

Документ подписан простой электронной подписью  
Информация о владельце: **Federal State Budgetary Educational Institution of Higher education**  
ФИО: Семенов Юрий Алексеевич  
Должность: Ректор  
Дата подписания: 20.02.2026 13:56:03  
Уникальный программный ключ:  
7ee61f7810e60557bee49df655173820157a6d87

**"URAL STATE MEDICAL UNIVERSITY"**  
**of the Ministry of Health of the Russian Federation**

**Department of Normal Physiology**

**APPROVE BY**

Vice-Rector for educational  
activities

Shakov A.A.



2025

**Work program of the discipline**  
**Normal Physiology**

**Specialty: 31.05.01 General Medicine**  
**Higher education level: Specialist degree**  
**Qualification: General Practitioner**

**Ekaterinburg**

**2025**

Work program of the discipline "Normal Physiology" is compiled according to the requirements of the Federal state educational standard of higher education in the specialty 31.05.01 General Medicine (specialist degree level), approved by the order of the Ministry of Science and Higher Education of the Russian Federation dated 12.08.2020 r. № 988, and taking into account the requirements of the professional standard "General Practitioner", approved by the order of the Ministry of Labor and Social Protection of the Russian Federation dated 21.03.2017 No293n.

Compiled by: Pestryaev V.A., Candidate of Medical Sciences, Associate Professor of the Department of Normal Physiology; Zudova A.I., Assistant of the Department of Normal Physiology

Reviewed by: Grebnev D.Yu., Doctor of Medical Sciences, Head of the Department of Pathophysiology, Federal State Budgetary Educational Institution of Higher Education Ural State Medical University, Ministry of Health of the Russian Federation

The program was discussed and approved at a meeting of the Department of Normal Physiology  
21.04.2025 Protocol No. 9.

The program was discussed and approved by the methodological commission of the specialty  
31.05.01 Medical practice  
14.05.2025 Protocol No. 5.

### **1. The purpose of studying the discipline**

The purpose of teaching the discipline: students acquire the necessary amount of knowledge on normal physiology, necessary for the formation of competencies in accordance with the federal state educational standard of higher education in the specialty "General Medicine", the ability and readiness to perform work functions required by the professional standard "General Practitioner".

### **2. Objectives of studying the discipline.**

To establish understanding:

- 1) mechanisms of functioning of organs and systems of the body;
- 2) the work of functional systems, their regulation and self-regulation when interacting with external environment;
- 3) methods for assessing the state of the body and its systems.

To develop skills and abilities:

- 4) research of the state of the body and its systems.

### **3. The place of the discipline in the structure of the BEP**

The discipline "Normal Physiology" is a mandatory (basic) part of the training program for a specialist in the specialty "General Medicine".

2.1. The study of normal physiology as a natural science discipline requires the presence of systemic knowledge based on secondary general or vocational education and formed by previous disciplines:

Philosophy (knowledge of the forms and methods of scientific knowledge)

Bioethics (moral and ethical standards, basic ethical documents of international and domestic medical associations)

Latin language (knowledge of medical terminology in Latin)

Foreign language (knowledge of terminology, level of communication)

Psychology and pedagogy (general and individual characteristics of the psyche)

History of medicine (the doctrine of a healthy lifestyle, outstanding medical discoveries, the influence of humanistic ideas on medicine).

Physics, Mathematics (basic laws of physics, physical phenomena and patterns underlying the processes occurring in the human body; mechanisms of the impact of physical factors on the body; fundamentals of the functioning of medical equipment; mathematical methods for solving problems and their application in medicine)

Medical informatics (theoretical foundations of informatics, use of information computer systems in medicine and healthcare)

Biology (general laws of life development, laws of genetics, laws of heredity and variability in individual human development; concepts of the biosphere and ecology)

Anatomy (anatomical and physiological, age-sex and individual characteristics of the structure and development of a healthy human body)

Histology (morphological features at tissue level)

2.2. Normal physiology should precede pathological physiology, pharmacology, and other disciplines that form professional competencies.

### **4. Requirements for the results of mastering the discipline**

The process of studying normal physiology is aimed at developing the following general professional competence (GPC):

GPC-5 is the ability to assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.

