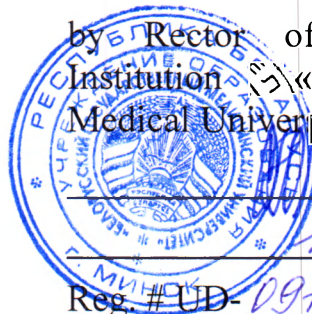


MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
Educational Institution
BELARUSIAN STATE MEDICAL UNIVERSITY

APPROVED

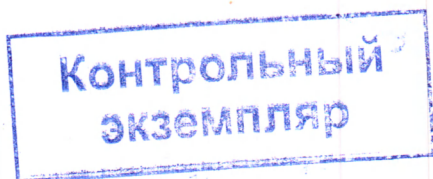
by Rector of the Educational
Institution «Belarusian State
Medical University»

S.P.Rubnikovich



15.11.2023

Reg. # UD-091-052/23291 edu.



NORMAL PHYSIOLOGY

**Curriculum of the educational institution
in the academic discipline for the specialty**

7-07-0911-03 «Dentistry»

Curriculum is based on the educational program «Normal Physiology» for specialty 7-07-0911-03 «Dentistry», approved 20.09.2023, registration # УД-091-052/пр.; on the educational plan of educational institution in the specialty 1-79 01 07 «Dentistry», approved 27.06.2023, registration # 7-07-0911-03/2324.

COMPILERS:

V.A.Pereverzev, Head of the Department of Normal Physiology of the educational institution «Belarusian State Medical University», D.Sc., Professor;

D.A.Alexandrov, Associate Professor of the of the Department of Normal Physiology of the educational institution «Belarusian State Medical University», PhD, Associate Professor;

Y.V.Haikovich, Senior Lecturer of the Department of Normal Physiology of the educational institution «Belarusian State Medical University»;

T.A.Pupa, Senior Lecturer of the Department of Normal Physiology of the educational institution «Belarusian State Medical University»

RECOMMENDED FOR APPROVAL:

by the Department of Normal Physiology of the educational institution «Belarusian State Medical University»
(protocol # 1 of 31.08.2023);

by the Scientific and Methodical Council of the educational institution «Belarusian State Medical University»
(protocol # 11 of 15.11.2023)

EXPLANATORY NOTE

«Normal Physiology» is the academic discipline of the Biomedical Module #1, which contains systematized scientific knowledge of the vital functions of a healthy body and its individual parts (cells, tissues, organs, functional systems), the mechanisms of these functions and the laws of their regulation.

The aim of the discipline «Normal Physiology» is the formation of basic professional competencies to solve problems of professional activity in assessing the physiological functions and characterizing their physiological state indicators of healthy and sick people on the basis of knowledge about the regularities of functioning and regulation of the vital functions of the whole human body, its organs and systems.

The objectives of the discipline «Normal Physiology» are to form students scientific knowledge about the principles of:

organization of physiological functions and the interaction of functional systems of the human body;

basic patterns of functioning of cells, tissues, organs and systems of a healthy human body and the mechanisms of their regulation;

as well as the most important indicators characterizing the normal state of physiological functions of the human body and its systems;

abilities and skills necessary for:

the formation of physiological and clinical thinking while observing the norms of medical ethics and deontology;

system analysis of indicators of physiological condition of healthy and sick person, his organs and systems;

interpretation of the results of laboratory and instrumental methods of research; formation of a healthy lifestyle.

The knowledge, abilities, and skills acquired in the academic discipline «Normal Physiology» are necessary for the successful study of the following academic disciplines: «First Aid», «Physical Education»; modules: «Propaedeutic Dentistry and Materials Science», «Preventive Medicine Module», «Biomedical Module #2», «General Clinical Therapy Module #1», «General Clinical Therapy Module #2», «General Clinical Surgical Module», «Medical Prevention in Dentistry», «Therapeutic Dentistry», «Periodontology», «Prosthodontics Module», «Oral and Maxillofacial Surgery Module», «Pediatric Dentistry», «Orthodontics Module».

Studying the educational discipline «Normal Physiology» should ensure the formation of students' basic professional competence:

BPC. Assess the indicators of a healthy and sick person physiological state on the basis of knowledge about the patterns of functioning and regulation of the human body vital activity, its organs and systems.

As a result of studying the discipline «Normal Physiology» the student should

know:

basic concepts of physiology;

relationship of organ structure and function, formation of functional adaptive

systems;

systemic principles of organization of functions and interaction of functional systems of the human body;

physiological basis of a healthy lifestyle;

basic regularities of functioning of cells, tissues, organs and systems of a healthy body and mechanisms of their regulation;

the main indicators characterizing the physiological state of the organs and systems of a healthy person;

be able to:

conduct clinical and physiological studies of the human body;

give physiological interpretation of the indicators obtained as a result of the study of individual functions of a healthy person's organism;

assess the normal state of functions of the human body and their reserve capacities with regard to age;

master:

methods of examination of basic physiological functions;

a systematic approach to the assessment of physiological functions and their characteristic indicators.

Total number of hours for the study of the discipline is 210 academic hours.

Classroom hours according to the types of studies: lectures - 30 hours (including 10 hours of supervised student independent work), practical classes - 105 hours, student independent work (self-study) - 75 hours.

Intermediate assessment is carried out according to the syllabus of the specialty in the form of a credit (2nd semester) and exam (3d semester).

Form of higher education – full-time.

**ALLOCATION OF ACADEMIC TIME
ACCORDING TO SEMESTERS OF STUDY**

Code, name of specialty	Semester	Number of academic hours						Form of intermediate assessment
		Total	In class	including			out-of-class self-studies	
				Lectures (including supervised independent work)	supervised student independent work	practical classes		
7-07-0911-03 «Dentistry»	2	102	70	16	5	54	32	credit
	3	108	65	14	5	51	43	exam
Total		210	135	30	10	105	75	

THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	practical classes
1. Introduction in the academic discipline «Normal Physiology». The basic concepts of physiology. Principles of biomedical ethics	1	3
2. The internal environment of the human body. Physiology of the blood	1	9
3. General physiology	6	18
4. Mechanism of physiological functions regulation	4	24
5. Physiology of circulation	4	12
6. Physiology of respiration	4	9
7. Physiology of digestion	2	6
8. Energy balance and metabolism. Principles of healthy nutrition	1	3
9. Thermoregulation	1	3
10. Physiology of excretion	2	6
11. Physiology of sensory systems	2	6
12. Integrative brain activity	2	6
Total hours	30	105

CONTENT OF THE EDUCATIONAL MATERIAL

1. Introduction in the discipline "Normal Physiology". The basic concepts of physiology. Principles of biomedical ethics.

Normal physiology as the science of vital functions of a healthy human body and its individual parts (cells, tissues, organs, functional systems), the mechanisms of implementation of these functions and patterns of their regulation.

The concept of the human body and its components. Levels of structural and functional organization of the human body. The concept of physiological functions and processes.

The system principle of organization and regulation of functions. Nervous and humoral mechanisms of regulation of human body functions. Local mechanisms of regulation of physiological functions. Levels of regulation: cellular, tissue, organ, organism level. Types of regulation (perturbation and deviation).

Systems approach to study of processes of vital functions of human organism. Functional system (P.K.Anokhin), the principle of self-regulation.

The concept of unity of the organism and the environment of its existence.

Relationship of physiology with other sciences. Physiology as a scientific basis for medicine. Stages of development of physiology.

The period of individual discoveries (the principal role of the works of W.Harvey, R.Descartes).

Formation and development of physiology in XIX-XX centuries (I.Muller, C.Bernard, C.Ludwig, E.Dubois-Reymond, H.Helmholtz, C.Sherrington, W.Kennon, F.V.Ovsiyannikov, I.M.Sechenov, N.A.Mislavsky, I.P.Pavlov, N.E.Vvedensky, A.A.Ukhtomsky, A.F.Samoilov, L.A.Orbeli, P.K.Anokhin, V.V.Parin, V.N.Chernigovsky, L.S.Stern and others).

Contribution of native physiologists to the development of physiological science (I.A.Vetohin, I.A.Bulygin, G.S.Yunev, G.A.Feshchenko, A.S.Dmitriev, N.I.Arinchin, V.N.Gurin, A.I.Kubarko and others).

Peculiarities of the modern period of the development of physiology. The development of molecular-biological, analytical and integrative direction. Human physiology and scientific and technical progress. Use of engineering achievements in physiology - telemetry, computer engineering, physiological cybernetics, computer modeling of physiological functions, modern means of visualization of physiological functions (functional magnetic resonance tomography, dispersion electrocardiography (ECG mapping), echocardiography, computerized electroencephalography (EEG) and others).

The importance of normal physiology for the dentist. Interrelation of functions of maxillofacial system with activity of other systems of the human body.

Principles and rules of biomedical ethics. Affirmation of the absolute value of human life as the basic principle of biomedical ethics. Principle of respecting the autonomy of the individual. Values of human life.

2. The internal environment of the human body. Physiology of the blood

Fluid media of the human body (intracellular fluid, intercellular fluid, blood, lymph, cerebrospinal fluid and others), their volume distribution in the human body.

Notion of the internal environment of the human body. Homeostasis. Mechanisms of homeostasis regulation.

Blood. Concept of the blood system (G.F.Lang), its age features. Composition, quantity, properties, main functions of blood. Basic physiological constants of blood characterizing homeostasis. Organic and inorganic compounds of blood plasma. Blood osmotic pressure and its regulation, its role in the exchange of water and electrolytes between blood and tissues. The concept of the state of hyper- and dehydration of tissues. Blood plasma proteins, their classification and importance. Plasma oncotic pressure and its role. Rheological properties of blood. Acid-base state of blood. Physicochemical and physiological mechanisms ensuring blood pH constancy. The concept of acidosis and alkalosis, the mechanisms of their occurrence. Changes in physiological functions in acidosis and alkalosis.

Lymph, mechanisms of its formation, quantity, composition, physical and chemical properties, functions.

Liquor. Composition, physicochemical properties, functions of cerebrospinal fluid, cerebrospinal fluid dynamics. The value of the study of cerebrospinal fluid for diagnosis. Other transcellular fluids (pleural, pericardial, synovial and others), their composition, physicochemical properties and physiological role.

Hemopoiesis (hemocytopoiesis): stem cell theory. Age peculiarities of hematopoiesis (in embryo, fetus, adult human). The role of stem cell microenvironment in hematopoiesis. Properties and functions of polypotent hematopoietic stem cell and other committed progenitor cells of mature blood cells. Nervous and humoral mechanisms of hematopoiesis regulation. The role of cytokines and other signaling molecules in the regulation of self-maintenance, differentiation, proliferation and apoptosis of these cells. The concept of obtaining stem cells from mature cells of the body by dedifferentiation: factors of regulation, prospects, dangers.

