

Approved by
Deputy Rector for Academic Affairs

_____ E.V. Konovalova

“ 16 ” June 2022, Record No. 6

Hominal Physiology

Syllabus

Department **Morphology and physiology**
Curriculum s310501- ЛечДелоИн-21-1.plx
Specialty 31.05.01 General Medicine

Qualification **General Practitioner**

Form of education **Full time**

Total (in credits) **7**

Total academic hours 252
including:
Classes 160
Self-study 65
Control hours 27

Control:
Exam, 4th term

Course outline in terms

Academic year (Term)	3 (2.1)		4 (2.2)		Total	
	Cur	Syl	Cur	Syl		
Weeks	17 2/6		18 3/6			
Types of classes	Cur	Syl	Cur	Syl	Cur	Syl
Lectures	16	16	16	16	32	32
Practical	64	64	64	64	128	128
Classes total	80	80	80	80	160	160
Self-study	28	28	37	37	65	65
Control hours			27	27	27	27
Total	108	108	144	144	252	252

The Syllabus is compiled by:

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The Syllabus

Hominal Physiology

Developed in accordance with Federal State Educational Standard:

Federal State Educational Standard of higher education in the specialty 31.05.01 General medicine (Order of the Ministry of Education and Science of the Russian Federation on August, 12, 2020 . №988)

Based on the Curriculum:

31.05.01 GENERAL MEDICINE

Specialization: General Medicine

Approved by the Academic Council of Surgut State University, “16” June 2022, Record No.6

The Syllabus was approved by the department

Morphology and physiology

Head of Department, Doctor of Medicine, Professor Stolyarov V.V.

1. COURSE OBJECTIVES							
1.1	The aim of the course of Hominal Physiology is to create the basis for a sufficiently broad theoretical training in the field of medical physiology, allowing students to master their knowledge and form the ideas about functioning of the human body, its systems, organs, tissues and cells, the basic mechanisms, regulations in the human body, the influence of environmental factors. It also develops skills in making a preliminary diagnosis and providing qualified medical care at the prehospital stage and of professional competencies through the systematic approach to get the current knowledge in the field of general and particular physiology.						
2. COURSE OVERVIEW							
Course code (in curriculum)		B1.O.04.10					
2.1	Assumed background:						
	Latin Language						
	Foreign Language (English)						
	Biology						
	Physics, Mathematics						
	Chemistry						
	Histology, Embryology, Cytology						
	Human Anatomy						
2.2	Post-requisite courses and practice:						
	Microbiology, Virology						
	Hygiene						
	Immunology and Allergology						
	Pathophysiology						
	Clinical Pathophysiology						
	Pharmacology						
3. COMPETENCES UPON COMPLETION OF THE COURSE (MODULE)							
GPC-5.1: Knows the histological structure of organ tissues - knows how to differentiate them microscopically; the anatomy of the human body - the macroscopic structure and topography of organs and body parts; human physiology - the mechanisms of homeostasis regulation and the functional systems of the body in the normal condition							
GPC-5.9: Knows immune defense mechanisms, types of immunological reactions and their role in the pathogenesis of human diseases							
By the end of the course students must:							
3.1	Know:						
3.1.1	principle analysis of social problems in various types of professional and social activities						
3.1.2	the subject and the tasks of the discipline						
3.1.3	the role, place and connection of the discipline with other sciences in the system of biological and medical disciplines						
3.1.4	the main historical stages of the discipline development						
3.1.5	the basic concepts of medical physiology						
3.2	Be able to:						
3.2.1	use the methods of the human study, natural sciences, biomedical and clinical sciences in various types of professional and social activities						
3.2.2	use the acquired knowledge in the study of other biomedical and medical disciplines						
3.2.3	interpret and apply the basic concepts of medical physiology in the study of biomedical and medical literature and when working with medical specialists						
3.3	Have skills of:						
3.3.1	methods of human study, natural sciences, biomedical and clinical sciences in various types of professional and social activities						
4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)							
Class Code	Topics /Class type	Term / Academic year	Academic hours	Competences	Literature	Interactive	Notes
	Module 1. General properties of excitable tissues						

1.1	The structure of biomembranes, their properties and functions. Membrane proteins, their types and role. Receptor functions of cell membranes. Membrane receptors, their properties. Inotropic receptors. Metabotropic receptors, their varieties. Participation in the implementation of effects /Lecture/	3	4	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	
1.2	Bioelectric signals in excitable tissues /Practice/	3	10	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Oral quiz, test, case-study
Module 2. General characteristics of central nervous system							
2.1	General principles of functional regulation. Nervous functional regulation /Lecture /	3	2	(GPC)-5.1	1.1 1.2	0	
2.2	Characteristics of excitable tissues. Bioelectric phenomena in cells and tissues. Irritability and excitability of cells and tissues. Measurement of excitability. Neuron. Properties of neurons. The laws of the excitation in nerve fibers. Properties of synapses. Parabiosis. /Practice/	3	11	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Oral quiz, test, case-study
2.3	Membrane transport protein. Facilitated transport. Active transport, its types and features /Self – study/	3	10	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Essay
Module 3. Private CNS and ANS							
3.1	Private physiology of the central nervous system. Dorsal, midbrain and posterior brain. Cerebellum. Intermediate brain /Lecture/	3	2	(GPC)-5.1	1.1 1.2	0	
3.2	Forebrain. Limbic system. Basal ganglia. Cerebral cortex. Functional brain asymmetry /Practice/	3	12	(GPC)-5.1	1.1 1.2	4	Oral quiz, test, case-study
3.3	Physiology of the spinal cord, medulla oblongata and brain, midbrain, cerebellum, reticular formation, diencephalon, subcortical structures, and the cerebral cortex /Self – study/	3	10		1.1 1.2	0	
Module 4. Endocrine system							
4.1	Thyroid and parathyroid glands. Pancreas, adrenal glands. Sex glands. Physiology of reproductive function. Endocrine function of non-endocrine organs /Lecture/	3	2	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	
4.2	Humoral and hormonal regulation. Hypothalamic-pituitary system /Practice/	3	10	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
4.3	Menstrual cycle. Conception, pregnancy, birth. Contraception. Male potency /Self – study /	3	8	(GPC)-5.1	1.1 1.2	0	Essay
Module 5. Blood							