<b>Category (group) of general professional</b>	<b>Code and name of general professional competence</b>	<b>Code and name of the indicator of achievement of general professional competence</b>
---	---	---

<b>competencies</b>		
Fundamentals of fundamental and natural scientific knowledge	GPC-5: the ability to assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	5.1. Able to: analyze the structure, topography and development of cells, tissues, organs and organ systems in interaction with their function in norm and pathology, anatomical and physiological, age-sex and individual characteristics of the structure and development of a healthy and sick organism 5.2. Able to: evaluate morphofunctional and physiological indicators based on the results of laboratory and instrumental examination of the patient 5.3. Able to: substantiate morphofunctional features, physiological states and pathological processes in the human body to solve professional problems

As a result of studying the discipline, the student must:

know:

- Moral and ethical standards, rules and principles for organizing scientific research on humans and experimental animals;
- Safety regulations and work in laboratories with reagents, devices, animals;
- The mechanism of action of the body's buffer systems, their interrelationship and role in maintaining the body's acid-base balance; the participation of hemoglobin in gas exchange and maintaining the acid-base balance;
- The basic patterns of development and vital activity of the organism based on the structural organization of cells, tissues and organs;
- Anatomical, physiological, age-related, gender-related and individual characteristics of the structure and development of a healthy and sick organism;
- Functional systems of the human body, their regulation and self-regulation when interacting with the external environment in norm and pathology.

be able to:

- Use educational, scientific, popular science literature, the Internet for professional activities;
- Use physical, chemical and biological equipment;
- Work with magnifying equipment;
- Perform calculations based on the results of the experiment, carry out elementary statistical processing of experimental data;
- Interpret the results of the most common methods of functional diagnostics used to identify pathologies of the blood, heart and blood vessels, lungs, kidneys, liver and other organs;
- Determine and evaluate the results of electrocardiography, spirometry, thermometry, hematological parameters;

own:

- Basic technologies for transforming information: text and spreadsheet editors, Internet search;
- Medical and anatomical conceptual apparatus;
- Skills in using simple medical instruments (phonendoscope, neurological hammer, tonometer).

## 5. Volume and type of academic work

Types of educational work	Labor intensity		Semesters (Indication of hours by semester)	
	Hours		3	4
Classroom lessons (total)	136		72	72
Including:				
Lectures	36		16	18
Practical classes	108		48	54
Seminars				
Laboratory work				
Independent work (total)	72		36	36
Including:				
Coursework (course project)	-			
Abstract	10			10
Other types of independent work (ERWS)	62		36	26
Forms of certification in the discipline (exam)	36			36
General complexity of the discipline	Hours 252	LIC 7	108	144

## 6. Contents of the discipline

### 6.1. Contents of sections and didactic units.

Name of the didactic unit (DU) and GPC	Section Contents (SC)
Disciplinary module 1 - Excitable tissues	
DE-1 General properties of excitable tissues. GPC-5	The organism as an open self-regulating system. Homeostasis. Physiological function and its regulation. Irritability and excitability. Membrane and intracellular processes during cell irritation. Electrical processes on cell membranes. Laws of irritation of excitable tissues. Lability.
DE-2 Muscle physiology. GPC-5	Classification and properties of skeletal muscles. Modern theory of muscle contraction and relaxation. Characteristics, properties, features of excitation and contractile activity of smooth muscles. Cardiac muscle tissue. Conducting system of the heart and its role.
DE-3 Physiology of synapses, receptors and nerve fibers. GPC-5	Functional properties of synapses. Mediators. Receptors of postsynaptic membranes. Postsynaptic potentials. Classification and mechanism of excitation in sensory receptors. Receptor and generator potential. Peculiarities of excitation occurrence in nerve cells. Conduction of excitation along myelinated and unmyelinated nerve fibers.
Disciplinary module 2 – Physiology of the nervous system	