Significance and needs of a healthy human body in essential nutrients, vitamins and trace elements to maintain normal hematopoiesis. General concept of disorders of hematopoiesis in case of deficiency of these substances in the human body.

The concept of erythron. Erythrocytogenesis and destruction of erythrocytes, their age features. Features of the structure and properties of red blood cells to ensure their functions. The number of red blood cells in the blood of a healthy person depending on age and sex. The concept of methods of their calculation. Hemoglobin, its functions. Features of the structure and properties that ensure the performance of its functions. Types of hemoglobin, quantity, methods of determination. Color index and its calculation.

Erythrocytic indices (mean hemoglobin content in an erythrocyte (MCH), mean hemoglobin concentration in an erythrocyte (MCHC), mean erythrocyte volume (MCV), erythrocyte distribution curve width (RDW)). The concept of anemia. Hemolysis, types and causes. Products of erythrocyte destruction, their physiological role, ways of utilization. Sedimentation rate of erythrocytes (Erythrocyte Sedimentation Rate) and factors affecting it.

Leukopoiesis. Leukocytes, their types, number, methods of calculation. Features of the structure and properties that ensure their functions. The concept of

leukocytosis and leukopenia. Leukocyte formula: granular and non-granular leukocytes, their varieties, number, functions, life span, the concept of age features. The concept of specific and nonspecific immunity.

Thrombocytopoiesis. Platelets: number, structure, functions, life span.

The main indicators of the complete blood count, the principles of its performance using modern methods of investigation. Physiological evaluation of the results of the analyses. The concept of age norms of the basic blood parameters. Diagnostic value of the complete blood count.

The concept of the hemostasis system. Primary (vascular-platelet) and secondary (coagulation) hemostasis. Theories of hemostasis. Phases of blood coagulation. Fibrinolysis. Anticoagulants. Role of vascular wall in maintenance of blood coagulation and fibrinolysis.

Blood types. ABO, HLA, Rhesus (Rh) system. Basic principles of donor blood products selection. The concept of blood substitute solutions.

The concept of regulation of functions. Mechanisms of regulation of human body functions. Levels of regulation: cellular, tissue, organ, organism. Types of regulation (according to perturbation and according to deviation). Principles of reliability of regulation. Nervous and humoral mechanisms of regulation of functions. Interaction of nervous and humoral mechanisms of regulation, their comparative characteristics.

Basic ways of intercellular communication involving chemical signals (auto-, para-, endo- and juxtacrine). Classification and properties of signal molecules (ligands). Molecular (cellular) receptors. Classification according to their structure and localization in the cell. Structure and functions of transmembrane and intracellular receptors. Metabotropic and ionotropic receptors. Receptors associated with G-proteins.

Ligand-receptor interactions. Major pathways of intracellular signal transmission involving seven-segment transmembrane receptors (G-protein-coupled receptors; 7-TMS). Primary and secondary messengers and their functions. Ligands interacting with 7-TMS receptors and physiological functions controlled involving these receptors. Single-segment transmembrane receptors (1-TMS), their structure, features of the mechanism of action. Ligands interacting with 1-TMS receptors and physiological functions controlled with the participation of these receptors.

Ion channels. Classification. Structure and mechanism of action of ligand-gated ion channels using N-cholinoreceptor as an example. Role of hormones and second messengers in regulation of permeability of ligand-gated ion channels

Intracellular signal transmission involving intracellular receptors. Ligands acting through intracellular receptors. Mechanism of action and main physiological effects. The main physiological effects of ligand-receptor interaction at the cell level.

The significance of the endocrine system for the vital functions of the human body. Modern ideas about the functions of the endocrine system (endocrine glands, diffuse elements). General characteristics and classification of hormones. Mechanisms of action of hormones. Regulation of hormone secretion. Links between the glands of internal secretion and the nervous system. Participation of endocrine

system in homeostasis regulation. Methods for studying the functions of the endocrine glands.

Pituitary gland, its functions, morphological and functional connections with hypothalamus. Hormones of pituitary gland and hypothalamus, their role in regulation of endocrine and non-endocrine organs activity. Interaction of nervous and humoral mechanisms of regulation of functions on hypothalamic level. The most frequent manifestations of disorders of endocrine function of pituitary gland and hypothalamus.

Epiphysis, its endocrine functions.

Thyroid gland. Thyroid hormones, mechanisms of their action and effects caused by them. The influence of thyroid hormones on the processes of growth and development of the CNS. Regulation of hormone secretion. Characteristic manifestations of excess or insufficient secretion of hormones. Calcitonin, its role in the regulation of calcium and phosphorus metabolism.

Parathyroid glands. The role of parathormone in the regulation of calcium and phosphorus homeostasis in the human body. Regulation of parathormone secretion. Characteristic manifestations of excess or insufficient secretion of the hormone.

Adrenal glands. Hormones of the cortical and brain substance of the adrenal glands. Mechanisms of action of hormones and effects caused by them. Regulation of hormone secretion. Characteristic manifestations of excess or insufficient hormone secretion. Regulation of adrenal functions.

Sex glands. Sex hormones. Mechanisms of action of hormones and effects caused by them. Mechanisms of regulation of hormone secretion. Characteristic manifestations of excess or insufficient hormone secretion. Age peculiarities of endocrine function of the reproductive glands.

The concept of endocrine function of the placenta.

Pancreas, its endocrine function. Hormones and their role in the regulation of carbohydrate, fat and protein metabolism. Mechanisms of action of hormones. Regulation of hormone secretion. The concept of the states of hypo- and hyperglycemia, their manifestations and causes.

Thymus gland. The concept of the diffuse endocrine system (APUD-system) of the intestine. Endocrine function of the heart. Endocrine function of the liver. Endocrine function of the kidneys. Hormonal mechanisms to maintain water-electrolyte balance in the body (antidiuretic hormone, renin-angiotensin-aldosterone system, atrial natriuretic factor, prostaglandins). Endocrine function of salivary glands.

Participation of the endocrine glands in the adaptive activity of the body. General adaptation syndrome, stress.

Cellular composition and basic substance of bone tissue. Types, functions and age-related changes of bone tissue. Nutrition and metabolism of bone.

The functions of calcium and phosphate in the body, their content in bone tissue and teeth. Role of bone tissue, gastrointestinal tract and kidneys in calcium and phosphate metabolism. Regulation of calcium and phosphorus homeostasis in the body. The role of calcitonin, parathormone and vitamin D in this process.

Relationship of phosphorus-calcium metabolism with the state of the dentoalveolar system.

Factors of preservation of bone and teeth health. Age and individual norms of calcium, phosphate and fluoride consumption.

3. General physiology

Information exchange between the cell and the environment. Information, signal. Types of information signals.

The concept of irritability and excitability as the basis of tissue (cell) response to stimulation. Excitation and forms of its manifestation. Indicators (parameters) of excitability. Application of various methods to study excitability of muscles and nerves in dentistry. Chronoximetry, electroodontometry, their application in dentistry.

The concept of lability (N.E. Vvedensky). Laws of response of excitable tissues to stimuli.

Galvanic phenomena occurring in the presence of metal inclusions in the oral cavity, the physical basis of these phenomena. Effect of galvanism on the state of oral organs and other systems of the human body.

Bioelectrogenesis. Biopotentials as carriers of information in living organisms. Types of biopotentials, their comparative characteristics.

Resting membrane potential, its origin, mechanism of resting potential maintenance (selective permeability of cell membrane, K-Na pump functioning, etc.).

Modern concepts of mechanisms and phases of action potential development. Changes of excitability during excitation. Refractory period, its causes and significance.

Sensory receptors: definition of the concept, classification, role, main properties. (high sensitivity to the action of an adequate stimulus, background activity, adaptation and others). Mechanisms of transformation of stimulus energy into nerve activity in primary and secondary-sensitive sensory receptors. The concept of the principles of analog and discrete coding in receptors.

Generation of nerve impulses in sensory receptors and axon hillocks. Nerve fiber. Physiological role of the structural elements of the nerve fiber. Mechanism and principles of nerve impulse conduction along the nerve fiber. Axonal transport of substances. Characteristics of nerve fibers of type A, B, C. Physiological basis of conduction anesthesia in dentistry.

Synapse. Structure and classification of synapses, their physiological role. Modern ideas about the mechanisms of excitation transmission in synapses. Neurotransmitters, their classification, synthesis, mechanism of secretion into synaptic cleft, interaction with ionotropic postsynaptic membrane receptors. Postsynaptic potentials. General properties of synapses (with the example of neuromuscular synapse). Notion of pharmacological influence on the processes on signal transmission processes in synapses (influence on neurotransmitter secretion, on postsynaptic membrane receptors, on reuptake of neurotransmitter or its precursors, on synaptic cleft enzymes and other).

Skeletal muscles. Physiological and physical properties of skeletal muscles. Types of muscle fibers. Motor units and their features in different muscles. Types and regime of contraction of skeletal muscles. Single contraction and its phases.

Mechanism of contraction and relaxation of single muscle fiber and muscle (thread slip theory). Summation of contractions, tetanus. Dependence of contraction amplitude on stimulus frequency. Optimum and pessimum (N.E.Vvedensky). Muscle tone. Muscle strength and function. Maintenance of muscle metabolism. Skeletal muscle fatigue and its nature. Concepts of methods of assessing the functional state of muscles in a person. Manual and standing dynamometry. Electromyography. Changes in the muscle after denervation. Role of motor activity in preservation of health. Physiological substantiation of application of methods which delay development of muscle atrophy and promote restoration of its functions (electrical stimulation, massage and others).

Features of masticatory and mimic muscles. Participation of the muscles of the maxillofacial region in the functions of chewing, swallowing, breathing and speech formation. Work and strength of the masticatory muscles. Periodontium, its endurance to the pressure developed by the masticatory muscles. Mastication performance.

Smooth muscles. Physiological properties and features of smooth muscles in comparison with skeletal muscles. Transmission of excitation from nerve fiber to smooth muscle. Types of neurotransmitters. Receptors of smooth muscle fibers (alpha- and beta-adrenoreceptors, M-cholinoreceptors and others). Mechanisms of contraction and relaxation of smooth muscles. Features of regulation of contraction (force, duration, tone) of smooth muscles. The role of calcium ions in the function of smooth muscles. The concept of the nature of smooth muscle tone and its correction.

The concept of myoepithelial cells and their functions.

Glandular epithelium. Functions of glandular epithelium (endocrinia, exocrinia). Types of exocrinia: merocrine, apocrine, holocrine. Physiological properties and peculiarities of glandular cells bioelectrogenesis (distribution of metabotropic receptors and ligand-dependent ion channels, heteropolarity, activating hyperpolarization).

