses (electrical and chemical). Ionic mechanisms of formation of postsynaptic potentials. Features of structure and excitation transmission in neuromuscular synapses.
17. Modern theory of muscle contraction and relaxation. Physical and physiological properties of muscles. Types of muscle contractions. Strength and work of muscles.
18. Single muscle contraction and its phases. Tetanus and its types. Optimum and pessimum of stimulation frequency. Lability.
19. Motor units, their classification. The mechanism of occurrence of tetanus in natural conditions.
20. Features of the structure and functions of smooth muscles.
21. Neuron as a structural and functional unit of the central nervous system. Classification of neurons, their functional structures. Mechanism of excitation. Integrative function of the neuron.
22. Types of neural circuits and the basic principles of excitation propagation along them. Types of irradiation and convergence of the excitation process.
23. Broad and narrow concepts of the nerve center and its basic physiological properties.
24. Inhibition in the central nervous system, its types and mechanisms.
25. Modern concepts of the integrative activity of the central nervous system. Interaction between different levels of the central nervous system in the process of regulating the body's functions. General principles of the coordination activity of the central nervous system.
26. The main functions of the spinal cord and their morphofunctional characteristics. Skin and tendon reflexes in humans, their clinical significance. The main spinal autonomic reflexes.
27. Spinal mechanisms of regulation of muscle tone and phase movements. The role of proprioceptive reflex arcs in self-regulation of these functions.
28. Supraspinal mechanisms of muscle tone regulation. Decerebrate rigidity and the mechanism of its occurrence.
29. Static and statokinetic reflexes (R. Magnus). Self-regulatory mechanisms for maintaining body balance.
30. The reticular formation of the brainstem and its descending influence on the reflex activity of the spinal cord.
31. Ascending activating influence of the reticular formation of the brainstem on the cerebral cortex. Participation of the reticular formation in the formation of the integral activity of the organism.
32. Physiology of the cerebellum and its influence on the motor and vegetative functions of the body. Impaired motor function in case of cerebellar damage.
33. The limbic system of the brain. Papes' circles , their role in the formation of motivations and emotions.
34. Hypothalamus. The role of the hypothalamus in the integration of vegetative, somatic and endocrine functions of the body, its relation to the organization of motivations, emotions, biorhythms.
35. Modern concepts of localization of functions in the cerebral cortex. Dynamic localization of functions.
36. Comparative characteristics of the somatic and autonomic nervous system.

37. Comparative morpho-functional characteristics of the sympathetic and parasympathetic divisions of the autonomic nervous system. Synergism and antagonism of their effects. The concept of adrenergic and cholinergic receptors.
38. Hormones, their characteristics, mechanisms of action at the cellular level. Self-regulation of the endocrine system
39. Hormonal regulation of calcium levels in the blood.
40. Hormonal regulation of blood glucose levels.
41. Physiology of the adrenal glands. The role of hormones of the cortex and medulla in regulating body functions.
42. Hormones of the pituitary gland, its functional connections with the hypothalamus and endocrine glands.
43. The hypothalamic-pituitary system, its role in the adaptation of the body to changes in the external environment.
44. Physiology of the thyroid gland.
45. Sex glands. Male and female sex hormones and their physiological role in the formation of sex and regulation of reproduction processes.

Section 2. Special physiology.

1. Characteristics of the physiological properties of the myocardium and the processes determined by these properties.
2. Action potential of cardiomyocytes and cells of the cardiac conduction system (pacemakers). Mechanism of automaticity .
3. The heart and its hemodynamic function. The cardiac cycle and its main phases. Systolic and minute blood volumes.
4. Phase analysis of heart function.
5. Electromechanical coupling in the myocardium, the relationship between the phases of excitation, excitability and contraction. Extrasystole.
6. Self-regulation of cardiac activity. Myogenic and neurogenic mechanisms of self-regulation .
7. Reflex regulation of cardiac activity and its types. Intrinsic and associated reflexes of the heart, their characteristics.
8. Humoral regulation of cardiac activity. What regulatory mechanisms are disrupted during heart transplantation?
9. Basic laws of hemodynamics and their use to explain the movement of blood through the vessels. Various sections of the vascular bed and their functional significance in hemodynamics.
10. Blood pressure and hemodynamic factors determining the optimal value of arterial and venous pressure. Physiological bases and causes of hypertension. Age-related changes in the contractile function of the myocardium, arterial and venous pressure.
11. Capillary blood flow and its features. Microcirculation and its role in the mechanism of exchange of fluid and various substances between blood and tissues.
12. Features of cerebral, pulmonary and coronary circulation.
13. Lymphatic system. Lymph formation , its mechanisms. Functions of lymph and features of lymph formation and lymph outflow .
14. Myogenic, nervous and humoral mechanisms of vascular tone regulation. Vasomotor center, its efferent influences.
15. Blood pressure as a plastic constant of the organism. Analysis of peripheral and central components of the functional system of self-regulation of blood pressure.
16. Respiratory function of the human body and its components. Mechanism of external respiration. Biomechanics of inhalation and exhalation. Mechanism of respiratory failure in pneumothorax.