DE-4 General physiology of the central nervous system. GPC-5	Principles of humoral and reflex regulation of functions in the body. Neurohumoral regulation. Reflex regulation, stages of development of reflex theory. Functional systems. Cellular structure of the central nervous system. Properties of nerve centers. Inhibition mechanisms in the central nervous system. Methods of studying the functions of the central nervous system.
DE-5 Private physiology of the central nervous system. GPC-5	Special physiology of the central nervous system. Spinal cord. Medulla oblongata. Pons. Midbrain. Cerebellum. Reticular formation. Diencephalon. Limbic system. Basal ganglia. Cerebral cortex.
DE-6 Physiology of the autonomic nervous system. GPC-5	The role of the autonomic nervous system in the regulation of physiological functions and the work of visceral organs. Features of the autonomic nervous system departments.
Disciplinary module 3 – Physiology of sensory systems	
DE-7 Physiology of sensory systems. GPC-5	Principles of information coding in sensory systems. Vision. Hearing. Vestibular system. Olfaction. Taste. Somatosensory sensitivity; Theories of pain; Antinociception systems; Methods of pain relief. Visceral sensitivity.
Disciplinary module 4 – Higher nervous activity (HNA)	
DE-8 Higher nervous activity. GPC-5.	Higher nervous activity and reflex theory. The role of needs and motivations in the formation of goal-oriented activity. Types of higher nervous activity. Development and features of human mental activity. Emotions. Memory. Consciousness, sleep, hypnosis, altered forms of consciousness. Thinking, speech.
Disciplinary module 5 – Blood	
DE-9 Humoral regulation in the body. GPC-5	Humoral mechanisms of regulation. Regulation and self-regulation of the endocrine system. Hormones of endocrine glands.
DE-10 Physicochemical properties of blood. OPK-5	The internal environment of the body. The blood system. Blood composition, basic physiological constants. Systems that maintain blood pH. Acidosis and alkalosis. Osmotic pressure of blood. Oncotic pressure. Erythrocyte sedimentation rate. Hematocrit index. Blood density.
DE-11 Form elements and their functions. GPC-5	Erythrocytes. Hemoglobin, its types and compounds. Color index. Leukocytes. Leukocyte formula. Immunity. Blood groups. Rh factor. Blood transfusion rules. Blood substituting solutions. Platelets. Hemostasis and fibrinolysis.
Disciplinary module 6 - Blood circulation	
DE-12 The role of the heart in blood circulation. GPC-5	Cardiac cycle, hemodynamic function of the heart. Electrical phenomena in the heart. Methods of studying cardiac activity. Mechanisms of regulation of cardiac activity.
DE-13 Hemodynamics. GPC-5	Basic laws of hemodynamics. Arterial pressure, factors determining its value. Arterial pulse, its origin. Functional features of vessels. Regulation of vascular tone. Microcirculation, its role in the mechanisms of fluid exchange between blood and tissues. Regulation of microcirculation. Methods of studying the cardiovascular system.

DE-14 Regional circulation. GPC-5	Features of fetal blood circulation, changes after birth. Features of cerebral, coronary, pulmonary, hepatic blood flow. Functions of the lymphatic system. Formation and movement of lymph in the lymphatic system.
Disciplinary module 7 - Breathing and energy exchange	
DE-15 Breath. GPC-5	Breathing, its main stages. The mechanism of external respiration and gas exchange in the lungs. Transport of gases by blood. Regulation of breathing. Features of breathing under conditions of high and low barometric pressure. The first breath of a child, the reasons for its occurrence. Age-related changes in breathing.
DE-16 Energy exchange. GPC-5	Basal metabolism. Methods of its determination, factors influencing its value. Work metabolism. Energy expenditure of the body during different types of work. Thermoregulation. Paths of heat production and heat transfer. Features of metabolism and energy in children of different ages.
Disciplinary module 8 – Digestion and excretory systems	
DE-17 Nutrition and digestion. GPC-5	Digestion, its physiological role. Classical and modern concepts of nutrition and digestion. Experimental and clinical methods for studying the functions of the digestive tract. Features of digestion and its regulation in various parts of the digestive tract.
DE-18 Excretory. GPC-5	Isolation, functions of the kidneys and methods of their study. Nephron and its blood supply. Urine formation. Urination.

**6.2. Controlled learning elements** (based on the Federal State Educational Standard)

Name of the competency category	Code and name of competence	Code and name of the indicator of achievement of competence	Didactic unit (DU)	Controlled learning elements formed as a result of mastering the discipline			Competence acquisition stage
				Knowledge	Skills	Skills	
				Know:	Be able to:	Own:	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-1 General properties of excitable tissues.	Mechanisms of formation of biopotentials; the role of biopotentials in excitation processes; laws of irritation of excitable tissues. Safety regulations and work in laboratories with instruments and animals.	Use educational, scientific, popular science literature, and the Internet for professional activities; To study the excitability of nerves and muscles; use experimental equipment.	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using basic medical instruments	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-2 Muscle physiology.	Physiological features and functions of skeletal, smooth and cardiac muscles. Safety rules and regulations for working in laboratories with	Use educational, scientific, popular science literature, and the Internet for professional activities; To examine tetanus of skeletal muscle, record and analyze the electromyogram;	Basic technologies for transforming information: text and spreadsheet editors, Internet search; medical-anatomical conceptual apparatus; Skills in using simple medical instruments, recording and	Elementary