Functions of the central nervous system (CNS) and its role in ensuring the vital functions of the human body and its relationship with the environment. Methods for studying the functions of the nervous system.

Neuron. Functional classification of neurons. Physiological properties of nerve cells and functions of neuron structural elements (soma, axon, dendrites). Morphological and biophysical peculiarities of neurons, providing their specific functions (perception, integration, information transfer). Peculiarities of emergence and distribution of excitation in a neuron. Integration of neurons into nerve circuits. Types and functions of these unions. Basic principles of excitation distribution in neural circuits (divergence, convergence, reverberation, etc.). Determinism and variability of neuronal circuits. The concept of conducting pathways and their functions. Other structures and cells of nervous system. Role of neuroglia.

Features of structure and functions of CNS synapses in comparison with peripheral synapses. Neurotransmitters in CNS. Physiological concept of the nerve center. Functions of nerve centers, their properties (spatial and temporal summation, transformation of excitation rhythm, tone, plasticity, fatigue of nerve centers). Afferent and efferent nerve pathways, their varieties and functions.

Reflex principle of nervous system functioning (R.Descartes, G.Prochazka, I.M.Sechenov, I.P.Pavlov, P.K.Anokhin). Reflex as stereotype adaptive response of the human body to the action of stimuli. Types of reflexes. Reflex arc and reflexive ring. Feedback and its significance. The multilevel organization of reflex. Substrate, mechanism and forms of manifestation of excitation on the neuron, in the nerve center.

Inhibition in the nervous system (I.M.Sechenov, F.Goltz). Modern concepts of the mechanisms of central inhibition (J.Eccles, Renshaw). Inhibition in the CNS, its types. Inhibition in CNS: primary (postsynaptic and presynaptic), secondary (pessimal and inhibition after excitation).

Interaction of the processes of excitation and inhibition as the basis of CNS coordination activity. Basic principles of coordination: principle of conjugate (reciprocal) inhibition, principle of a common final pathway (Ch. Sherrington), principle of dominant (A.A. Ukhtomsky), feedback principle (P.K. Anokhin). Interaction of various reflexes (allied, antagonistic, chain reflexes). The concept of integrative activity of the CNS.

4. Mechanism of physiological functions regulation

The concept of central and peripheral nervous systems. The brain as an organ, peculiarities of metabolism. The concept of the structure and function of the blood-brain barrier. The role of the cerebrospinal fluid in the vital activity of the brain. Brain functions: sensory, motor, vegetative, integrative. Interaction between different levels of the central nervous system in the regulation of functions. Methods of studying CNS functions.

Spinal cord: structural and functional organization. Reflex activity of the spinal cord. Sensory functions of the spinal cord. Motor functions of the spinal cord. The concept of afferent and efferent conductive pathways of the spinal cord. Autonomic centers. Integrative functions of the spinal cord. Spinal mechanisms of integration of somatic and autonomic functions. Clinically important spinal reflexes in humans (somatic and vegetative).

The medulla oblongata: structural and functional organization. Sensory functions of medulla oblongata. Motor functions of the medulla oblongata. Centers of salivation, chewing, swallowing, breathing, their functional relationship. Features of control of tone and force of contraction of masticatory and mimic muscles. Autonomic functions. The vasomotor center. Reflex regulation of cardiac activity. The respiratory center. Regulation of functions of the digestive system and other internal organs. Integrative functions of medulla oblongata. Protective reflexes.

Midbrain and the pons: structural and functional organization. Sensory functions of the midbrain. Motor functions of the midbrain. Oculomotor functions of the midbrain. Autonomic functions of the midbrain. Pupillary and other reflexes. Integrative functions. The concept of organization of orientation, visual and auditory reflexes, «start-reflexes», and alertness reactions. The concept of organization of complex movements, integration of vegetative and somatic functions (chewing, swallowing, etc.), regulation of breathing.

Cerebellum: structural and functional organization. Sensory functions of the cerebellum. Motor functions of cerebellum. The concept of participation of the

cerebellum in distribution of a muscular tone, organization of a posture, in realization of purposeful slow and fast ballistic movements, correction of motor programs.

Brainstem reticular formation: structural and functional organization. Descending and ascending effects of reticular formation on CNS activity. Participation of reticular formation in maintenance and redistribution of muscle tone, in regulation of autonomic functions. Participation of reticular formation in integrative activity of CNS.

Thalamus: structural and functional organization. Main sensory and motor conducting pathways of thalamus. Functional characteristics of thalamic nuclei. Participation of thalamus in formation of pain sensations and in realization of higher integrative functions of the brain.

Hypothalamus. Structural and functional organization. Sensory functions. Connections of hypothalamus with the cerebral cortex and other parts of the brain. Neurosecretory cells. Hypothalamic sensory neurons proper (thermo-, osmosensitive and others). Polysensory neurons. Endocrine functions (hypothalamic hormones and releasing factors). Autonomic functions. The main autonomic centers. Integrative functions.

Limbic system: structural and functional organization. The role of limbic system in formation of motivations, emotions, memory. Participation of limbic structures in integrative activity of CNS.

Basal nuclei: structural and functional organization. Integrative function of basal nuclei in organization and realization of complex movements.

Cortex of the large cerebral hemispheres: structural and functional organization. Modules (columns) as examples of structural and functional units. The role of the large hemisphere cortex in the formation of systemic activity of the human body. Modern ideas about localization of functions in the cortex. Plasticity of the cortex.

Influence of physical and mental work on functional state of central nervous system.

The concept of structural and functional basics of a multilevel system of regulation of muscle tone, posture and movements. Specific role of different elements, plasticity and reliability of the system. Intrinsic mechanisms of the spinal cord that provide regulation of muscle tone. The spinal cord as a common terminal pathway for supraspinal CNS sections in the mechanisms of regulation of muscle tone, posture and movements. Changes in muscle structure and function in hypodynamy, inactivity, and denervation. The most characteristic changes in the tone of muscles and movements in disorders of the spinal cord, brain stem, cerebellum, basal ganglia, cortex of the large cerebral hemispheres. Theoretical basis of correction of disorders of tone, trophics of muscles and movements. Significance of electrodiagnostics and electrostimulation in prevention of muscle atrophy and restoration of their functions in case of innervation disorders, hypodynamia and other conditions.

Role of autonomic (vegetative) nervous system (ANS) in ensuring the vital activity of the integral human body. Functions of the ANS. Comparative characteristics of the general structure and physiological properties of the ANS and

somatic nervous system (afferent, central, efferent sections). Comparative characteristics of the structure and physiological properties of the sympathetic and parasympathetic sections of the ANS. The concept of metasympathetic nervous system. Autonomic ganglia, their functions (transmissive, reflexive, integrative). Preganglionic and ganglionic neurons and their axons: morphological, functional and neurochemical (neurotransmitters, types of receptors of pre- and postsynaptic membranes) differences between them. The concept of principles of correction of autonomic functions by influence on transmitters-receptor mechanisms.

General characteristics of the influence of sympathetic and parasympathetic sections of the ANS on effector organs, sensory functions. Synergism and relative antagonism of their influences. Autonomic reflexes. Autonomic centers, their tonus. Interaction of somatic and ANS in regulation of body functions. Adaptation and trophic function of the ANS. Participation of the ANS in integration of functions in forming holistic behavioral acts. Autonomic provision of somatic functions.

5. Physiology of circulation

Basic laws of hemodynamics. Morphological and functional classification of blood vessels. Basic laws of hemodynamics. Systemic, organ and local blood flow. Factors causing blood flow in vessels. Volumetric and linear velocity of blood flow in different parts of the vascular bed, the factors determining them. Blood pressure, its types: arterial (systolic, diastolic, pulse, mean), venous. The role of blood pressure; factors determining its value. Blood pressure in different parts of the vascular bed. The concept of «normal values» of blood pressure (BP), age-related changes in BP. Methods of measuring blood pressure. Arterial pulse, its origin and characteristic. Pulse wave velocity, methods of research and registration. Blood flow in the venous vessels, venous return of blood. Blood pressure in the veins.

Microcirculation. Structural and functional characteristics of the main components of the microcirculatory bed. Capillary blood flow and its peculiarities. Transcapillary exchange of fluids and various substances between blood and tissues, its mechanisms. Factors affecting the processes of microcirculation and transcapillary exchange (hemodynamic indices, blood properties, state of vascular wall, lymph flow, properties of intercellular fluid).

Lymphatic system, its structure and functions. Lymph formation and lymph outflow, mechanisms of their regulation.

Organ blood circulation. Blood flow in the brain, myocardium, lungs and other organs and its regulation. Features of microcirculation in tissues and organs of the oral cavity (periodontium, dental pulp). The concept of methods of studying vascular reactions in the maxillofacial area (capillaroscopy).

The role and place of the circulatory system in the human body as a system serving metabolic processes. Structural and functional characteristics of the circulatory system.

The heart. Blood supply to the myocardium. Blood flow in coronary vessels in systole and diastole. Consumption of oxygen and nutrients by the heart in conditions of relative rest and during physical activity.

Structure, physiological properties and functions of cardiac conduction system. Current understanding of the mechanism and gradient of automaticity. Interaction of

cardiac conductive system with typical cardiomyocytes. The course of excitation propagation in the heart. Electromechanical coupling. Role of calcium ions. Structure, physiological properties and functions of contractile myocardium. Laws of cardiac contraction.

Functions of atria, ventricles and valves of the heart. Direction of blood flow. Relation of the large and small circuits of the circulation. Sequence of phases and periods of the cardiac cycle. Position of valves, changes of pressure and volumes of blood in heart cavities during different phases of cardiocycle. Comparative characteristic of pumping function of right and left ventricles. Systolic and minute volumes of blood flow in an adult healthy person at relative rest and at physical load. Methods of their determination. Ejection fraction, cardiac index. Cardiac performance. Reserves of cardiac activity and coronary blood flow, their realization during physical activity.

Electrical manifestations of cardiac activity. Electrocardiography (ECG). Formation of ECG components. General plan of analysis and criteria of ECG norm. The concept of extrasystoles. Sound manifestations of cardiac activity. Heart tones, their origin. Auscultation and phonocardiography, their diagnostic value. Mechanical manifestations of cardiac activity. The apex beat of the heart, arterial and venous pulse. Sphygmography and its diagnostic value. Polycardiography. The concept of ultrasound cardiography, invasive techniques of cardiac examination.

Regulation of cardiac functioning (intracardial and extracardial mechanisms). Reflex changes of heart activity caused by irritation of receptors of oral mucosa as well as arising in response to medical manipulations in the oral cavity.

Circulatory regulation as a system of maintenance of metabolic processes of the human body. Regulated parameters of circulatory system: cardiac activity, vascular tone, circulating blood volume, its composition and properties. Vascular tone and its nature. Regulation of vascular tone as the main mechanism of maintaining blood pressure in systemic blood flow and local blood flow. Reflex regulation of vascular tone. Causes of changes in blood pressure during various manipulations in the oral cavity. Humoral regulation of vascular tone including vessels of oral mucosa.