17. Gas exchange in the lungs. Partial pressure of gases (O_2 and CO_2) in the alveolar air and gas tension in the blood. Oxygen capacity of the blood. Oxygen transport by the blood. Oxygen hemoglobin dissociation curve.
18. Gas exchange in tissues. Gas tension (O_2 and CO_2) in tissue fluid and cells. Carbon dioxide transport by blood. The importance of carbonic anhydrase.
19. The respiratory center, modern ideas about its structure and localization. Its cellular composition and automaticity .
20. Mechanisms of respiratory rhythm formation and its reflex self-regulation . Chemo- and mechanoreceptor circuits of respiratory rhythm regulation.
21. Functional system that ensures the constancy of blood gas constants. Analysis of its elements.
22. Breathing under conditions of low and high atmospheric pressure. Analysis of the causes that ensure its changes.
23. Blood, its properties and functions. Electrolyte composition of blood plasma. Osmotic pressure. Functional system that ensures the constancy of the osmotic pressure of the blood.
24. Blood plasma proteins, their quantitative and qualitative characteristics and functional significance. Oncotic pressure and its role.
25. Acid-base balance and the functional system that maintains its constancy.
26. Red blood cells and their functions. Functional system of regulation of the number of red blood cells in the blood. Morphofunctional system of erythron . Processes of hematopoiesis and hematodestruction.
27. Types of hemoglobin, its compounds, their physiological significance. Hemolysis, its types and mechanisms.
28. LeUCocytes, their quantitative and qualitative characteristics. Functions of different types of leUCocytes. Physiological bases of immunity, T and B lymphocytes .
29. Stopping bleeding (hemostasis) and its stages. Platelets, quantitative characteristics and functions.
30. General characteristics of the coagulation and anticoagulation systems of blood, ensuring its optimal state of aggregation.
31. Physiological immune systems of blood. Blood groups and Rh factor. Rules of blood transfusion.
32. Digestion in the oral cavity. Salivation and its regulation.
33. Digestion in the stomach. Quantitative and qualitative characteristics of gastric juice. Neurohumoral regulation of gastric secretion. Appetite gastric juice and its importance
34. Motor function of the stomach and types of its motor activity. Neurohumoral regulation of gastric motility.
35. Exocrine function of the pancreas. Pancreatic juice, its daily quantity and qualitative composition. Neurohumoral regulation of pancreatic secretion.
36. Digestion in the small intestine. Composition and properties of intestinal juice. Cavity and membrane hydrolysis of nutrients in the small intestine.
37. Liver as a multifunctional organ. The role of the liver in digestion. Bile formation and bile secretion, their neurohumoral regulation.
38. Motility of the small and large intestines, its types and mechanisms of regulation. The importance of motility for absorption and secretory function of the intestine
39. The large intestine and its functions. Digestion in the large intestine. The act of defecation and its mechanism.
40. Absorption of substances in different parts of the digestive tract. Types and mechanisms of absorption.
41. Functional nutrition system that ensures the optimal level of nutrients in the blood, its external and internal regulation circuits. Food motivation. Physiological mechanisms of hunger and satiety.
42. Endocrine function of the gastrointestinal tract and its participation in the regulation of its motility, secretion and the body as a whole.

43. The functional system of excretion and its executive elements ensure the constancy of the internal environment of the body.
44. The kidney and its functions. Nephron - the structural and functional unit of the kidney. Mechanisms of urine formation.
45. The process of glomerular filtration, quantitative and qualitative characteristics of primary urine. General principles of regulation of the filtration process. Artificial kidney and its application in the clinic
46. Tubular reabsorption and its types and mechanisms. Humoral mechanisms of reabsorption regulation in the distal part of the nephron.
47. Physiology of the act of urination and its regulatory mechanisms.
48. The concept of metabolism in the body. The plastic and energetic role of nutrients. Nitrogen balance, its types.
49. Energy balance of the body. Work metabolism. Energy expenditure of the body during various types of work.
50. Basal metabolism, its normal values, clinical significance.
51. Constancy of body temperature and its importance for metabolism. Body temperature scheme. Functional thermoregulation system.