5.1	General properties of blood. Leukocytes /Lecture/	3	2	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	
5.2	Hemostasis, its types. /Lecture/	3	2	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	
5.3	Erythrocytes. Hemoglobin. Blood groups. System AB0. Rhesus factor. Rules of blood transfusion. Platelet properties. Hemocoagulation. Anticoagulant and fibrinolytic blood systems. /Practice/	3	11	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
5.4	Anticoagulants. Fibrinolytic blood system. /Practice/	3	10	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Oral quiz, test, case-study
5.5	Physiology of the central nervous system /Test/	3	0	(GPC)-5.1 (GPC)- 5.9		0	essay
Module 6. Blood circulation							
6.1	Functional characteristics of the circulatory system. Regulation of the heart. External manifestations of cardiac activity (mechanical, sound). /Practice/	3	4	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
6.2	Physiological properties of the heart muscles /Lecture/	4	2	(GPC)-5.1	1.1 1.2	0	
6.3	Vascular tone. Systemic hemodynamics. Blood pressure. Microcirculation. Features of blood circulation in various organs. Regulation of systemic hemodynamics. /Practice/	4	16	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
6.4	Methods for the study of blood vessels, blood pressure measurement. Organ circulation, methods of its examination /Self – study/	4	8	(GPC)-5.1	1.1 1.2	0	Essay
Module 7. Breathing and Excretion							
7.1	External breathing. Biomechanics of respiration. Water-salt metabolism. Physiology of secretion. Renal Physiology /Lecture /	4	4	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
7.2	Gaseous exchange. Respiration /Practice/	4	16	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
7.3	Water balance, factors to maintain balance, and water regulation. Water spaces, their characteristic. /Self – study/	4	8		1.1 1.2	0	Essay
Module 8. Digestion and metabolism							

8.1	The physiology of digestion. Methods for studying the functions of the digestive tract. Functions of the digestive tract. Secretory function of the gastrointestinal tract. /Lecture/	4	2	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	
8.2	Motor, absorption and excretory functions of the gastrointestinal tract. Regulation of digestion. Metabolism. Heat exchange. Thermoregulation. Energy exchange. Methods for estimating energy consumption /Practice/	4	16	(GPC)-5.1	1.1 1.2	0	Oral quiz, test, case-study
8.3	The secretory function of the gastrointestinal tract /Self – study/	4	8	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Essay
Module 9. Analyzers							
9.1	General properties of analyzers /Lecture/	4	2	(GPC)-5.1	1.1 1.2	0	
9.2	Private physiology of analyzers (auditory, vestibular, tactile, taste and temperature analyzers) /Practice/	4	16	(GPC)-5.1	1.1 1.2	4	Oral quiz, test, case-study
9.3	Physiology of pain perception. Nociception and anti-nociception. /Self – study/	4	8	(GPC)-5.1	1.1 1.2	0	Essay
Module 10. Higher nervous activity							
10.1	Congenital and acquired behaviors. Unconditioned reflexes, instincts. Conditioned reflexes. Dynamic stereotype /Lecture/	4	2	(GPC)-5.1	1.1 1.2	4	Oral quiz, test, case-study
10.2	Congenital and acquired behaviors. Conditioned reflexes. Types of higher nervous activity. Methods for evaluating behavioral responses. Emotions. Motivations. Memory. Architectonics of a focused behavioral act. Methods of memory evaluating /Practice/	4	10	(GPC)-5.1	1.1 1.2	0	
10.3	Stress and adaptation. Mechanisms of urgent and long-term adaptation. /Self – study/	4	5	(GPC)-5.1	1.1 1.2	0	
10.4	Higher nervous activity/ Test	4	0	(GPC)-5.1	1.1 1.2	0	Essay
10.5	Exam	4	27	(GPC)-5.1 (GPC)- 5.9	1.1 1.2	0	Oral quiz Case – study

5. ASSESSMENT TOOLS

5.1. Tests and tasks

Supplement 1

5.2. Topics for written papers

Supplement 1

5.3. Assessment tools

Supplement 1

5.4. List of assessment tools

1. Points for oral quiz				
2. Tests				
3. Case-studies				
4. Essay				
6. COURSE (MODULE) RESOURCES				
6.1. Recommended Literature				
6.1.1. Core				
	Authors	Title	Publish, year	Quantity
1.1	Hall, John E.	Guyton and Hall Textbook of Medical Physiology	Philadelphia: Elsevier, cop.2016	31
1.2	Lapkin M.M., Trutneva E.A.	Selected Lectures on Normal [Electronic resource]: study guide in Russian and English https://www.studentlibrary.ru/book/ISBN97859704446782.html	M.: GEOTAR- Media. 2019	1
6.2. Internet resources				
1	FreeMedicalJournals			
6.3.1 Software				
6.3.1.1	Operational system Microsoft, applied programs pack Microsoft Office			
6.3.2 Information Referral systems				
6.3.2.1	"Garant", "Consultant plus"			
8. Course manuals				
Supplement 2				

ASSESSMENT TOOLS

[Syllabus](#)

Hominal Physiology

Qualification

Specialist

Specialty

31.05.01 General Medicine

Form of education

Full-time

Designer
Department

Morphology and physiology

Graduate
Department

Internal diseases

Sample tasks and tests

Stage I: Formative assessment.

1.1 Points for oral quiz for module 1-10.

Module 1. General properties of excitable tissues

1. The concept of excitable tissues, their physiological properties.
2. Structure, functions of the cytoplasmic membrane, types of transport proteins of the membrane, the portal mechanisms of ion-selective channels.
3. The main parameters of excitability: the threshold of irritation, useful time, chronaxia
4. Membrane and ionic mechanisms of the bio potentials origin.
5. Sodium-potassium pump, its role at rest and in activation.