Functional system providing regulation of systemic arterial pressure. Physiological prerequisites of arterial pressure disorders and theoretical basis for the correction of these disorders. Age-related peculiarities of hemodynamics. Recommendations on healthy lifestyle for preserving the functions of the cardiovascular system and increasing its reserves. Hemodynamics under physical load and hypokinesia. Risk factors.

6. Physiology of respiration

The role and place of the respiratory system in the body as a system serving metabolic processes. The main stages of respiration.

Physiology of respiratory system. Regulation of their lumen. Significance of airways ciliated epithelium. Respiratory cycle. Ventilation of the lungs, its unevenness in different parts. Elastic properties of the thorax. Surfactant. Pressure in pleural cavity, its role and change during breathing. Biomechanics of inspiration and

expiration. Work of the respiratory muscles. Relationship between pulmonary blood flow, ventilation and gravity.

Indices of lung ventilation (vital capacity, minute respiratory volume, flow characteristics of lung ventilation, flow-volume curve) in a healthy person depending on age and sex, their changes in obstructive and restrictive disorders. Spirometry, spirometry, pneumotachometry.

Gas exchange in lungs. Composition of atmospheric, expired and alveolar air. Partial pressure of oxygen and carbon dioxide in alveolar air and their tension in blood. Relative constancy of alveolar air composition. Diffusion capacity of the lungs.

Transport of gases by the blood. Binding of hemoglobin to gases. Factors affecting the affinity of hemoglobin for oxygen and carbon dioxide. Mechanisms of regulation of oxygen-binding blood properties inside erythrocytes. Oxygen capacity of blood. Gas exchange between blood and tissues. Relationship between gas exchange and acid-base balance.

Regulation of respiration as a way to meet the needs of cellular respiration and maintain blood gas constants (pO_2 , pCO_2 , pH). Regulated indicators of external respiration: frequency, depth of breathing. The respiratory center, its departments. Mechanisms providing respiratory periodicity. Receptors of the airways, lungs and respiratory muscles. Reflex reactions to their irritation. Receptors of pH, CO_2 and O_2 in human body and their role.

Functional system of maintenance of relative constancy of tension of gases in an internal environment of an organism. External respiration during muscular work, increased and decreased air pressure. The first breath of a newborn. Theoretical basis of various types of artificial respiration. Functional reserves of the hemocardiorespiratory system in gas exchange.

7. Physiology of digestion

The role and place of the digestive system in the human body as a system serving metabolic processes. General characteristic of functional nutrition system, the role and place of digestive processes in it. Nutritional motivations. Physiological mechanisms of hunger and satiety. Appetite. I.P. Pavlov's concept of the food center. Types of digestion depending on the features of hydrolysis and its localization. Experimental and clinical methods of investigating the functions of the gastrointestinal tract. Digestive and non-digestive functions of the gastrointestinal tract.

Mechanical and chemical processing of food in the oral cavity. Functional characteristics of the chewing apparatus, masticatory muscles of various groups of teeth, periodontal and temporomandibular joints, their role in the process of mechanical processing of food in the oral cavity. Age-related changes in the processing of food in the oral cavity (partial or complete adentia, hyposalivation), ways to correct them. Formation of the food clump. The act of swallowing, its self-regulation. Methods of studying the mechanical processing of food in the oral cavity.

Characteristics of the activity of salivary glands. Qualitative features of the chemical composition of the secretions secreted by various salivary glands (parotid, submandibular, hyoid). The composition and properties of saliva. Digestive and non-

digestive functions of saliva. Saliva reaction (pH) as a physiological constant. Methods of its determination and its importance in dentistry. Mouth and gingival fluid, their difference from saliva and physiological significance. The mechanism of salivation. The influence of the blood supply on the secretion of the salivary glands. Regulation of the activity of salivary glands. The influence of the sympathetic and parasympathetic department of the autonomic nervous system on the activity of the salivary glands. The states of hypo- and hypersalivation and their causes. Adaptive nature of salivation to food and rejected substances. Conditioned reflex salivation. The influence of saliva enzymes on the digestive activity of gastric and intestinal enzymes.

Experimental methods of study of salivary glands in acute and chronic experiments. Physiological methods of study of salivary secretion in man. Methods of examination of salivary ducts and salivary glands in man (probing, sialography, thermovisography and others).

Absorptive function of oral mucosa. Mechanisms and functional features of suction capacity of oral mucosa. Influence of various factors on the permeability of the oral mucosa.

Digestion in the stomach. The composition and properties of gastric juice. The role of hydrochloric acid and mucus of gastric juice. Phases and mechanisms of regulation of gastric gland secretion on an empty stomach and after meals.

Digestion in the duodenum.

The role of the pancreas in digestion. The composition and properties of pancreatic juice. Mechanisms of regulation of pancreatic juice secretion on an empty stomach and after a meal.

The role of the liver in digestion. Bile formation and biliary excretion. The composition and properties of bile, its participation in the processes of digestion. Mechanisms of regulation of bile formation and biliary excretion.

Digestion in the jejunum and ileum. The composition and properties of intestinal juice. Mechanisms of regulation of intestinal secretion. Cavitory and membrane hydrolysis of nutrients. Motor function of the small intestine and its regulation.

Digestion in the large intestine. The importance for the human body of the microflora of the large intestine. Motor activity of the large intestine. Defecation.

Absorption. The conjunction of hydrolysis and absorption (digestive-transport conveyor belt). Regulation of absorption. Age peculiarities of digestion. Nervous, humoral and local mechanisms of regulation of digestive functions and their relationship in different parts of the gastrointestinal tract.

8. Energy balance and metabolism. Principles of healthy nutrition

Definition of the concept of metabolism of substances and energy. The exchange of substances between the human body and the external environment as a basic condition of life. Characteristics of the processes of anabolism and catabolism, their relationship, the ratio of these processes in different conditions of life. The plastic role of metabolism. Influence of quantitative and qualitative composition of food on the condition of oral organs and tissues. The importance of a healthy diet for the prevention of dental caries. Irreplaceable substances for the human body. General

concepts of the metabolism of fats, carbohydrates and proteins. Nitrogen balance. Positive and negative nitrogen balance. The energy role of metabolism. Sources of energy. Energy balance of the human body.

Methods of determining the energy expenditure of the human body (direct and indirect calorimetry). Caloric value of various nutrients. Caloric equivalent of oxygen. Respiratory rate. Basic metabolic rate, the value and its determining factors. Energy expenditure of the human body in various types of work activities (according to the degree of physical labor intensity). The influence of limiting motor activity on metabolism. Specific-dynamic (thermogenic) effect of food. Basics of ergonomics in dentistry.

The principles of a healthy diet. The balance of energy intake and expenditure. The use of data on the body's energy expenditure and the human body's need for plastic substances to compose nutritional diets. The importance of healthy diet for the preservation of health. The balance of energy intake and expenditure. The concept of the norm of body weight. Overweight (obesity) and underweight. Excessive consumption of carbohydrates and fats as risk factors for diseases. Processes of deposition and use of deposited nutrients (glycogen depot in liver and muscles, fat depot). General principles of regulation of metabolism in human body. Integration of metabolic processes.

9. Thermoregulation

Role and place of thermoregulation as a system providing optimal conditions for metabolic processes. The importance of the constancy of the temperature of the internal environment of the human body for the normal course of the processes of vital activity. The concept of homoiothermy, poikilothermy and heterothermy. Human body temperature and its daily fluctuations. Temperature of different parts of the skin and internal organs. Thermometry, its use for diagnosis. Thermodiagnosis in dentistry.

Physical and chemical thermoregulation. Sources of heat production in the human body. Regulation of heat production processes.

Heat production in the body. Physical processes which ensure heat production. Physiological mechanisms of regulation of heat production processes. Nervous and humoral mechanisms of thermoregulation. Role of peripheral and central receptors in thermoregulation processes.

Functional system that maintain the temperature constancy in the internal environment of the human body. Age-related peculiarities of thermoregulation. Endo- and exogenous pyrogens. Hyperthermia and fever. Protective role of fever. Hypothermia. Increasing resistance of human organism to high and low temperatures, problem of hardening of human organism.

10. Physiology of excretion

The role and place of excretion as a system serving metabolic processes. Organs of excretion (kidneys, skin, lungs, digestive tract), their participation in the maintenance of homeostasis of the body. Excretory function of salivary glands.

The kidney. Excretory and non-excretory functions of the kidney. Nephron as a structural and functional unit of the kidney. Blood flow in the kidney, peculiarities of its regulation.

The main processes of urine formation (glomerular filtration, tubular reabsorption and secretion). Mechanisms of glomerular filtration, composition of primary urine. Reabsorption in tubules and collecting tubes. The turn-over-counterflow system. Secretory processes in the tubules. Processes of synthesis in the kidney. Ultimate urine and its composition. The significance of quantitative and qualitative analysis of urine for evaluation of human body functions. Indicators of general analysis of urine in a healthy person.

Neurohumoral regulation of urine formation (processes of filtration, reabsorption, secretion). The role of the kidneys in the maintenance of acid-base balance, osmotic pressure, ionic composition of blood, blood volume, in the regulation of systemic blood flow, hemopoiesis, water-electrolyte balance. Adaptive changes in renal function under various environmental conditions (stress, heat, cold, work, water stress and deprivation). Function and regulation of the urinary system (frequency, volume of urination, night and day diuresis). Regulation of urinary excretion. Clinical and physiological methods of investigation of kidney function. Artificial kidney. Blood dialysis. Physiological basis of kidney removal and transplantation. Age-related changes in urination and urinary excretion.

11. Physiology of sensory systems

The concept of sense organs, analyzers, sensory systems. General principles of the structure of sensory systems, their classification and role in maintaining the functional state of the human body.

Mechanisms of perception of action of stimuli of external and internal environment of the human body by receptors. Coding, decoding, transmission and processing of information in the conductive pathways and central departments of sensory systems. The role of sensory systems in brain development and cognition of the world.

The visual system: structure, functions. Features of the structure and properties of the eye that ensure the function of vision. Structure and functional significance of the retina. Photochemical processes in retinal receptors under the action of light. Functions of retinal pigment, horizontal, bipolar and ganglion cells. Information transmission and processing in conductive pathways and central parts of visual system. Theories of color perception. Visual field. Visual acuity. Refraction and accommodation. Basics of correction of refractive errors. Adaptation, levels of adaptation. Central and peripheral mechanisms of coordination of visual and oculomotor functions. Basic forms of color perception disorders, significance for work activity. Illumination and the problem of visual fatigue. Age features of vision.