Section 3. Integrative activity of the organism.

1. An analytical and systematic approach to the study of body functions.
2. I. P. Pavlov's teaching on analyzers. Their importance. General plan and basic diagram of the analyzer structure.
3. Receptor department of analyzers. General classification of receptors, Physiological properties and patterns of information coding.
4. Functional properties of analyzers and the patterns of functioning in which they manifest themselves.
5. Conductive and central sections of analyzers. Peculiarities of conducting afferent excitations. Participation of subcortical structures in conducting and stage-by-stage processing of afferent excitations.
6. Auditory analyzer. Receptor section of the auditory analyzer. Mechanism of occurrence of receptor potential in hair cells of the spiral organ. Modern ideas about mechanisms of perception of pitch and intensity of sounds.
7. Physiology of the vestibular analyzer. Receptor, conductive and cortical sections. Complex of reactions that occur when the vestibular apparatus is irritated.
8. Visual analyzer and its characteristics. Receptor apparatus. Color perception. Main forms of color vision impairment.
9. The optical system of the eye and its importance. Physiological mechanisms of eye accommodation. Adaptation of the visual analyzer. The role of the cortex in the formation of a visual image.
10. Tactile analyzer. Receptor, conductive and cortical sections of this analyzer.
11. Temperature analyzer. Its role in perceiving the temperature of the external and internal environment of the body. Receptor, conductive and cortical sections of the temperature analyzer.
12. Nociceptive analyzer. Modern concepts of pain receptors, types of pain sensitivity. Conducting pathways of pain irritation and central mechanisms of pain perception.
13. Antinociceptive system. Neurochemical mechanisms of antinociception . Systemic concepts and biological significance of pain.
14. Physiological bases of pain relief and anesthesia. Opiate receptors and their ligands .
15. The role of the cortex, subcortical formations and humoral factors in the formation of pain reactions.

16. The motor analyzer and its role in the perception and assessment of the position of the body in space and in the formation of movements.
17. Physiological characteristics of the olfactory analyzer, mechanism of odor perception.
18. Physiological characteristics of the taste analyzer. Receptor, conductive and cortical sections. Classification of taste sensations.
19. The role of the interoceptive analyzer in maintaining the constancy of the internal environment of the body, its structure. Classification of interoreceptors, features of their functioning.
20. Innate forms of behavior. Their neurophysiological basis, significance for adaptive activity.
21. Conditioned reflexes as a form of adaptation of animals and humans to changing conditions of existence. Patterns of formation and manifestation of conditioned reflexes, their classification.
22. Physiological bases of formation of conditioned reflexes. Concepts of mechanisms of formation of temporary connection.
23. The structure (architectonics) of purposeful behavior from the standpoint of the theory of functional systems of P.K. Anokhin and its main key elements.
24. The stage of afferent synthesis of the functional system of behavior and its neurophysiological mechanisms.
25. Needs and motivations. Principles of classification of needs and motivations and neurophysiological mechanisms of their occurrence. Purposeful activity as a motivationally determined form of behavior.
26. Inhibition of conditioned reflexes, its types. Modern ideas about the mechanisms of unconditional and conditioned inhibition.
27. Analytical and synthetic activity of the cerebral cortex. Dynamic stereotype. Its physiological essence.
28. Memory, its types. The importance of memory in the formation of integral adaptive reactions.
29. Education and its main forms. The importance of education in the formation of the psyche and personality.
30. I. P. Pavlov's teaching on the 1st and 2nd signal systems. Figurative and verbal thinking. Functional asymmetry of higher mental functions of the brain.
31. Types of higher nervous activity in various concepts, their characteristics and principles of classification.
32. Emotions and their role and significance in the organization of behavior. Need -information theory of emotions. Vegetative and somatic components of emotional states. Types and role of emotions in the occurrence of psychosomatic diseases.
33. The role of emotions in purposeful human activity. Emotional tension (emotional stress) and its role in the emergence of psychosomatic pathology.
34. Sleep and its physiological mechanisms. Theories of sleep. Modern phase-informational theory of sleep by Kleitman - Azerinsky . Physiological significance of sleep phases.
35. Speech. Functional asymmetry of the cerebral cortex and its connection with human speech. Suggestion, self-suggestion, psychotherapy.
36. The symbolic function of the brain: gnosis and praxis .
37. Physiological bases of labor activity. Peculiarities of human labor activity in conditions of modern production. Physiological characteristics of labor with nervous-emotional and mental stress.
38. Peculiarities of changes in vegetative and somatic functions in the body associated with physical labor and sports activities. Physical training, its impact on human performance.
39. Features of mental work. Nervous, vegetative and endocrine changes during mental work. The role of emotions in the process of mental activity.
40. Physical and mental performance and fatigue in the process of purposeful human activity. Features of physical, motor and mental fatigue.
41. Methodological principles of studying the physiological bases of formation of various forms of behavior . The paradigm of reactivity and activity.