Module 2. General characteristics of central nervous system

4. General characteristics of nerve cells: classification, structure, functions.
5. Structure and types of nerve fibers and nerves. Main properties of nerve fibers and nerves. Mechanisms of activation propagation along the nerve fibers.
6. Concept of the synapse. Structure and types of synapses. Mechanisms of synaptic transmission of activation and inhibition. Mediators. Receptors. Main properties of synapses.
7. General patterns of human adaptation. Evolution and forms of adaptation. Adaptogenic factors.
8. Concept of reflex and reflex arc. Reflex classification and types of reflex arcs. Features of reflex arcs of somatic and vegetative (sympathetic and parasympathetic) reflexes.
9. Concept of the nerve center. The main features of the nerve centers. Compensation of functions and plasticity of nervous processes.
10. Basic principles of coordination in the central nervous system activity.

Module 3. Private CNS and ANS

1. Spinal cord, its neural and synaptic organization. Spinal cord functions.
2. Reflex activity of the spinal cord. Clinically important reflexes of the spinal cord.
3. Participation of the spinal cord in the regulation of muscle tone. The role of alpha and gamma motor neurons in this process.
4. Reflex activity of the medulla oblongata, its role in the regulation of muscle tone. Decerebral rigidity.
5. Structural and functional organization of the midbrain, its participation in the implementation of postural-tonic muscle activity. Static and statokinetic reflexes (M. Magnus).
6. Reticular formation of the brainstem, its characteristics, functions. The role of the reticular formation in the regulation of the autonomic functions of the body.
7. Descending (IM Sechenov, G. Megun) and ascending (G. Magun, D. Moruzzi) influences of the reticular formation on the structures of the central nervous system.

8. Thalamus is a collector of afferent pathways. Functional characteristics of thalamic nuclei, their role in the integrative activity of the brain.
9. The hypothalamus is the highest subcortical center for the regulation of the autonomic functions of the body, the role of its nuclei in the integration of autonomic and somatic functions.
10. Basal ganglia, their participation in the formation of muscle tone, complex motor programs. Parkinson's syndrome, the role of dopaminergic pathways in its genesis.
11. Modern ideas about the structural and functional organization of the cerebral cortex, characteristics of the cortical fields (functional and cytoarchitectonic).
12. Polyfunctionality, plasticity of cortical areas. The concept of the functional asymmetry of the hemispheres in humans.
13. Modern electrophysiological methods for studying the functions of the central nervous system (electroencephalography, method of evoked potentials, microelectrode technique, stereotaxic technique).
14. Basic physiological properties and functions of the autonomic nervous system. Features of the reflex arc of the autonomic reflex.
15. Vegetative ganglia, their closure function.
16. Influence of the sympathetic and parasympathetic divisions of the autonomic nervous system on the functions of organs and body systems, the relativity of antagonism of the divisions of the autonomic nervous system.
17. Vegetative reflexes. Centers of regulation of vegetative functions, their hierarchy.

Module 4. Endocrine system

1. The main components of the endocrine system (local and diffuse). The concept of endocrine glands, hormone.
2. Types of endocrine glands. Morphofunctional signs of endocrine glands. The biological role of the endocrine glands, their hormones.
3. Classification of hormones, stages of biological life of hormones, transport of hormones by blood.
4. Characteristics of the hypothalamic-pituitary systems.
5. Morpho functional characteristics of peripheral endocrine glands, the effect of their hormones on organs, body systems.
6. The functional significance of hormones, their structural and functional characteristics.
7. Stages of the biological life of hormones, their main properties.
8. Mechanisms of hormone action (direct action), hormone receptors.
9. Indirect action of hormones.
10. The relationship of the endocrine glands, the mechanisms of their self-regulation.
11. Methods of research of endocrine glands.
12. Internal secretion of the thyroid gland. The role of iodine-containing hormones in the body's vital processes, the mechanisms of their action, regulation of secretion.
13. Hormones of the pancreas: representatives, mechanism of action, regulation of secretion.
14. Corticosteroids: classification, role in the body, mechanism of action, regulation of secretion.
15. Hormones of the adrenal medulla: role in the body, mechanism of action, regulation of secretion.
16. Sex hormones: role in the body, mechanism of action, regulation of secretion.

Module 5. Blood

1. Concept of blood, blood system, blood function. The amount of circulating blood, its composition. Basic blood constants, their value and functional significance.
2. The concept of osmotic blood pressure, oncotic blood pressure, their values. Functional systems that maintain a constant osmotic pressure and blood pH.
3. Concept of the protective function of blood and its manifestations (immune reactions, blood coagulation).

4. Blood plasma proteins, their composition, functions, role in the formation of immunity, in maintaining the physicochemical constants of blood, in blood coagulation.
5. Corpuscular elements of blood. Erythrocytes and their morphological and functional characteristics. Erythrocyte reactions, mechanisms of physiological erythrocytosis.
6. The concept of hemolysis, its types. Osmotic resistance of erythrocytes, the boundaries of the minimum, maximum osmotic resistance of erythrocytes.
7. The erythrocyte sedimentation rate, its mechanisms, the clinical significance of ESR.
8. Hemoglobin, its functions. Types, hemoglobin compounds, their functional significance.
9. The concept of erythropoiesis, its nervous and humoral regulation. The process of blood coagulation, its meaning. The main factors involved in the coagulation process, their functional characteristics.
10. Blood groups as a manifestation of the body's immune specificity. Varieties of groups, blood systems. Rh factor, their importance for obstetric and surgical practice.
11. Physiological basis of blood transfusion. Blood substitution solutions, their use in medical practice.
12. Leukocytes, their morphological and functional characteristics. Leukocyte reactions, types of physiological leukocytosis, their mechanisms.
13. The concept of leukopoiesis, its nervous and humoral regulation.
14. Non-specific immunity, its mechanisms (humoral and cellular)
15. Specific immunity, its mechanisms (humoral and cellular)
16. The concept of vascular-platelet, coagulation hemostasis. Phases of vascular-platelet hemostasis, their characteristics.
17. Coagulation hemostasis. Stages of coagulation hemostasis, their characteristics.
18. A functional system that maintains the liquid state of the blood. Coagulant, anticoagulant and fibrinolytic systems, their functional interaction.