Auditory system. Features of the structure and properties of the sound-conducting and sound-receiving apparatuses that provide the function of hearing. Mechanisms of perception and analysis of sounds. Adaptation. Protective reflexes. Binaural hearing. Audiometry, its significance for hearing assessment. Age features of hearing. Basics of the correction of hearing disorders.

Vestibular system. Peculiarities of the structure and properties of the receptor department, providing perception and evaluation of the position of the body and its movement in space.

Olfactory system. Reception of smells. Conductive pathways and central sections of the olfactory system. Classification of smells.

Somatovisceral sensory system. Skin sensitivity. Mechanoreception. Types of receptors. Transmission and processing of information in conductive pathways and central departments. Thermoreception. Reactions of the human body to the action of heat and cold.

Nociception. Reception of painful stimuli. Features of structure and properties of conductive pathways and central departments. Central mechanisms of pain. Antinociceptive systems. Neurochemistry of antinociception. The concept of principles of anesthesia in dentistry. The concept of anesthesia and analgesia. Projective and reflected pain.

Proprioceptive sensitivity. Receptor mechanisms. Features of the structure of conductive pathways and central departments. Role in perception and evaluation of body position in space, in formation of muscle tone, posture and movements.

Interoceptive sensitivity. Receptor mechanisms. Types of interoceptive sensitivity. Reactions of the human body to interoceptor stimulation. The role of interoception in the maintenance of homeostasis.

Classification of receptors in the oral cavity. Taste sensitivity. Taste bulbs, structure. Conduction pathways and central sections of the gustatory system. Perception of taste. Classification of taste sensations. Polymodality of taste sensation. Methods for determination of threshold of taste sensation and functional mobility. Tactile receptivity of different parts of oral mucosa. Temperature receptivity, gradient of cold and heat sensitivity of different parts of oral mucosa. Thresholds of cold and heat sensitivity of teeth. Pain sensitivity of the mucous membrane of the oral cavity and teeth. Peculiarities of pain sensitivity of dental hard tissues.

12. Integrative brain activity

Integrative functions of the brain that ensure the integrity of the human body (integration of somatic, autonomic, endocrine functions). Levels of integration. Integrative functions of the brain that provide interaction of the human organism with the environment and human organism adaptation to changing conditions of existence.

Innate forms of behavior (unconditioned reflexes and instincts), their significance for adaptive activity of the human body.

The concept of higher nervous activity (I.P.Pavlov). Acquired forms of behavior. The importance of learning and neural memory in their formation. Types of learning. Conditioned reflex as a form of adaptation of animals and humans to changing conditions of existence. Rules and physiological mechanisms of formation of conditioned reflexes. Classification of conditioned reflexes. Importance of conditioned reflexes for formation of labor skills. Dynamic stereotype as a physiological basis of productive activity (motor skills, automated movements).

Inhibition in higher nervous activity. Types of inhibition. Modern understanding of the mechanisms of inhibition.

Types of higher nervous activity of animals and man (I.P.Pavlov), their classification, characteristics, and methods of determination. I.P.Pavlov's doctrine of the first and second signaling systems.

Parity of cerebral cortex activity, functional asymmetry of the human brain hemispheres and its role in realization of mental functions (speech, thinking, etc.). Functions of the associative cortex of the large hemispheres. Functions of the frontal cortex areas.

Memory, its types and mechanisms. Role of different parts of the brain in memorizing, storing and reproducing information. Reserves and ways to improve memory.

The concept of physiological bases of human mental functions (attention, perception, memory, motivations, emotions, thinking, consciousness, speech). The importance of the functional state of the central nervous system for the implementation of mental functions.

Attention and its physiological mechanisms. Role of attention in memory and learning processes.

States of sleep and wakefulness. Modern ideas about the role and mechanisms of sleep. Somatic, autonomic and endocrine functions during sleep.

Emotions and their neurophysiological mechanisms. Role of emotional states. Behavioral, autonomic and endocrine manifestations of emotions. Emotional tension as a risk factor for health. The importance of emotional stress in professional activity of a dentist. Ways of preventing emotional stress in case of dento-mandibular system dysfunction.

Thinking and speech, their neurophysiological mechanisms. Development of abstract thinking in man. Functional asymmetry of the large hemisphere cortex related to speech development in humans.

Purposive behavior, its systemic mechanisms (on the example of eating behavior). The architecture of a complete behavioral act from the viewpoint of the theory of functional systems (P.K.Anokhin). Motivation and dominant, their neurophysiological mechanisms and role in goal-directed behavior.

General efficiency as a combination of mental and physical performance. Dynamics of human performance within a working day and working week. Physiological substantiation of rational regimen of work and rest. Prediction of a person's physical and mental capacity for work activities. An integrated view of fatigue of the holistic human organism. I.M.Sechenov's theory of fatigue. Generalization and distinction of nature of physical and mental fatigue. Local and General Fatigue. Chronic fatigue. Prevention of physical and mental fatigue.

The concept of physiological bases of consciousness and their neurophysiological mechanisms. Medical criteria for assessing human consciousness.

ACADEMIC DISCIPLINE CURRICULAR CHART

Section , topic #	Section (topic) name	number of hours			Self-studies	Form of control
		Lectures (including supervised independent	supervised student independent work	practical		
	2nd semester	16	5	54	32	
1.	Introduction in the academic discipline «Normal Physiology». The basic concepts. Principles of biomedical ethics.	2	0,5	12	5	
2.	The internal environment of the human body. Physiology of the blood.	2	0,5	-	-	Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	The subject and tasks of Normal Physiology. Fluid media. Physiology of the blood system					
	Introduction. The subject and tasks of Normal Physiology. Homeostasis. Physic-chemical properties of blood.					
	Practical works: Technique of taking capillary blood (demonstration) Studying the technique for determination of hematocrit Studying types of hemolysis	-	-	3	2	
	Physiological functions of red blood cells. Hematopoiesis. Erythrocytopoiesis. Physiological functions of platelets. Thrombocytopoiesis. Hemostasis system.					
	Practical works: Counting Red Blood Cells in the counting chamber under a microscope Estimation of hemoglobin by Sahli's method Assessment of color index and MCH Determination and physiological assessment of primary hemostasis	-	-	3	1	

indices							
Physiological functions of white blood cells. Leukopoiesis. Non-specific and specific resistance of the human body. Physiological evaluation of the complete blood count. Practical works: Determination of ESR by Panchenkov's method. Counting white blood cells in the counting chamber under a microscope Calculation of the percentage of white blood cells different types in a blood smear (leucocyte formula) Physiological evaluation of the complete blood count test Blood types. ABO system. Rhesus (Rh) and other systems. Physiological bases of blood matching for the transfusion. Practical works: Blood typing in the ABO using standard sera. Blood typing in Rhesus system. Blood typing in the ABO and in Rhesus system using monoclonal antibodies	-	-	3	1			
4. Mechanism of physiological functions regulation							
Physiology of endocrine system. Physiology of bone tissue and regulation of calcium-phosphorus metabolism Fundamentals of information exchange of the cell with the environment. Chemical signaling. General physiology of endocrine system Practical works: Human height evaluation. Studying the endocrine system functions by the example of estimation of cortisol and adrenocorticotrophic hormone concentration in blood plasma Special physiology of endocrine system. Practical works: Comparison of arm muscle strength in men and women. Analysis of the effects of catecholamines as hormones and as neurotransmitters on cardiovascular system Physiology of bone tissue and regulation of calcium-phosphorus metabolism. Practical works: Evaluation of dental formula. Evaluation of the maximum intercuspatation.	2	0,5	12	8			
		2	0,5	-	-		
		-	-	3	2		
		-	-	3	2		
		-	-	3	2		
		-	-	3	2		

Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers

	Studying the influence of female sex hormones and thyroid hormones on bone mineralization						Interviews; electronic tests; quizzes; final tests; essays,
	Concluding lesson on the sections «Introduction in the academic discipline «Normal Physiology». The basic concepts. Principles of biomedical ethics», «The internal environment of the human body. Physiology of the blood», «Mechanism of physiological functions regulation»	-	-	3	2		
3.	General physiology	6	2	18	11		
	Bioelectrogenesis. Conduction of excitation along nerve fibers, synaptic transmission	2	0,5	-	-		Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	Physiology of skeletal and smooth muscles. Features of the muscles of the maxillofacial region	2	1	-	-		
	The concept of the regulation of physiological functions. General physiology of CNS	2	0,5	-	-		
	Electrical signaling. Laws of action of excitable tissues. Biological potential. Changes of excitability in excitation. Practical works:						
	Studying the action potential (AP) mechanisms; changes of excitability of cell membrane in different phases of AP.	-	-	3	2		
	The effect of Na ⁺ and K ⁺ ions on the resting membrane potential and action potential						
	Conduction of excitation along nerve fibers. Neuro-muscular synapse. Practical works:						
	Demonstration of the effect of local anesthetics depending on the time of action	-	-	3	2		
	Physiology of skeletal muscles. Practical works:						
	Contraction of motor units and muscle as a whole	-	-	3	1		
	Dynamometry of hands and back muscles. Ergometry of arm muscles						
	Physiology of the muscles of the maxillofacial region. Smooth muscles. The concept of myoepithelial and glandular cells. Practical works:						
	Electromyography of the muscles of mastication	-	-	3	2		
	Studying the movements of the lower jaw in different planes. (Gothic arch).						