42. The structure of the human psyche and its main components. Localization of mental functions in brain structures from the systemic positions of A.R. Luria .
43. The functional state of wakefulness of the brain and the main mechanisms of its maintenance.
44. The role of the cerebral cortex in regulating the work of internal organs. Cortico -visceral theory and its application in the clinic. Suggestion and self-suggestion.
45. Physiological mechanisms of occurrence of stress reactions of the organism. Adaptation to stress factors. Structural trace of adaptation.

Section 4. Methods of studying physiological functions.

1. Method of recording electrical activity of muscles. Strength of muscle contraction and its definition.
2. Method for determining chronaxie. Chronaximetry.
3. Method for counting leUCocytes in the blood.
4. Methods for counting the number of red blood cells in the blood.
5. Method for determining the osmotic stability of erythrocytes.
6. Method for determining the amount of hemoglobin in the blood.
7. Color index, its information value, calculation method.
8. Method for determining blood group.
9. Rhesus factor and method for determining Rhesus status.
10. The concept of hematocrit and the method of its determination.
11. ESR, a method for determining the erythrocyte sedimentation rate.
12. Methods for determining blood clotting time and bleeding duration.
13. Gradient of automation . Stannius' experiment .
14. Principles of determining systolic and minute blood volumes.
15. Heart sounds, their origin. Research methods (auscultation, phonocardiography).
16. Electrocardiography. Principles of electrocardiogram analysis.
17. Bloodless methods for determining blood pressure.
18. Blood method of recording blood pressure. Analysis of the blood pressure curve recorded in an acute experiment.
19. Methods of recording arterial and venous pulse. Analysis of sphygmogram and phlebogram .
20. vascular reactions. Plethism o- and rheography.
21. Methods for determining the time of complete blood circulation.
22. Respiratory muscles, bronchial muscle tone. Pneumotachometry .
23. Pneumothorax. Methods for determining pleural pressure.
24. Frederick's experiment with cross-circulation.
25. Respiratory volumes. Spirometry. Spirometry as a method of recording external respiration.
26. Physiological surgery. Chronic methods of studying the secretory function of the gastric glands (I. P. Pavlov, R. Heidenhain) and salivation.
27. Methods of studying the motor function of the stomach and intestines in humans. Methods of studying absorption processes in the gastrointestinal tract.
28. Methods for studying salivation and secretory function of the stomach in humans.
29. Methods for studying bile secretion in animals and humans.
30. Thermometry of the body surface and internal organs.
31. Methods of studying energy expenditure. Direct and indirect calorimetry. Principles of methods.
32. Principles of compiling food rations. Physiological bases of rational nutrition and diet therapy.
33. Respiratory quotient, its definition and significance for energy calculations.
34. Method for determining renal plasma flow and blood flow.
35. Clearance coefficient. Methodology for assessing the amount of filtration.
36. Principles of methods for studying the functions of endocrine glands .
37. Methods for determining renal reabsorption and secretion.

38. Microelectrode method of recording the activity of single neurons in the brain. Stereotaxic technique. Method of recording evoked potentials in the cerebral cortex.
39. Objective methods of studying functional states of the brain and their characteristics
40. Electroencephalography and EEG analysis.
41. Methods for studying the functions of the visual analyzer (visual acuity, visual fields, color perception).
42. Methods of studying the tactile analyzer. Esthesiometry .
43. Methods of studying the functions of the taste analyzer. Determination of taste irritation thresholds.
44. Methods of studying the auditory analyzer. Speech and tonal audiometry.
45. Rinne auditory tests . Study of binaural hearing.
46. Methodology for developing conditioned reflexes.