Module 6. Blood circulation

1. Characteristics of the phases of the cardiac cycle. Change in blood pressure in the cavities of the heart in different phases of the cardiac cycle.
2. The main indicators of heart activity. Their dependence on the functional state of the body.
3. Automation of the heart: nature, the conducting system of the heart, its features.
4. Characteristics of the action potential of working cardiomyocytes.
5. Physiological properties of the heart muscle and its features.
6. Characteristics of the contractility of the heart muscle.
7. Mechanisms of homeometric and heterometric self-regulation of heart activity.
8. The structure and features of the conducting system of the heart.
9. Basic methods of research of heart activity.
10. Electrocardiography: the principle of the method, ECG leads.
11. The main pacemaker of the heart, the mechanisms of its rhythm-forming function. Features of the occurrence of PD in the cells of the sinus node.
12. The gradient of automation, the role of the atrioventricular node and other parts of the cardiac conduction system.
13. Analysis of the spread of excitement through the heart.
14. Excitability of the heart muscle.
15. Correlation of excitation, contraction and excitability during the cardiocycle. Extrasystoles, mechanisms of its formation.
16. Characteristics of the influences of sympathetic and parasympathetic nerves and their mediators on the activity of the heart.
17. Reflex regulation of the heart.
18. Humoral regulation of the heart.
19. Functional organization of the vascular bed. Types and features of blood vessels.
20. Mechanisms of blood flow through the vessels. Factors affecting the movement of blood through the vessels. Features of the movement of blood through the veins.
21. The main indicators of hemodynamics.
22. Blood pressure: its determining factors, the main indicators.
23. Methods of research of blood pressure.
24. The concept of vascular tone.
25. Myogenic mechanisms of regulation of vascular tone (intravascular pressure, metabolites, etc.).
26. Nervous regulation of vascular tone.
27. Vascular reflexogenic zones and their role in the regulation of vascular tone.
28. Vasomotor center. Levels of central regulation of vascular tone (spinal, bulbar, hypothalamic, cortical).
29. Humoral mechanisms of regulation of vascular tone.

Module 7. Breathing and Excretion

1. The respiratory system, its main components, the importance of respiration for the body, the main stages of respiration.
2. Biomechanics of inhalation and exhalation. Intrapleural pressure, its value.
3. Composition and partial pressure of gases in the inhaled and exhaled air.
4. Indicators of external respiration (lung volumes, capacities, ventilation of the lungs).
5. Transport of gases by blood. Oxyhemoglobin dissociation curve. Features of the transport of carbon dioxide.
6. Gas exchange between alveolar air and blood. Gas exchange between blood and tissues.
7. Respiratory center. Modern ideas about its structure and function. Respiratory center automation.
8. Spinal level of breathing regulation. The role of proprioceptors of the respiratory muscles in the regulation of respiration.
9. The role of the medulla oblongata and the pons varoli in maintaining the periodicity and optimal level of pulmonary ventilation.
10. The role of the hypothalamus of the limbic system and the cerebral cortex in the regulation of respiration during various adaptive reactions of the body.
11. Humoral regulation of respiration: experiments recording the role of oxygen and carbon dioxide.
12. Breathing in conditions of high and low atmospheric pressure. Decompression sickness. Mountain sickness.
13. The mechanism of the first breath of a newborn.
14. The role of the kidneys in the body. The main functions of the kidneys.
15. The kidney as the main organ of the excretory system. Nephron is a structural and functional unit of the kidney. Features of the nephron blood supply.
16. Mechanisms of urination. Glomerular filtration.
17. Nervous and humoral regulation of the glomerular filtration rate.
18. Tubular reabsorption, its mechanisms. Characterization of the processes of reabsorption of various substances in the tubules and loop of Henle.
19. Nervous and humoral regulation of reabsorption processes.
20. Characteristics of the process of tubular secretion.
21. Composition and properties of the final urine.
22. Mechanisms of urine excretion and urination.
23. Participation of the kidneys in the regulation of the acid-base state of the blood.
24. Methods for studying the processes of urine formation. The concept of the coefficient of purification (clearance).

Module 8. Digestion and metabolism

1. Digestion in the oral cavity. Changes in food in the mouth - mechanical and chemical processing.
2. Salivation, study methods. The composition and physiological role of saliva. Regulation of salivation.
3. Digestion in the stomach. Composition, properties of gastric juice, role in digestion. Features of gastric secretion during the digestion of proteins, fats, carbohydrates.
4. Phases of gastric secretion. Regulation of gastric secretion (nervous and humoral).
5. Methods for studying the secretory function of the stomach in animals and humans.
6. Digestion in the duodenum, its regulation. Composition and properties of pancreatic juice.
7. The role of the liver in digestion. Composition and properties of bile. Bile formation and bile secretion, mechanisms of their regulation.
8. The secretory function of the intestine. Composition and properties of intestinal juice, role in digestion. Cavity and membrane hydrolysis of nutrients in the small intestine.
9. Concept of homoiothermal and poikilotherm organisms. Meaning and mechanisms of maintaining permanent body temperature. Temperature core concept.
10. The act of chewing, its self-regulation. Research methods. Swallowing, its phases.
11. Types of stomach contraction, their neuro-humoral regulation, research methods.
12. The process of evacuation of the contents of the stomach into the duodenum, its regulation.
13. Motor activity of the small intestine. Types of "contractions, role in digestion. Mechanisms of regulation. Intestinal reflexes.
14. Motor activity of the colon. Types of contractions, role in digestion. Regulation mechanisms. The value of the microflora of the large intestine.
15. Methods for studying intestinal motor function in animals and humans.
16. Absorption of substances in various parts of the digestive tract. The mechanism of water and salt absorption, its regulation.