	Assessment of interocclusal space. The occlusion (in Dentistry)							
	General physiology of the central nervous system. Practical works: Studying of knee reflex.	-	-	3	2			Interviews; electronic tests; quizzes; final tests; essays,
	Concluding lesson on section «General Physiology»	-	-	3	2			Interviews; electronic tests; quizzes; final tests; essays,
4.	Mechanisms of regulation of physiological functions	2	0,5	12	8			Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	Nervous regulation of autonomic functions The role and functions of spinal cord, brain stem, and cerebellum. Practical works: Studying of some tendon reflexes in humans (mandibular, upper limb flexor reflex, upper limb extensor reflex) Studying the cerebellum functions Studying the motor functions of some cranial nerves Studying the pupillary reflexes	2	0,5	-	-			
	The role and functions of mesencephalon, forebrain. Practical works: Studying the tactile sensitivity in humans Studying the musculotendinous sensation Electroencephalography Studying the role of the intermediate and forebrain in the formation of sensory modalities	-	-	3	2			
	Nervous regulation of autonomic functions. Practical works: Assessment of Clinostatic reflex. Assessment of Orthostatic reflex. Assessment of Hering's respiratory-cardiac reflex. Assessment of neurotransmitter mechanisms of the effect of sympathetic and parasympathetic parts of ANS on the heart functioning Concluding lesson on the section «Mechanisms of regulation of physiological functions»	-	-	3	2			Interviews; electronic tests; quizzes; control tests; essays; assessment based on a modular rating system. Credit
5.	Physiology of circulation	4	1,5	-	-			Interviews; oral quizzes; tests,
	Laws of hemodynamics. Blood pressure. Physiological properties and	2	0,5	-	-			Interviews; oral quizzes; tests,

	baroreflex. Analysis of some receptor and ion mechanisms of blood pressure and heart function regulation						
6.	Physiology of respiration	4	1	9	9		
	Ventilation of the lungs. Gas exchange in the lungs and tissues	2	0,5	-	-		Interviews; electronic tests; quizzes; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	Transport of gases by the blood. Regulation of respiration	2	0,5	-	-		
	External respiration. Gas exchange in the lungs and tissues. Practical works: Studying the biomechanics of inspiration and exhalation on models. Spirometry. Spirography. Pneumotachometry (peak flowmetry). Studying of lung ventilation indices using an automatic spirometer (MAS-1)	-	-	3	3		
	Transport of gases. Regulation of respiration. Practical works: Pulse oxymetry. Studying the effects of holding breath on blood saturation Effect of increasing CO ₂ in alveolar air on external respiration. Testing the respiratory muscles strength Model of nerve connections of the respiratory center	-	-	3	3		
	Concluding lesson on the sections «Physiology of circulation», «Physiology of respiration»	-	-	3	3		Colloquiums; electronic tests; final tests; control questioning
7.	Physiology of digestion	2	1	6	5		
	Physiology of Digestion	2	1	-	-		Interviews; electronic tests; quizzes; test papers; tests; essays
	General characteristics of digestion. Regulation of eating behavior. Digestion in the oral cavity. Practical works: Sialometry. Determination of oral pH. Starch digestion by human saliva enzymes Digestion in the gastrointestinal tract, absorption.	-	-	3	3		Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral

	<p>Practical works: Studying of the enzymatic properties of gastric juice. Effect of bile on fats. Parietal digestion. Blood plasma amylase activity. Influence of sympathetic nervous system neurotransmitters on small intestine peristalsis and analysis of neurotransmitter mechanisms of excitation conduction on smooth intestinal muscles</p>					<p>defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers</p>
8.	Energy balance and metabolism. Principles of healthy nutrition	2	1	3	3	
9	Thermoregulation	2	1	3	2	
	<p>Energy balance and metabolism. Physiology of thermoregulation Energy balance and metabolism. Principles of healthy nutrition. Practical works: Calculation of the Basal Metabolic Rate due values by tables and formulas Evaluation of body mass. Diet planning and its assessment.</p>	-	-	3	3	<p>Colloquiums; electronic tests; final tests; control questioning Interviews; electronic tests; quizzes; test papers; tests; essays Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers</p>
	<p>Physiology of thermoregulation. Practical works: Measurement of the axillary body temperature; Determination of heat sensitivity of teeth. Studying of the role of blood circulation in heat transfer process in the superficial tissues using the method of color thermography</p>	-	-	3	2	<p>Interviews; electronic tests; quizzes; test papers; tests; essays Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral</p>

						defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
10.	Physiology of excretion	2	0,5	6	4	Interviews; oral quizzes; tests, electronic tests; control questioning; reports at practical classes; essays; written accounts on classroom (home) practical exercises; written accounts on practical works; accounts on classroom (home) practical exercises with their oral defense; accounts on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	Physiology of excretion. Practical works: Performing a common urine analysis using the express method Studying the mechanisms of regulation of homeostasis, hyperhydration and dehydration of tissues. Studying of some renal functions on a model	2	0,5	-	-	
	Concluding lesson on the sections «Physiology of digestion», «Energy balance and metabolism. Principles of healthy nutrition», «Thermoregulation», «Physiology of excretion»	-	-	3	2	Interviews; oral quizzes; tests, electronic tests; control questioning, essays
11.	Physiology of sensory systems	2	0,5	6	4	Interviews; electronic tests; quizzes; tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers
	Physiology of sensory systems General physiology of sensory systems. Physiology of the visual system. Practical works: Evaluation of visual acuity. Studying of color vision. Determination of visual field bounds (perimetry). Determining the location of the blind spot. Determination of retina's central regions sensitivity of the (campimetry). Evaluation of the simple sensorimotor reaction velocity Special physiology of sensory systems. Sensory function of mucous membranes and structural formations of the oral cavity	2	0,5	-	-	
		-	-	3	2	
		-	-	3	2	

	<p>Practical works: Studying the mechanisms of the sound source direction determination Studying the bone and air conduction. Studying the dependence of auditory sensitivity on sound frequency (audiometry). Studying the tactile sensitivity. Esthesiometry (measurement of spatial thresholds). Studying the impact of the vestibular system on the somatic and autonomic functions of the body. Studying the taste sensitivity</p>				
12.	<p>Integrative brain activity Higher integrative functions of the brain Higher integrative functions of the brain. Innate and acquired adaptive reactions of the organism to changing environmental conditions. Memory. Practical works: Assessment of the associative memory volume; Evaluation of a short-term auditory memory volume using letter and digit complexes in the human</p>	<p>2 2</p>	<p>1 1</p>	<p>6 -</p>	<p>4 -</p>
	<p>Higher integrative functions of the brain as the physiological basis of human mental functions. Practical works: Identification of hemispheres functional asymmetry. Assessment of the latent period of simple and complex sensorimotor reactions. Assessment of attention indices using a correction test</p>	<p>-</p>	<p>-</p>	<p>3 3</p>	<p>2 2</p>
		<p>30</p>	<p>10</p>	<p>105</p>	<p>75</p>

Interviews; electronic tests; quizzes; tests; practical reports; written reports on classroom (home) practical exercises; written reports on practical works; abstracts; reports on classroom practical exercises with their oral defense; reports on home practical exercises with their oral defense; reports on practical works with their oral defense; electronic workshops; visual practical works; conference papers. Exam

INFORMATION AND INSTRUCTIONAL PART

LITERATURE

Basic:

1. Нормальная физиология : учебник = Normal Physiology : textbook / В. В. Зинчук [и другие] ; под редакцией В. В. Зинчука. – Минск : Вышэйшая школа, 2020. – 496 p.

Additional:

2. Hall, J. E. Guyton and Hall Textbook of Medical Physiology / J. E. Hall. – 13th ed., Elsevier Inc., 2015. – 1168 p.

3. Ganong's Review of Medical Physiology / K. E. Barret [at al.] –25th ed., McGraw-Hill Companies, 2016. – 726 p.

4. Fox, S. I. Human Physiology / S. I. Fox. – 14th ed. – New York : McGrawHill, 2016. – 832 p.

5. Северина, Т. Г. Физиология крови. Материалы лекций = Physiology of blood. Lecture notes : пособие / Т. Г. Северина. – Минск : БГМУ, 2014. – 51 p.

6. Constanzo, L. S. Physiology / L. S. Constanzo – 6th ed., Elsevier Inc., 2016. – 520 p.

7. Rhoades, R. A. Medical Physiology: Principles for Clinical Medicine / R. A. Rhoades, D. R. Bell. – 4th ed. – LWW, 2018. – 968 p.

8. Physiology : textbook / edited by V. M. Moroz, O. A. Shandra. – 2nd edition. – Vinnitsia: Nova Knyha, 2016. – 728 p.

METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE

The time assigned for independent work can be used by students for:

- preparation for lectures and practical classes;
- preparation for colloquiums, tests and exams on the discipline;
- working on topics (questions) that have been set for independent study;
- problem solving;
- research and creative assignments;
- preparing thematic reports, essays, and presentations;
- completing practical assignments;
- taking notes from books;
- report writing;
- writing reviews of scientific literature on a given topic;
- designing information and demonstration materials (stands, posters, graphs, tables, newspapers, etc.);
- making models and laboratory-teaching aids;
- compilation of thematic selection of literary sources, Internet-sources;
- making tests for self-control.

METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE

Main forms of supervised student independent work:
preparation and presentation of abstracts;
presentation of reports and essays;
studying topics and problems that have not been discussed at the lectures;
taking notes of original sources (sections of anthologies, collections of documents, monographs, textbooks);
computer (electronic) testing;
preparation of tests for the organization of mutual assessment;
preparation of didactic materials;
participation in active forms of education.

Control of supervised student independent work is carried out in the form of:
test paper;
concluding class, colloquium in the form of an oral conversation, written work, testing;
discussion of abstracts;
defense of educational assignments;
defense of the accounts (protocols) of the practical works;
evaluation of an oral answer to a question, report, or problem solving in a practical class;
checking up abstracts, written essays, and reports;
electronic tests;
individual interview.

LIST OF AVAILABLE DIAGNOSTIC TOOLS

The following forms are used for competences assessment:

Oral form:

interviews;
quizzes;
colloquiums;
practical reports;
conference papers.

Written form:

tests;
control works;
final tests;
written reports on classroom (home) practical exercises;
written reports on practical works;
essays;
abstracts;
research work reports;

publication of articles, reports;

Oral and written form:

reports of classroom (home) practical exercises with their oral defense;

reports on practical works with their oral defense;

credit;

examination;

assessment based on a modular rating system.

Technical form:

electronic tests;

electronic workshops (practicals);

visual practical work.

LIST OF AVAILABLE TEACHING METHODS

Traditional method (lecture, practical classes);

Active (interactive) methods:

Problem-Based Learning (PBL);

Team-Based Learning (TBL);

Case-Based Learning (CBL) (teaching using examples from clinical practice that help to learn the structure, functions and relationships)

Research-Based Learning (RBL);

training based on simulation technologies (work in computer programs on virtual animals).

LIST OF PRACTICAL SKILLS

1. Implementation of measures to prevent infection with viral hepatitis and human immunodeficiency virus during the investigation of blood and other biological materials. Technique of taking capillary blood.

2. Physiological evaluation of complete blood count indices obtained using manual and semi-automatic methods of counting (number of erythrocytes, hemoglobin, color index and erythrocytic indices, leukocyte count and leukocytic formula, platelet count, erythrocytes sedimentation rate according to Panchenkov's method).

3. Blood typing in AB0 and Rh systems using standard sera and monoclonal antibodies.

4. Electroodontometry.

5. Evaluation of dental formulas. Determination of the bite.

6. Physiological evaluation of the results of electromastaciomyography.

7. Studying the movement of the lower jaw in different planes. Gothic arch evaluation.

8. Determination of resting height, occlusal height and interocclusal space.

9. Dynamometry (manual and standing, ergometry) and physiological evaluation of the results.

10. Studying of basic tendon reflexes (knee, Achilles, etc.), physiological evaluation of the results.

11. Assessment of tone and reactivity of sympathetic and parasympathetic divisions of ANS (clinostatic and orthostatic tests, cold test, study of Hering's respiratory-cardiac reflex, and physiological evaluation of obtained indices).