				reagents, devices, animals.	to study the gradient of automaticity of the cardiac conduction system; use experimental equipment.	analyzing electromyograms	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-3 Physiology of synapses, receptors and nerve fibers.	Mechanisms and features: occurrence of excitation in receptors; spread of excitation along nerve fibers; transmission of excitation and inhibition through synapses. Regulations and work in laboratories with reagents, devices, animals.	Use educational, scientific, popular science literature, and the Internet for professional activities; To study and model the properties of synapses, the speed of excitation conduction along the motor nerve; Use experimental equipment; Make calculations based on the results of the experiment.	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using basic medical instruments	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-4 General physiology of the central nervous system.	Properties of nerve centers; inhibition mechanisms in the central nervous system; theory of	Use educational, scientific, popular science literature, and the Internet for professional activities;	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus;	Elementary

				functional systems. Safety regulations and work in laboratories with reagents, devices, animals.	To study the reaction time of subjects; Use experimental equipment; Perform calculations based on the results of the experiment, carry out elementary statistical processing of experimental data	Skills in using simple medical instruments (neurological hammer, tonometer)	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-5 Private physiology of the central nervous system.	Regulatory functions of the central nervous system. Safety rules and regulations for working in laboratories with equipment.	Use educational, scientific, popular science literature, and the Internet for professional activities; Examine tendon reflexes, coordination tests; record EEG, use experimental equipment; Make calculations based on the results of its research	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using simple medical instruments, recording and analyzing EEG	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-6 Physiology of the autonomic nervous system.	Features of the autonomic nervous system and their role in the regulation of physiological functions and the	Use educational, scientific, popular science literature, and the Internet for professional activities;	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus;	Elementary

				work of visceral organs. Safety regulations and work in laboratories with reagents, devices, animals.	To evaluate the indicators characterizing the tone of the ANS, changes in galvanic skin response and heart rate with changes in the tone of the sympathetic division of the ANS.	Skills in using simple medical instruments, measuring pulse, blood pressure indicators	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-7 Physiology of sensory systems.	General principles of functioning of human sensory systems. Vision. Hearing. Vestibular system. Olfaction. Taste. Somatosensory sensitivity; Nociception and antinociception systems. Visceral sensitivity. Safety regulations and work in laboratories.	Use educational, scientific, popular science literature, and the Internet for professional activities; Record and analyze the electrooculogram; examine visual acuity; field of view; binocular vision; pupillary reflex; hearing acuity; acuity of muscle sense; tactile sensitivity.	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using simple medical instruments (perimeter, esthesiometer, dynamometer, etc.)	Elementary
Fundamentals of fundamental	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-8 Higher nervous activity.	Unconditioned and conditioned reflexes.	Use educational, scientific, popular science literature,	Basic technologies for transforming information: text and	Elementary

and natural scientific knowledge				Instincts and dynamic stereotypes. Types of higher nervous activity. Development and features of human mental activity. Emotions. Memory. Consciousness, sleep, hypnosis. Thinking, speech. Safety regulations and work in laboratories with reagents, devices, animals.	and the Internet for professional activities; To study the strength and mobility of nervous processes; individual psychological properties of the personality; the relationship between the first and second signal systems; logical thinking; mechanical short-term memory	spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-9 Humoral regulation in the body.	Humoral mechanisms of regulation. Regulation and self-regulation of the endocrine system. Hormones of endocrine glands.	Use educational, scientific, popular science literature, the Internet for professional activities	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus	Elementary

Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-10 Physicochemical properties of blood.	The internal environment of the body. The blood system. Blood composition, basic physiological constants. Systems that maintain blood pH. Acidosis and alkalosis. Osmotic pressure of blood. Oncotic pressure. Erythrocyte sedimentation rate. Hematocrit index. Blood density. Safety regulations and work in laboratories with reagents and devices.	Use educational, scientific, popular science literature, and the Internet for professional activities. Determine the hematocrit index, blood density, erythrocyte sedimentation rate, study hemolysis and osmotic stability of erythrocytes.	basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using the simplest medical instruments, analysis of basic laboratory blood parameters	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-11 Form elements and their functions.	Erythrocytes. Hemoglobin, its types and compounds. Color index. Leukocytes. Leukocyte formula. Immunity. Blood groups. Rh factor.	use educational, scientific, popular science literature, and the Internet for professional activities; To carry out the counting of formed	basic technologies for transforming information: text and spreadsheet editors, Internet search; medical-anatomical conceptual apparatus; Skills in using simple medical instruments,	