17. Heat production and heat transfer: mechanisms and their determinants. Compensatory changes in heat production and heat transfer. Neurohumoral mechanisms of permanent body temperature regulation.
18. Main stages of metabolism in the body. Metabolism regulation. Liver role in the metabolism of proteins, fats, carbohydrates.
19. Characteristics of carbohydrate metabolism in the body.
20. Characteristics of proteins metabolism in the body.
21. Characteristics of fats metabolism in the body.
22. Energy balance of the body. Methods for determining body energy intake. Caloric oxygen ratio. Concept of the general exchange and its components (basal metabolism, specifically the dynamic effect of food).
23. Characteristics of energy intake in various activities, principles of dieting.

Module 9. Analyzers

1. Visual analyzer. The optical system of the eye, its functions. Accommodation. Refractive errors of the eye. Pupillary reflex.
2. The structure of the retina. Photoreceptor apparatus. Photochemical processes in the retina. Bioelectric phenomena in the retina. Visual acuity, visual fields, methods of their determination.
3. Theories of color vision. The main forms of color vision disorders.
4. Auditory analyzer. The outer, middle and inner ear are their structure and function. Corti's organ.
5. Coding of information in the organ of hearing (Rutherford, Helmholtz, Bekesy). Research methods of the auditory analyzer.
6. Vestibular analyzer. The structure of the vestibular apparatus, its functions. Research methods of the vestibular analyzer.
7. Olfactory analyzer, its structure and function. Research methods of the olfactory analyzer.
8. Taste analyzer, its structure. Taste buds. Gustatory sensitivity. Mechanisms of the occurrence of gustatory sensations.
9. Somatosensory analyzer. Tactile, cold and heat receptors. Features of their structure and functioning. Proprioceptive sensitivity.
10. Painful sensory system, its receptors and biological significance.
11. The structure of the visceral analyzer. Visceroceptors, their structure and features of functioning.

Module 10. Higher nervous activity

1. Methods of studying the functions of the cerebral cortex
2. Congenital forms of behavior, unconditioned reflexes, their role for the adaptive activity of the organism
3. Conditioned reflex as a form of adaptation to changing conditions of existence. Rules for the development of conditioned reflexes
4. Classification of conditioned reflexes
5. Physiological mechanisms of reflex communication formation. Development of I.P. Pavlova on the mechanisms of forming a temporary connection.
6. Inhibition of conditioned reflexes. Braking types. Modern ideas about the mechanisms of inhibition of conditioned reflexes.
7. The doctrine of I.P. Pavlova on the types of higher nervous activity, their classification and characteristics.

8. The biological role of emotions. Vegetative and motor components of emotions.
9. Physiological mechanisms of sleep. Sleep phases. Sleep theories.
10. Memory and its importance for the formation of integral adaptive reactions. Concept of the mechanisms of short-term and long-term memory.
11. The law of power relations in higher nervous activity and its changes in various functional states. Experimental neuroses.
12. The architecture of a holistic behavioral act from the point of view of the theory of a functional system P.K. Anokhin
13. The concept of the highest mental functions of a person (attention, perception, memory, emotions, thinking, consciousness, speech)
14. Speech, speech functions. Functional asymmetry of the cerebral cortex associated with the development of speech in humans.

1.2 Sample tests for module 1-10

NERVOUS CELL PERFORM ALL FUNCTIONS EXCEPT

- 1) receiving information
- 2) storage information
- 3) coding information
- 4) mediator production
- 5) mediator inactivation

THE MAIN FUNCTION OF DENDRITES IS

- 1) conducting activation from the cell body to the effector
- 2) mediator production
- 3) conducting activation to the neuron body

IN NATURAL CONDITIONS POTENTIAL ACTION IN NEURON ARISES

- 1) in the field of dendrites
- 2) in the synapse
- 3) in the soma nerve cell
- 4) in the initial axon segment

1.3 Sample case-study for module 1-10.

1. The concentration of potassium ions increases when myocardial blood supply deteriorates in the extracellular fluid. What way and why will this one affects the generation of action potential of myocardial cells?
2. What happens in the nerve center if impulses enter it with a frequency at which acetylcholine does not have time to break down?
3. Why, during the first stage of spinal shock, inhibition of reflexes occurs, the centers of which are located below the site of injury?
4. At what phase of sleep can sympathetic tone increase?
5. What hormone causes hypertrophy of the uterine lining in the first half of the menstrual cycle, and during pregnancy contributes to the growth of the uterus?

1.4 Sample essay topics for module 1-10.

1. Modern ideas about the structural and functional organization of the central nervous system. Physiological features and functions of neurons. Blood-brain barrier.
2. Interneuron interactions. Synaptic organization of the central nervous system. Types of synapses, characterization of mediators, mediator systems of the brain.
3. Polysensory neurons, processes of heterogeneous convergence as the basis of the integrative function of polysensory structures.
4. General concepts about hormones and hormonal regulation.
5. Principles of regulation of hormonal secretion:
6. Methods for studying the functional activity of the endocrine glands and methods for assessing it: clinical and experimental.
7. Hormones of the female reproductive glands. Cyclic activity of the ovaries.
8. The sympathoadrenal system and its role in nonspecific adaptive reactions of the body. The concept of stress (Selye, 1936-1952).
9. Nervous regulation of the secretory function of the adrenal chromaffin tissue.
10. Hormonal regulation of blood calcium levels.

Stage II: Midterm assessment exam 2nd term.

Midterm assessment is carried out in the form of exam. Tasks for the exam include two theoretical points and one case – study.