12. Study of the state of cerebellar functions. Physiological evaluation of the obtained indices.

13. Evaluation of EEG rhythms in different functional states of the CNS.

14. Assessment of arterial pulse rate by palpation.

15. Evaluation of cardiac cycle duration and functional state of the cardiovascular system in humans after physical activity.

16. Measurement of arterial pressure and physiological assessment of the results.

17. Conducting electrocardiography (ECG). Analysis of ECG (calibration, rhythm, frequency, origin of waves, intervals, segments).

18. Conducting spirometry and spirometry. Calculation of proper values. Physiological evaluation of the obtained values.

19. Pneumotachometry (peak flowmetry). Calculation of proper values. Physiological evaluation of the values obtained.

20. Pulse oximetry and physiological assessment of hemoglobin oxygen saturation curve.

21. Conducting sialometry and physiological evaluation of the results.

22. Determination of oral pH.

23. Calculation of the proper values of the basic metabolism and the total energy expenditure of the human body.

24. Determination of energy consumption by indirect calorimetry with complete and incomplete gas analysis.

25. Body mass estimation. Calculation of body mass index. Physiological assessment of the obtained indicators and the formation of evidence-based recommendations for the correction of body weight.

26. Making a diet based on the general metabolism of the human body.

27. Measure axillary body temperature using mercury (or similar) and electronic thermometers. Evaluation of possible performance errors. Physiological evaluation of the results.

28. Determination of heat sensitivity of teeth.

29. Study of pupillary reflexes. Physiological evaluation of the obtained indexes.

30. Assessment of functions of the visual sensory system (visual acuity, perimetry, campimetry, color vision examination).

31. Assessment of auditory sensory system functions (audiometry, Weber and Rinne experiments).

32. Determination of taste sensitivity thresholds.

33. Assessment of somatosensory system functions (examination of tactile, pain, temperature, proprioceptive sensitivity, esthesiometry).

34. Physiological evaluation of the composition and properties of the final urine.

35. Evaluation of endocrine system functions (measurement and evaluation of height, body weight, temperature, carbohydrate metabolism indicators, etc.).

36. Evaluation of integrative functions of the brain (evaluation of indicators of attention and information processing speed according to the results of the proofreading test, evaluation of manifestation of emotions, memory, functional asymmetry of the brain hemispheres, etc.).

LIST OF EQUIPMENT USED

1. Gas analyzer.
2. Antiseptics and disinfectants.
3. Audiometer (sound generator).
4. Biological material of the experimental animal (rats) - blood, blood plasma, intestines.
5. Bicycle ergometer.
6. Floor scales.
7. Hand-operated dynamometer.
8. Sali's hemometer
9. Dynamometer standing.
10. Nose clip.
11. Ionometer (pH-meter).
12. Alveolar air collection chamber.
13. Barani's chair.
14. Couch.
15. Lancet device.
16. Ruler.
17. Magnifying glass.
18. Gauze, absorbent cotton.
19. Microscope.
20. Neurological mallet with needle and brush.
21. Body Composition Monitor.
22. Set of containers for disinfection of biological materials and equipment small (100-300 ml) and large (1-5 liters).
23. A set of tuning forks.
24. A set of laboratory utensils and equipment (graduated and non-graduated test tubes, flasks, vials, pipettes, burettes, funnels; tripods, rubber and friction glass stoppers, beakers, glassograph, absorbent cotton, tweezers, round glass sticks, glass sticks with spatula, dissecting needle, surgical scissors, eye scissors, glass tubes, rubber tubes; litmus paper).
25. Monoclonal reagent kit for determination of AB0 and Rh blood groups.
26. Set of disposable mouthpieces, masks, mouthpieces, connecting hoses for spirometry and pneumotachometry.
27. Set of standard sera for blood typing in AB0 system and reagent for blood typing Rh system.

28. Chemical kits (distilled water, NaCl, sodium bicarbonate, glucose, ammonia alcohol, hydrochloric acid, Lugol or iodine solution, Ringer's solution, hydrogen peroxide, sodium glutamate, quinine or benzalkonium chloride, citric acid, acetic acid, sodium citrate or EDTA, methylene blue, ionometer calibration buffer kit, saccharin; egg protein or fibrin, gastric juice; starch; bile; vegetable oil).

29. Electrocardiogram, phonocardiogram, polycardiogram, electroencephalogram sets.

30. Headphones.

31. Nomograms (DuBois to determine the surface area of the body; to determine the minute volume of breathing; to determine the proper values of indicators of human physical development).

32. Objects of different colors for perimetry.

33. Osmometer.

34. Oscilloscope.

35. Forster's Perimeter.

36. Personal computer.

37. Blood typing plates.

38. Pneumotachograph.

39. Pneumotachometer (pneumotachometer).

40. Rabkin or Ishihara polychromatic tables.

41. Watch slides, flat slides, slides with Goriaev grid, cover slides.

42. Panchenkov device with Panchenkov capillaries.

43. Projector.

44. Pulse oximeter.

45. Pulse oximeter wrist gauge.

46. Height meter.

47. Measuring tape at 5 m.

48. Sanitary and hygienic clothing (rubber gloves, masks, goggles or face shield, waterproof apron and armbands).

49. Mixer for Red Blood Cells

50. Mixer for White Blood Cells

51. Stopwatch.

52. Sterile scarifiers (lancets) disposable.

53. Spirograph automatic.

54. Dry-air spirometer.

55. Spirit stove;

56. Harris-Benedict Tables.

57. Tables for determination visual acuity (Golovin, Sivtsev, Orlova) with standard light.

58. Standard correction tables.

59. Tables with numeric and letter complexes.

60. TV set.

61. Medical mercury-free thermometer.

62. Water thermometer (0-50° C);

63. Infrared thermometer with the ability to determine body temperature and surface temperature.
64. Electronic thermometer.
65. Thermostat or water bath.
66. Test strips for general urinalysis.
67. Tonometer automatic.
68. Tonometer mechanical with phonendoscope.
69. Pointer.
70. Biopotential amplifier.
71. Filter paper.
72. Neurological flashlight.
73. Phonendoscope with tubes of different lengths.
74. Hourglass for 5 min.
75. Standard cap for EEG recording.
76. Eye shield.
77. Electrodes (push-button metal; plate metal; disposable surface electrodes; crocodile type; bridge electrodes for EEG recording).
78. Electrocardiographer.
79. Electromyographer.
80. Electromyoreflexometer.
81. Electrical conductive paste.
82. Electroencephalographer.
83. Esthesiometer (Weber's compass).

LIST OF LECTURES

2 semester

1. The subject and tasks of Normal Physiology. Fluid media. Physiology of the blood system.
2. Physiology of endocrine system. Physiology of bone tissue and regulation of calcium-phosphorus metabolism.
3. Bioelectrogenesis. Conduction of excitation along nerve fibers, synaptic transmission.
4. Physiology of skeletal and smooth muscles. Features of the muscles of the maxillofacial region.
5. The concept of the regulation of physiological functions. General physiology of the CNS.
6. Nervous regulation of autonomic functions.
7. Laws of hemodynamics. Blood pressure. Physiological properties and characteristics of the myocardium.
8. Regulation of cardiac activity. Mechanisms of regulation of systemic arterial pressure.

3 semester

1. Ventilation of the lungs. Gas exchange in the lungs and tissues.
2. Transport of gases by the blood. Regulation of respiration.

3. Physiology of Digestion.
4. Energy balance and metabolism. Physiology of thermoregulation.
5. Physiology of excretion.
6. Physiology of sensory systems.
7. Higher integrative functions of the brain.

PRACTICAL CLASS LIST

2 semester

Lesson 1. Introduction. The subject and tasks of Normal Physiology. Homeostasis. Physic-chemical properties of blood.

Practical work:

- Technique of taking capillary blood (demonstration).
- Studying the technique for determination of hematocrit
- Studying types of hemolysis

Lesson 2. Physiological functions of red blood cells. Hematopoiesis. Erythrocytopoiesis. Physiological functions of platelets. Thrombocytopoiesis. Hemostasis system.

Practical work:

- Counting Red Blood Cells in the counting chamber under a microscope
- Estimation of hemoglobin by Sahli's method
- Assessment of color index and MCH
- Determination and physiological assessment of primary hemostasis indices

Lesson 3. Physiological functions of white blood cells. Leukopoiesis. Non-specific and specific resistance of the human body. Physiological evaluation of the complete blood count.

Practical work:

- Determination of ESR by Panchenkov's method.
- Counting white blood cells in the counting chamber under a microscope
- Calculation of the percentage of white blood cells different types in a blood smear (leucocyte formula)
- Physiological evaluation of the complete blood count test.

Lesson 4. Blood types. ABO system. Rhesus (Rh) and other systems. Physiological bases of blood matching for the transfusion.

Practical work:

- Blood typing in the ABO using standard sera.
- Blood typing in Rhesus system
- Blood typing in the ABO and in Rhesus system using monoclonal antibodies.

Lesson 5. Fundamentals of information exchange of the cell with the environment. Chemical signaling. General physiology of the endocrine system.

Practical work:

- Human height evaluation.
- Studying the endocrine system functions by the example of estimation of cortisol and adrenocorticotrophic hormone concentration in blood plasma.

Lesson 6. Special physiology of endocrine system.

Practical work:

Comparison of arm muscle strength in men and women.

Analysis of the effects of catecholamines as hormones and as neurotransmitters on cardiovascular system.

Lesson 7. Physiology of bone tissue and regulation of calcium-phosphorus metabolism.

Practical work:

Evaluation of dental formulas. Evaluation of the maximum intercuspation.

Studying of the influence of female sex hormones and thyroid hormones on bone mineralization.

Lesson 8. Concluding lesson on the sections «Introduction in the discipline «Normal Physiology». The basic concepts. Principles of biomedical ethics», «The internal environment of the human body. Physiology of the blood», «Mechanism of physiological functions regulation»

Lesson 9. Electrical signaling. Laws of action of excitable tissues. Biological potential. Changes of excitability in excitation.

Practical work:

Studying the action potential (AP) mechanisms; changes of excitation and excitability of cell membrane in different phases of AP.

The effect of Na⁺ and K⁺ ions on the resting membrane potential and action potential.

Lesson 10. Conduction of excitation along nerve fibers. Neuro-muscular synapse.

Practical work:

Studying the structure of the neuromuscular synapse.

Studying the role of acetylcholinesterase.

Studying the ways of bioactive substances transmission in the neuromuscular synapse.

Lesson 11. Physiology of skeletal muscles.

Practical work:

Contraction of motor units and muscle as a whole

Dynamometry of hands and back muscles. Ergometry of arm muscles

Lesson 12. Physiology of the muscles of the maxillofacial region. Smooth muscles. The concept of myoepithelial and glandular cells.

Practical work:

Electromasticacyomyography.