				Blood transfusion rules. Blood substituting solutions. Platelets. Hemostasis and fibrinolysis. GPC-5; Safety rules for working in laboratories with reagents, devices, and animals.	elements in Goryaev's chamber, determine the hemoglobin content using the Sali method, calculate color index	analysis of basic laboratory blood parameters	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-12 The role of the heart in blood circulation.	Cardiac cycle, hemodynamic function of the heart. Electrical phenomena in the heart. Methods of studying cardiac activity. Mechanisms of regulation of cardiac activity. Safety rules and regulations for working in laboratories with equipment.	Use educational, scientific, popular science literature, the Internet for professional activities GPC-5 determine and evaluate the results of electrocardiography, phonocardiography; Perform calculations based on the results of the experiment, carry out elementary statistical processing of experimental data	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using the simplest medical instruments (phonendoscope, tonometer), analysis of the main characteristics of the ECG	
Fundamentals of	GPC-5	IGPC-5.1; IGPC-5.2;	DE-13 Hemodynamics.	Basic laws of hemodynamics.	Use educational, scientific, popular	Basic technologies for transforming	

fundamental and natural scientific knowledge		IGPC-5.3.		Factors determining arterial pressure. Arterial pulse, its origin. Functional features of vessels. Regulation of vascular tone. The role of microcirculation in the mechanisms of fluid exchange between blood and tissues. Regulation of microcirculation. Methods of studying the cardiovascular system. Safety rules and regulations for working in laboratories with equipment.	science literature, and the Internet for professional activities; Determine blood pressure readings; perform calculations based on the results of the experiment, carry out elementary statistical processing of experimental data	information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using basic medical instruments (phonendoscope, tonometer, pulse oximeter)	
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-14 Regional blood circulation.	Features of fetal blood circulation, changes after birth. Features of cerebral, coronary, pulmonary,	Use educational, scientific, popular science literature, and the Internet for professional activities;	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus;	Elementary

				<p>hepatic blood flow.          Functions of the lymphatic system.          Formation and movement of lymph in the lymphatic system.          Safety rules and regulations for working in laboratories with equipment.</p>	<p>Record ECG, pulse plethysmography;          perform calculations based on the results of the experiment,          carry out elementary statistical processing of experimental data</p>	<p>Skills in using simple medical instruments,          analysis of the main characteristics of ECG and pulse oximetry</p>	Elementary
<p>Fundamentals of fundamental and natural scientific knowledge</p>	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-15 Breath.	<p>The main stages of breathing. The mechanism of external respiration and gas exchange in the lungs.          Transport of gases by the blood.          Regulation of breathing.          Features of breathing under conditions of high and low barometric pressure. The first breath of a child, the reasons</p>	<p>Use educational, scientific, popular science literature, and the Internet for professional activities;          Determine and evaluate the results of spirometry and pneumotachometry,          perform calculations based on the results of the experiment,          carry out elementary statistical processing of experimental data</p>	<p>Basic technologies for transforming information: text and spreadsheet editors, Internet search;          Medical-anatomical conceptual apparatus;          Skills in using the simplest medical instruments, analysis of the main characteristics of spirometry</p>	

				for its occurrence. Age-related changes in breathing. Safety rules and regulations for working in laboratories with equipment.			
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-16 Energy exchange.	Basal metabolism. Methods of its determination, factors influencing its value. Work metabolism. Energy expenditure of the body during different types of work. Thermoregulation. Paths of heat production and heat transfer. Features of metabolism and energy in children of different ages. Safety rules for working in laboratories with equipment.	Use educational, scientific, popular science literature, the Internet for professional activities; Calculate the indicators of the main and working metabolism	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus; Skills in using the simplest medical instruments, calculating the proper and working basal metabolic rate	Elementary
Fundamentals of	GPC-5	IGPC-5.1; IGPC-5.2;	DE-17	The physiological role of digestion.	Use educational, scientific, popular	Basic technologies for transforming	Elementary