Tasks for competence assessment «Knowledge»	Task type
<p>List of theoretical points</p> <ol style="list-style-type: none"> 1. The concept of excitable tissues. Main properties of active tissues. Stimuli. Classification of stimuli. 2. Modern ideas of cell membranes structure and function. Membrane potential concept. Resting potential. 3. Characteristics of changes in the cell membrane potential in the activation and inhibition process. Action potential, its parameters and value. 4. General characteristics of nerve cells: classification, structure, functions. 5. Structure and types of nerve fibers and nerves. Main properties of nerve fibers and nerves. Mechanisms of activation propagation along the nerve fibers. 6. Concept of the synapse. Structure and types of synapses. Mechanisms of synaptic transmission of activation and inhibition. Mediators. Receptors. Main properties of synapses. 7. General patterns of human adaptation. Evolution and forms of adaptation. Adaptogenic factors. 8. Concept of reflex and reflex arc. Reflex classification and types of reflex arcs. Features of reflex arcs of somatic and vegetative (sympathetic and parasympathetic) reflexes. 9. Concept of the nerve center. The main features of the nerve centers. Compensation of functions and plasticity of nervous processes. 10. Basic principles of coordination in the central nervous system activity. 11. Functional organization of the spinal cord. The role of spinal centers in the regulation of movements and autonomic functions. 12. Characteristics of the functions of the medulla, middle, intermediate brain, cerebellum, their role in the motor and autonomic reactions of the organism. 13. The cerebral cortex as the highest part of the central nervous system, its value, organization. Localisation of functions in the cerebral cortex. Dynamic stereotype of nervous activity. 14. Functional organisation and functions of the autonomic nervous system (ANS). The concept of the sympathetic and parasympathetic divisions of the 	<p>-theoretical</p>

ANS. Features, differences, impact on human bodies.

15. Pavlov's doctrine about analyzers. Biological significance and main functions of sensory systems. Classification and activation mechanism of analyzers.
16. Characteristics of the visual sensory system.
17. Characteristics of the motor sensory system.
18. Concept of the auditory, pain, visceral, tactile, gustatory sensory systems.
19. Concept of inborn reflexes, their classification according to various indicators. Examples of simple and complex reflexes. Instincts.
20. Definition of higher nervous activity. Pavlov's doctrine about conditioned reflexes, as the basis of higher nervous activity, differences from inborn ones. Characteristics and mechanism of conditioned reflexes background. Signaling systems concept.
21. Types and characteristics of inhibition of conditioned reflexes.
22. Basic patterns of motion control. Involvement of various sensory systems in motion control. Motor skill: physiological basis, conditions and phases of its background.
23. Types of higher nervous activity and their characteristics.
24. Striated muscle composition. Types of muscle contraction. Types of muscle fibers.
25. Main features of skeletal muscle. Single cut. Aggregation of contractions and tetanus. Optimum and pessimum concept. Parabiosis and its phases.
26. Physiological basis of muscle strength. Maximum statistical power: conditions necessary for its origin. Maximum conditional force: concept definition, determining factors.
27. Fatigue concept. Physiological phenomenon and stages of fatigue development. Main physiological and biochemical body changes with fatigue. The concept of "active" rest.
28. Comparative characteristics of smooth and skeletal muscles. Mechanism of muscle contraction.
29. Concept of the "blood system". Main functions and the structure of the blood. Physical and mathematical blood features. Blood buffer systems. Blood plasma and its structure. Regulation of blood construction.
30. Erythrocytes: structure, functions, methods of determination. Hemoglobin: structure, functions, methods of determination.
31. Leukocytes: types, structure, functions, methods of determination, counting. Leukocyte formula.
32. The doctrine of blood groups. Blood groups and Rh factor, methods of their determination. Blood transfusion.
33. Blood coagulation: mechanism, process value. Anticoagulant system, fibrinolysis.
34. Heart: structure, phases of the cardiac cycle. Key indicators of the heart activity.
35. Automation of the heart muscle: concept, current understanding of the causes, features. Automation degree of various parts of the heart. Stannius Experiment.
36. Heart muscle excitability: concept mechanisms. Excitability changes in different periods of the cardiac cycle. Extrasystole.
37. Ductance of the heart muscle: concept, mechanism, features.
38. Contractility of the heart muscle: concept mechanism. Hetero - and homeometric mechanisms of contractility regulation.
39. Characteristics of the nervous, reflex and humoral regulation of cardiac activity.
40. Electrical heart activity. Physiological basis of cardiography. Electrocardiogram. Electrocardiogram analysis.
41. Blood vessels types. Mechanisms of blood flow through the veins. Features of