Studying the movements of the lower jaw in different planes. (Gothic arch).

Assessment of interocclusal space. The occlusion (in Dentistry).

Lesson 13. General physiology of the central nervous system.

Practical work:

Studying of knee reflex.

Studying of reciprocal inhibition of motor reactions by electromyography.

Lesson 14. Concluding lesson on section « General Physiology»

Lesson 15. The role and functions of spinal cord, brain stem, and cerebellum.

Practical work:

Studying of some tendon reflexes in humans (mandibular, upper limb flexor reflex, upper limb extensor reflex)

Studying the cerebellum functions

Studying the motor functions of some cranial nerves

Studying the pupillary reflexes

Lesson 16. The role and functions of mesencephalon, forebrain.

Practical works:

Studying the tactile sensitivity in humans

Studying the musculotendinous sensation

Electroencephalography

Studying the role of the intermediate and forebrain in the formation of sensory modalities

Lesson 17. Nervous regulation of autonomic functions.

Practical works:

Assessment of Clinostatic reflex.

Assessment of Orthostatic reflex.

Assessment of Hering's respiratory-cardiac reflex.

Assessment of neurotransmitter mechanisms of the effect of sympathetic and parasympathetic parts of ANS on the heart functioning.

Lesson 18. Concluding lesson on the section «Mechanisms of regulation of physiological functions»

3 semester

Lesson 19. Hemodynamics. The main indices of the circulation system.

Microcirculation.

Practical works:

Measurement of arterial blood pressure by Korotkoff's auscultatory method

Measurement of the arterial pulse properties by palpation.

Evaluation of the arterial pulse waveform by sphygmogramm

Lesson 20. Physiological properties and characteristics of the heart muscle.

Cardiac cycle.

Practical works:

Studying the heart automaticity and various factors affecting it.

Studying the mechanisms of generation of action potentials (AP) in the cells of the sinoatrial node and the cells of the contractile myocardium of the ventricles

Determination of the duration of the cardiac cycle in a person by pulse at rest and in physical training.

Lesson 21. Methods of the heart investigation. |Regulation of the heart function.

Practical works:

Influence of some substances on work of isolated heart

Recording and analysis of ECG (calibration, velocity, HR).

Analysis of receptor mechanisms of the effects of sympathetic and parasympathetic divisions of the ANS and their neurotransmitters on cardiac function.

Studying the basics of polycardiography.

Recording and analysis of ECG and PCG (synchronous record).

Studying the basics of ultrasound examination of the heart (ultrasound).

Lesson 22. Regulation of circulation

Practical works:

Determination of a person's physical performance using the PWC170 test.

Studying the changes in blood pressure during the postural (orthostatic) baroreflex.

Analysis of receptor and ion mechanisms of blood pressure and heart function regulation.

Lesson 23. External respiration. Gas exchange in the lungs and tissues.

Practical work:

Studying the biomechanics of inspiration and exhalation on models.

Spirometry.

Spirography.

Pneumotachometry (peak flowmetry).

Studying of lung ventilation indices using an automatic spirometer (MAS-1).

Lesson 24. Transport of gases by the blood. Regulation of respiration.

Practical work:

Pulse oxymetry. Studying the effects of holding breath on blood saturation.

Effect of increasing CO₂ in alveolar air on external respiration.

Testing the respiratory muscles strength.

Model of nerve connections of the respiratory center.

Lesson 25. Concluding lesson on the sections «Physiology of circulation», «Respiratory physiology».

Lesson 26. General characteristics of digestion. Regulation of eating behavior.

Digestion in the oral cavity.

Practical work:

Sialometry.

Determination of oral pH.

Starch digestion by human saliva enzymes.

Lesson 27. Digestion in the gastrointestinal tract, absorption.

Practical work:

Study of the enzymatic properties of gastric juice.

Effect of bile on fats.

Parietal digestion.

Blood plasma amylase activity.

Influence of sympathetic nervous system neurotransmitters on small intestine peristalsis and analysis of neurotransmitter mechanisms of excitation conduction on smooth intestinal muscles.

Lesson 28. Energy balance and metabolism. Principles of healthy nutrition.

Practical work:

Calculation of the Basal Metabolic Rate due values by tables and formulas.

Evaluation of body mass.

Diet planning and its assessment.

Lesson 29. Physiology of thermoregulation.

Practical work:

Measurement of the axillary body temperature.

Determination of heat sensitivity of teeth.

Studying the role of blood circulation in heat transfer process in the superficial tissues using the method of color thermography.

Lesson 30. Physiology of excretion.

Practical works:

Performing a common urine analysis using the express method.

Studying the mechanisms of regulation of homeostasis, hyperhydration and dehydration of tissues.

Studying of some renal functions on a model.

Lesson 31. Concluding lesson on the sections «Physiology of digestion», «Energy balance and metabolism. Principles of healthy nutrition», «Thermoregulation», «Physiology of excretion».

Lesson 32. General physiology of sensory systems. Physiology of the visual system.

Practical works:

Evaluation of visual acuity.

Studying of color vision.

Determination of visual field bounds (perimetry).

Determination of retina's central regions sensitivity of the (campimetry).

Evaluation of the simple sensorimotor reaction velocity.

Lesson 33. Special physiology of sensory systems. Physiology of auditory, vestibular, taste, olfactory, pain and tactile sensory systems.

Practical works:

Studying the mechanisms of the sound source direction determination

Studying the bone and air conduction.

Studying the dependence of auditory sensitivity on sound frequency (audiometry).

Studying the tactile sensitivity. Esthesiometry (measurement of spatial thresholds).

Studying the impact of the vestibular system on the somatic and autonomic functions of the body.

Studying the taste sensitivity

Lesson 34. Higher integrative functions of the brain. Innate and acquired adaptive reactions of the organism to changing environmental conditions. Memory.

Practical works:

Assessment of the associative memory volume.

Evaluation of a short-term auditory memory volume using letter and digit complexes in the human.

Lesson 35. Higher integrative functions of the brain as the physiological basis of human mental functions.

Practical works:

Identification of hemispheres functional asymmetry.

Assessment of attention indices using a correction test.

SAMPLES OF ABSTRACT TOPICS

1. Electrophysiological activity of the brain in different states.
2. Development of student scientific work at the Department of Normal Physiology. Anniversary dates.
3. Electrophysiological activity of the brain in extra- and intraverts.
4. Physiological basis of regeneration of nerve fibers and other tissues.
5. Functional organization of the basal nuclei of the brain.
6. The role of calcium potentials of the cerebellum.
7. Age-related changes in the organ of vision.
8. Basics of nonspecific and specific immunity.
9. The blood aggregate state regulation system, its components and functions.
10. Anti-coagulation and fibrinolytic systems.
11. Apoptosis. A review of the physiological mechanisms of cell death.
12. Current understanding of the mechanisms of cardiac automaticity.
13. Physiological role of HCN channels.
14. Central regulation of cardiac activity.
15. Blood flow in coronary and cerebral vessels and peculiarities of its regulation.
16. Renin-angiotensin-aldosterone and kallikrein-kinin systems.
17. Modern methods of investigation of cardiovascular system functions.
18. Circulatory system in the fetus and newborn.
19. Mechanisms that ensure the patency of the upper airways.
20. Reflex influences from the receptors of the nose, pharynx and mouth on respiration.
21. The effect of gravity on blood flow.
22. Mechanisms of regulation of O₂ and CO₂ transport.
23. Breathing under special conditions (hypo- and hyperbaric).
24. Physiological basis of a decompression sickness.
25. The role of aquaporins in physiological functions.
26. Regulation of body mass.
27. Mechanisms of regulation of energy metabolism in children and adults.
28. Principles of healthy diets. The basics of diet therapy.
29. Nervous and hormonal mechanisms of the general adaptation syndrome.
30. Physiological mechanisms of alcohol and other addictions formation.
31. Current state of alcohol and other addictions control in the Republic of Belarus and in the world. Physiological basis of addiction prevention.
32. Current state of tobacco addiction control in the Republic of Belarus and in the world. Changes of physiological functions in tobacco smoking.
33. Sleep and its disorders.
34. Mental and physical performance. Fatigue and its prevention.

35. Epiphysis hormones and their role in the regulation of physiological functions of the body.
36. Participation of calcium (Ca^{2+}) and phosphates (P_i) ions in the maintenance of the functional state of bone tissue.
37. The importance of vitamin D_3 , physical activity and other factors for bone formation in children and adults.
38. Nobel Prize in Physiology or Medicine. A review of the most important scientific achievements.
39. Reviews of scientific literature in the field of physiology.

**PROTOCOL OF THE CURRICULUM APPROVAL
BY OTHER DEPARTMENTS**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department that designed the curriculum (date, protocol #)
1. Psychology of interpersonal relationships	Psychiatry and Medical Psychology	There are no offers	29.08.2023, protocol # 1
2. General Surgery	General Surgery	There are no offers	29.08.2023, protocol # 1
3. Physical Education	Physical Education and Sports	There are no offers	29.08.2023, protocol # 1
4. General Hygiene	General Hygiene	There are no offers	29.08.2023, protocol # 1
5. Pathological Physiology	Pathological Physiology	There are no offers	29.08.2023, protocol # 1
6. Pharmacology	Pharmacology	There are no offers	29.08.2023, protocol # 1
7. Propaedeutics of Internal Diseases	Propaedeutics of Internal Diseases	There are no offers	29.08.2023, protocol # 1

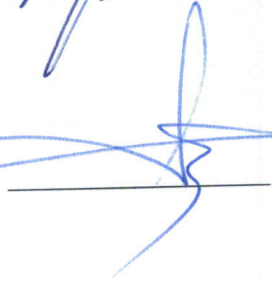
COMPILERS/AUTHORS:

Head of the Department of Normal Physiology of the educational institution «Belarusian State Medical University», Doctor of Medicine, Professor



V.A.Pereverzev

Associate Professor of the Department of Normal Physiology of the educational institution «Belarusian State Medical University», PhD, Associate Professor



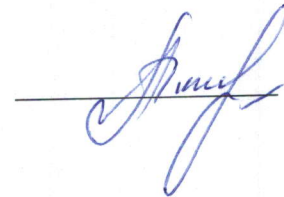
D.A.Alexandrov

Senior Lecturer of the Department of Normal Physiology of the educational institution «Belarusian State Medical University»



Y.V.Haikovich

Senior Lecturer of the Department of Normal Physiology of the educational institution «Belarusian State Medical University»



T.A.Pupa

Curriculum content, composition and the accompanying documents comply with the established requirements.

Dean of the Medical Faculty for International Students of the educational institution «Belarusian State Medical University»

13. 11. 2023



O.S.Ishutin

Methodologist of the educational institution «Belarusian State Medical University»

13. 11. 2023



S.V.Zaturanova