fundamental and natural scientific knowledge		IGPC-5.3.	Nutrition and digestion.	Classical and modern concepts of nutrition and digestion. Experimental and clinical methods for studying the functions of the digestive tract. Features of digestion and its regulation in various parts of the digestive tract. Safety regulations and work in laboratories with reagents, devices, animals.	science literature, and the Internet for professional activities; Interpret the results of the most common methods of functional diagnostics used to identify pathologies of the liver and other organs	information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus	Elementary
Fundamentals of fundamental and natural scientific knowledge	GPC-5	IGPC-5.1; IGPC-5.2; IGPC-5.3.	DE-18 Excretory.	Physiological role and features selection process. Kidney functions; methods of studying Nephron and its blood supply. Physiological mechanisms urine formation urination.	Use educational, scientific, popular science literature, the Internet for professional activities	Basic technologies for transforming information: text and spreadsheet editors, Internet search; Medical-anatomical conceptual apparatus	

### 6.3. Sections of the discipline (SDS) and types of classes

Section of discipline, DE	Hours by type of activity					
	Lectures	Practical. classes	Labor works	Semina rs	Self work stud.	total
1. General properties of excitable tissues.	2	6			3	11
2. Muscle physiology	1	6			2	9
3. Physiology of synapses, receptors and nerve fibers	1	6			3	10
4. General physiology of the central nervous system	1	3			3	7
5. Particular physiology of the central nervous system	2	6			3	11
6. Physiology of the autonomic nervous system	1	6			2	9
7. Physiology of sensory systems	4	9			8	21
8. Higher nervous activity	4	9			8	21
9. Humoral regulation in the body	2	-			4	6
10. Physicochemical properties of blood	1	3			2	6
11. Formed elements of blood and their functions	3	9			6	18
12. The role of the heart in blood circulation.	2	6			4	12
13. Hemodynamics	1	3			2	6
14. Regional blood circulation	1	6			2	9
15. Breathing	3	9			6	18
16. Energy exchange	1	6			2	9
17. Nutrition and digestion.	4	9			8	21
18. Excretory.	2	-			4	6
	36	108			72	216

### 7. Approximate topics:

**Laboratory work:** laboratory work is not provided.

**Coursework:** none in the curriculum.

**Educational and research works:**

- Comparison of the excitability of nerve and skeletal muscle.
- Tetanus and its varieties.
- Electromyography.
- Determination of the speed of conduction of excitation along the motor nerve.
- Study of reaction time.
- Electroencephalography.
- Galvanic skin response.
- Electrooculogram.
- Study of tactile sensitivity.
- Study of the strength and mobility of nervous processes in humans.
- Study of mechanical short-term memory.
- Determination of hematocrit index.
- Counting formed elements of blood in Goryaev's chamber.
- Determination of blood group according to the ABO system.
- Thromboelastography.
- Electrocardiogram.
- Heart sounds.
- Blood pressure.
- Peripheral pulse and plethysmography.
- Study of external respiration parameters, spirometry.
- Determination of the required basal metabolic rate.

**Abstracts:**

- Adaptive reactions of the body to the action of natural and artificial factors environment.
- Functional significance of EEG rhythms.
- Using biofeedback to correct functional human condition.
- Features of regulation of trophotropic and ergotropic functions.
- Central mechanisms of regulation of vasomotor reactions.
- Heart rate variability.
- Mechanisms of regulation of hematopoiesis.

**8. Resource provision.**

The department has human resources that guarantee the quality of training of a specialist in the discipline "Normal Physiology". Subject to conscientious training, the student acquires the knowledge, skills and abilities necessary for the formation of competencies that meet the requirements of the Federal State Educational Standard of Higher Education in the specialty 31.05.01 - "General Medicine" and the professional standard "District Therapist".

The educational process is implemented by the department staff who have higher education, experience in teaching the discipline "Normal Physiology", have the academic degree of candidate or doctor of science, and the academic title of associate professor or professor.

**8.1. Educational technologies.**

77% of practical classes (26 out of 34) are conducted in an interactive form. They include educational and research work (88 works) on 8 topics: Excitable tissues, CNS, Physiology of sensory systems, Higher nervous activity, Blood, Blood circulation, Respiration and energy metabolism, Digestion. In 69% of practical classes with students' research work (18 out of 26), the

modern computer research system Biopac student lab is used, which allows to record and analyze electromyogram, electroencephalogram, electrocardiogram, electrooculogram, pulse (using an optical sensor), blood pressure, spirogram, measure reaction time, etc.