<p>blood flow through the veins. Main hemodynamic parameters of blood flow through the vessels.</p> <p>42. Features of blood circulation in various parts of the vascular channel. Microcirculation. Mechanisms of exchange in the microvasculature.</p> <p>43. Blood pressure concept. Blood pressure in different parts of the vascular channel. Blood pressure, its determining factors, method of determination.</p> <p>44. Nervous and humoral regulation of the vascular system. Vasomotor center, its structure. Vascular tone reflex regulation. Vascular reflex zones, their place and value in the regulation of blood circulation.</p> <p>45. Breathing: importance, basic respiratory organs. Mechanisms of inhalation and exhalation, main respiratory muscles. Structure of inhaled and alveolar air. Concept of "dead space", its physiological meaning.</p> <p>46. Intrapleural pressure, its value. Lung tissue elasticity. Factors determining lungs elastic traction. Pneumothorax.</p> <p>47. Lung ventilation. Gas exchange between alveolar air and blood. Main lungs volumes and capacities, their value, methods of determination.</p> <p>48. Blood oxygen transport. Bohr effect.</p> <p>49. Carbon dioxide transportation by the blood.</p> <p>50. Nervous and humoral regulation of respiration. Respiratory center concept. Respiratory center automation. Reflex effects of lungs mechanoreceptors, their meaning.</p> <p>51. Digestion: concept, physiological basis of hunger and satiety. Food Center. Main theories explaining the state of hunger and saturation.</p> <p>52. Main stages of digestion in the gastrointestinal tract. Classification of digestion depending on the enzymes and localization process.</p> <p>53. Characteristics of the digestive process in the stomach. Mechanisms and phases of gastric secretion. Pancreas role in the digestion. Neurohumoral regulation of gastric secretion and pancreatic secretory activity.</p> <p>54. Main functions of the liver. Digestive function of the liver. Role of bile in the digestion process. Bile structure and biliary excretion.</p> <p>55. Concept and characteristics of abdominal and parietal digestion. Suction mechanisms.</p> <p>56. Main functions of the gastrointestinal tract. Basic principles of the digestion regulation. Main effects of nerve and humoral effects on the digestive organs</p> <p>57. Phases of the adaptation process development. Adaptation mechanisms. Management adaptation.</p> <p>58. Excretory processes: significance, organs of excretion. Main functions of the kidneys.</p> <p>59. Features of the renal blood flow. Nephron: structure, functions, characteristics of the processes of urination and excretion. Primary and secondary urine. Urine</p>	
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<p>structure.</p> <p>60. Nervous and humoral regulation of the kidneys.</p> <p>61. Concept of homoiothermal and poikilotherm organisms. Meaning and mechanisms of maintaining permanent body temperature. Temperature core concept.</p> <p>62. Heat production and heat transfer: mechanisms and their determinants. Compensatory changes in heat production and heat transfer. Neurohumoral mechanisms of permanent body temperature regulation.</p> <p>63. Main stages of metabolism in the body. Metabolism regulation. Liver role in the metabolism of proteins, fats, carbohydrates.</p> <p>64. Characteristics of carbohydrate metabolism in the body.</p> <p>65. Characteristics of proteins metabolism in the body.</p> <p>66. Characteristics of fats metabolism in the body.</p> <p>67. Energy balance of the body. Methods for determining body energy intake. Caloric oxygen ratio. Concept of the general exchange and its components (basal metabolism, specifically the dynamic effect of food).</p> <p>68. Characteristics of energy intake in various activities, principles of dieting.</p> <p>69. Concept of the endocrine glands. Hormones: concept, general properties, classification by chemical structure. Mechanisms of hormones action.</p> <p>70. Value of the thyroid gland, its hormones. Hyper-and hypofunction. Parathyroid gland, its role.</p> <p>71. Pituitary function. Hormones of the anterior and posterior lobes of the pituitary gland, its effects.</p> <p>72. Physiology of the adrenal glands. Hormones of the adrenal cortex, their functions. Hormones of the medulla adrenal glands, their role in the body.</p>	
<p>Tasks for competence assessment «Abilities»</p>	<p>Task type</p>
<p>Case – studies</p> <ol style="list-style-type: none"> 1. The level of angiotensin II in the blood increased. How will this affect urine formation and why? 2. Explain why there is a decrease in the formation of urine with blood loss? 3. Calculate the minute blood volume if the heart rate is 80 beats / min, the systolic volume is 70 ml. How much oxygen will be associated with a given blood volume, if it is known that in 100 ml. the subject's blood contains 15 grams. hemoglobin? 4. When probing the left heart of a healthy person at one of the moments of the cardio cycle, the pressure in the left ventricle is 125 mm Hg. When probing the right ventricle, the pressure in it was equal to 20 mm Hg. What phase does this correspond to? 5. When calculating the ECG of the subject, the duration of the PQ interval was 0.24 sec. What does this mean? 6. Calculate the respiratory coefficient if it is known that the subject absorbs 0.4 liters of oxygen per minute and releases 0.36 liters. carbon dioxide. What kind of nutrition does this value indicate? 7. Are the conditions for the occurrence of "heatstroke" and heat fainting in humans the same? 	<p>-practical</p>

<p>8. Why, when adrenaline is injected into the blood, blood pressure first increases significantly and then decreases?</p> <p>9. When examining a 5-year-old boy, a significant lag in mental development and growth was noted. The child is not very active. General exchange is reduced. Is it possible to think about hypo- or hyperfunction of the thyroid gland?</p> <p>10. A predominance of type II-A fibers, thickening of type I fibers and a decrease in the number of type II-B fibers were found in the patient's 4 thigh muscle. What does this mean? What kind of work will this person be more adapted to?</p> <p>11. In a person after a car accident, examination revealed that the elbow joints and upper abdominal reflexes are normal, while the middle, lower abdominal, knee, Achilles and plantar reflexes are not evoked. What does this indicate?</p>	
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METHODOLOGICAL GUIDELINES FOR LEARNING OUTCOMES ASSESSMENT

Stage I: Formative assessment

Formative assessment is a regular checking of student academic progress during the academic term. It is performed in various oral and written forms (quizzes, essays, checking of home assignments, compilation of cases, self-study, colloquiums, and testing). During formative assessment, the teacher monitors the level of student's academic progress according to the curriculum identifying lack of knowledge, or misunderstanding.

The tasks of formative assessment are aligned with the Curriculum and Syllabus.

1. Guidelines for assessing the oral quiz:

In assessing the teacher takes into account:

- knowledge and understanding of the subject matter;
- activity during the class;
- consistency of presentation;
- argumentation of the answer, the level of independent thinking;
- ability to link theoretical and practical principles with future professional activity.

Assessment criteria:

The results are assessed in a four-grading scale: "excellent", "good", "satisfactory", "unsatisfactory".

Type of the task	Assessed competences	Assessment criteria	Grade
Oral answer	GPC-5.1 GPC- 5.9	The student demonstrates a comprehensive, systematic and in-depth knowledge of the academic material; has learned the required and additional resources. The student demonstrates a consistent and thorough understanding of the required knowledge, concepts, skills of the material learned, and their significance for future profession.	Excellent
	GPC-5.1	The student demonstrates a comprehensive knowledge of the	Good

	GPC- 5.9	academic material; has learned the required and additional resources. The student demonstrates a consistent understanding of the required knowledge, concepts, skills of the material learned, but makes minor errors.	
	GPC-5.1 GPC- 5.9	The student demonstrates basic knowledge necessary for further study; has learned basic recommended literature. The student operates with inaccurate formulating, has difficulties in the independent answers, makes significant mistakes but is able to correct them under the guidance of a teacher.	Satisfactory
	GPC-5.1 GPC- 5.9	The student does not know the obligatory minimum or demonstrates gaps in knowledge of the academic material, makes major mistakes or gives completely wrong answers.	Unsatisfactory

2. Guidelines for case-study assessment:

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Case - study	GPC-5.1 GPC- 5.9	The student correctly and solves the case-study task, demonstrating deep knowledge. There are no errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained; ways are clearly described.	Excellent
		The student correctly solves the case-study task, demonstrating deep knowledge. There are minor errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained, ways are clearly described.	Good
		The student correctly solves the case-study task, demonstrating basic	Satisfactory

		knowledge. There are significant errors in logical reasoning and solution. The student demonstrates difficulties, but still is able to solve a case-study task.	
	GPC-5.1 GPC- 5.9	The student incorrectly solves the case-study task, makes significant mistakes. The student is not able to solve a case-study.	Unsatisfactory

3. Guidelines for test assessment.

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Test	GPC-5.1	80 – 100%	Excellent
	GPC- 5.9	66 – 80%	Good
		46 – 65%	Satisfactory
		Less Than 46%	Unsatisfactory

4. Essay requirements:

1) Volume: 1500-300 words,

2) Contents structure:

- Introduction
 - prove the relevance of the chosen topic
 - point out the purpose of the essay
 - give a summary of the main points
- Body
 - use information obtained from different sources during the research
 - show inaccuracy of the opposite points of view
- Conclusion
- List of references

The essay assumes usage of several specialized sources (at least 8-10 publications, monographs, the reference media, manuals). Preference is given to the publications in specialized medical journal and monographs including foreign databases.

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Essay	GPC-5.1 GPC- 5.9	The requirements are fulfilled: - the problem is formulated and its relevance is proved; - the various approaches to problem are presented; - conclusions are formulated; - the subject is thoroughly studied; - volume is observed; - design requirements are observed; - correct answers to additional questions are given.	Excellent
	GPC-5.1 GPC- 5.9	The main are fulfilled with some mistakes: - inaccuracies in material statement; - no logical sequence in judgments; - volume is not observed; - errors in design requirements; - incomplete answers are given to additional questions in the process of defense.	Good
		There are significant deviations from requirements: - topic is only partially explored; - mistakes in contents of the paper; - mistakes in answers to additional questions; - no conclusion is given at the process of defense.	Satisfactory
	GPC-5.1 GPC- 5.9	The essay is not prepared at all. The subject of the essay is not explored, significant misunderstanding of a topic.	Unsatisfactory

Stage II: midterm assessment (examination)

Methodological guidelines for summative assessment (examination)

Examination is held in the oral form and includes several stages:

- oral quiz (the card includes two questions);
- case-study;

Requirements for the student:

- 1) regularly attend classes; the absence from classes is not allowed without good reason;
- 2) in case of absence from classes the student has to work out passed classes;
- 3) the student has to hand over written papers on time;
- 4) the student has successfully passed all colloquiums provided by the plan;
- 5) in case the student has been negatively assessed on the colloquium, he/she should try to pass it again;
- 6) during the test week the student has to hand over all the tasks (clinical case).

The students are allowed to take examinations in case of all the tests passed and no academic debts (on the basis of the academic records).

The students are not allowed to take examination:

- with unpassed tests on the discipline;
- with missed classes, debts on the discipline;
- with 5 (five) and more debts for the previous term;
- with one debt for earlier terms for more than a year.

Recommendations for the examination assessment:

Type of the task	Assessed competences	Assessment criteria	Grade
Oral answer	GPC-5.1 GPC- 5.9	The student demonstrates comprehensive, systematic and profound knowledge of the subject, can independently perform the tasks provided by the program; who has a good knowledge of the main literature and familiar with the additional literature recommended by the program; demonstrates creative abilities in understanding, statement and use of material of the studied	Excellent

		discipline, faultlessly answers not only questions of the card, but also additional questions within the main program, correctly performs a practical task.	
	GPC-5.1 GPC- 5.9	The student has good knowledge of material of the studied discipline; can successfully perform the tasks provided by the program; has a good knowledge of the main literature recommended by the program; answers all questions of the card, correctly performs a practical task, but makes some mistakes.	Good
	GPC-5.1 GPC- 5.9	The student demonstrates knowledge of material for further study; can cope with the tasks provided by the program; familiar with the main recommended literature; makes mistakes when performing examination tasks, but has necessary knowledge for their elimination under the supervision of the teacher.	Satisfactory
	GPC-5.1 GPC- 5.9	The student demonstrates poor knowledge of the material, makes significant mistakes in performance of the tasks provided by the program.	Unsatisfactory
Case - study	GPC-5.1 GPC- 5.9	The student correctly and fully solves the case-study task, demonstrating deep knowledge. There are no errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained; ways are clearly described.	Excellent
	GPC-5.1 GPC- 5.9	The student correctly solves the case-study task, demonstrating deep knowledge. There are minor errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained, ways are clearly described.	Good
	GPC-5.1 GPC- 5.9	The student correctly solves the case-study task, demonstrating basic knowledge. There are significant errors in logical reasoning and solution. The student demonstrates difficulties, but still is able to solve a case-study task.	Satisfactory
	GPC-5.1	The student incorrectly solves the case-study task, makes significant	Unsatisfactory

	GPC- 5.9	mistakes answering most of the questions of the case-study. The student is not able to solve a case-study.	
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Chart of the examination grade assessment:

Tasks	Assessed competences	Grade	Score
Theoretical point № 1 (Oral answer)	GPC-5.1 GPC-5.9	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2
Theoretical point № 2 (Oral answer)	GPC-5.1 GPC-5.9	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2
Practical task (case studies)	GPC-5.1 GPC-5.9	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2
Total	GPC-5.1 GPC-5.9	Excellent	15-13
		Good	12-10
		Satisfactory	9-6
		Unsatisfactory	5-0