## **8.2. Material and technical support of discipline**

1. Computer and plasma panel in each classroom.
2. Each classroom has a computerized Biopac complex student lab to conduct physiological research in practical classes.
3. Diagnostic equipment (electrocardiographs, spirometers, tonometers, etc.).
4. Laboratory equipment (microscopes, laboratory glassware, Panchenkov's apparatus, Shklyar centrifuge, etc.).
5. Computers for testing students.
6. Electronic educational resources (atlases, films, knowledge testing program MyTest).
7. Illustrative tables on physiology.
8. Manual for practical classes in normal physiology (8.1.4. p. 1)  
– for each student in class.

## **8.3. List of licensed software.**

### **8.3.1 System software**

#### **8.3.1.1. Server software:**

- VMwarevCenterServer 5 Standard, license term: unlimited; VMwarevSphere 5 EnterprisePlus, license term: unlimited, agreement No. 31502097527 dated 03/30/2015, Krona-KS LLC;
- Windows Server 2003 Standard No. 41964863 dated 03/26/2007, No. 43143029 dated 12/05/2007, license validity period: unlimited;
- Windows Server 2019 Standard (32 cores), license agreement No. V9657951 dated 08/25/2020, license validity period: 08/31/2023, Microsoft Corporation;
- ExchangeServer 2007 Standard (license No. 42348959 from 06/26/2007, license validity period: indefinite);
- SQL ServerStandard 2005 (license No. 42348959 dated 06/26/2007, license validity period: unlimited);
- CiscoCallManager v10.5 (agreement No. 31401301256 dated 07/22/2014, license validity period: indefinite), Mikrotest LLC;
- Ideco UTM Enterprise Edition Security Gateway (license No. 109907 dated November 24, 2020, license validity period: indefinite), IDECO LLC.

#### **1.1.2. Personal computer operating systems:**

- Windows 7 Pro (OpenLicense No. 45853269 from 02.09.2009, No. 46759882 from 04.09.2010, No. 46962403 from 05.28.2010, No. 47369625 from 09.03.2010, No. 47849166 from 12/21/2010, No. 47849165 from 12/21/2010, No. 48457468 from 05/04/2011, No. 49117440 from 10/03/2011, No. 49155878 from 12.10.2011, No. 49472004 dated 20.12.2011), license validity period: indefinitely);
- Windows7 Starter (OpenLicense No. 46759882 from 04/09/2010, No. 49155878 from 10/12/2011, No. 49472004 from 12/20/20 11, license validity period: indefinite);
- Windows 8 (OpenLicense No. 61834837 dated 04/09/2010, license validity period: unlimited);
- Windows 8 Pro (OpenLicense No. 61834837 dated 04/24/2013, No. 61293953 dated 12/17/2012, license term: unlimited);

### **8.3.2. Application software**

#### **8.3.2.1. Office programs**

- OfficeStandard 2007 (OpenLicense No. 43219400 dated 12/18/2007, No. 46299303 dated 12/21/2009, license validity period: unlimited);
- OfficeProfessionalPlus 2007 (OpenLicense No. 42348959 dated 06/26/2007, No. 46299303 dated 12/21/2009, license validity period: unlimited);

- OfficeStandard 2013 (OpenLicense№ 61293953 from 12/17/2012, № 49472004 from 12/20/2011, № 61822987 from 04/22/2013, № 64496996 from 12/12/2014, № 64914420 from 03/16/2015, license term: perpetual);

#### **8.3.2.2. Data processing programs, information systems**

- Software "TANDEM.University" (including the educational portal educa.usma.ru) (license certificate No. UGMU/21 dated 12/22/2021, license validity period: indefinite), Tandem IS LLC.

#### **8.4. External electronic information and educational resources**

- Institutional repository on the DSpace platform (USMU Electronic Library), license validity period: indefinite; installation and configuration agreement No. 670 dated 01.03.18 FGAOU VO UrFU named after the first President of Russia B.N. Yeltsin.

- National Electronic Library, Federal State Budgetary Institution "Russian State Library", Agreement No. 101/NEB/5182 dated 10.26.2018 valid until 2023.

- Electronic educational resource for foreign students "Russian as a foreign language", LLC Company "IPR Media" License agreement No. 8514/21 dated 10/19/2021 is valid until 10/24/2022

### **9. Educational, methodological and informational support of the discipline**

#### **9.1. Basic literature.**

##### **9.1.1. Electronic educational publications:**

1. Normal physiology / V.P. Degtyarev, N.D. Sorokina – M.: GEOTAR-Media, 2016 – <http://www.studmedlib.ru/book>
2. Normal Physiology / Edited by L.Z. Tel, N.A. Agadzhanyan. – M.: Litterra, 2015 – <http://www.studmedlib.ru/book>
3. Normal physiology. / Edited by K.V. Sudakov. – M.: GEOTAR-Media, 2015. – <http://www.studmedlib.ru/book>

##### **9.1.2. Electronic databases**

1. Electronic library system (ELS) "Student Consultant". ELS website [www.studmedlib.ru](http://www.studmedlib.ru) (29 textbooks)
2. "Doctor's Consultant". [EBS website www.rosmedlib.ru](http://www.rosmedlib.ru)
3. Electronic database (DB) Medline with Fulltext . Database website <http://search.ebscohost.com>
4. Full-text electronic database Clinical Key . Database site <http://health.elsevier.ru>

##### **9.1.3. Textbooks:**

1. Normal physiology: textbook / V.P. Degtyarev, N.D. Sorokina - M.: GEOTAR-Media, 2016 – 480 p.
2. Normal Physiology: Textbook. / Edited by L.Z. Tel, N.A. Agadzhanyan. – M.: Litterra. 2015 – 768 p.
3. Normal physiology. / Edited by K.V. Sudakov. – M.: GEOTAR-Media, 2015. – 880 pp.
4. Human Physiology: Textbook. 3rd edition, revised. / Edited by V.M. Pokrovsky and G.F. Korotko. – Publisher: "Medicine", 2011. – 662 p.

##### **9.1.4. Study aids**

1. Normal Physiology. A Manual for Practical Classes and Independent Work. / Pestryaev V.A., Bankov V.I. - Ekaterinburg: Publ. UGMU, 2014. - 201 p.
2. Workbook. For practical classes and independent work on a normal physiology. / – Ekaterinburg: UGMU publishing house, 2014. – 177 p.
3. Atlas of normal physiology. / Edited by N.A. Agadzhanyan. - M.: OOO

"Medical Information Agency", 2007. - 496 p.

4. Guide to practical classes in normal physiology. / Budylna S.M., Smirnov V.M. - M.: Publishing center "Academy", 2005. - 336 p.

## **9.2. Further reading**

### **9.2.1. Textbooks and teaching aids**

1. Normal Physiology. In 3 volumes/Edited by V.N. Yakovlev. – M.: Publishing Center “Academy”, 2006. – vol. 1, 240 pp.; vol.2, 288 pp.; vol.3, 224 pp.

2 Physiology. Fundamentals and functional systems: Lecture course / Edited by K.V. Sudakova. - M.: Medicine, 2000. - 784 p.

3. Human physiology. / Ed. by V.M. Smirnov. Moscow: Medicine, 2002. – 608 p.

4. Workshop on normal physiology: Proc. Manual / Ed. N.A. Agadzhanian. – M.: Publishing house in RUDN, 1996. – 339 p.

5. Guide to practical classes in physiology: Textbook / Ed. G.I. Kositsky, V.A. Polyantseva. M.: Medicine, 1988. – 288 p.

### **9.2.2. Literature for in-depth study, preparation of abstracts**

1. Basics of physiology: Textbook for universities. 2nd ed., revised / Ed. acad. HELL. Nozdracheva.

– St. Petersburg: Publishing house “Lan”, 2002 – 1088 p.

2. Human physiology: in three volumes. / Edited by R. Schmidt, G. Tevs. - M.: Mir, 1996, v.1, 323 pp.; vol.2, 313 pp.; vol.3, 198 p.

3. Filimonov V.I. Handbook of General and Clinical Physiology / V.I. Filimonov. – M.: Medical Information Agency, 2002. – 958 p.

4. Fundamental and clinical physiology / Edited by A.G. Kamkin, A.A. Kamensky. - M.: Publishing center "Academy", 2005. -1072 p.

## **10. Certification in the discipline**

Certification of students is carried out in accordance with the developed point-rating system for assessing students' academic achievements in the discipline.

At the end of each disciplinary module, students submit a report on the work done in class using the student workbook, take a computer test and an oral interview with the teacher. Students who have passed all disciplinary modules are allowed to take the exam in the discipline.

## **11. Fund of assessment tools for the discipline.**

EF for conducting interim certification (presented in Appendix No. 1).