Ministry of Education and Science of the Russian Federation
Federal State Budgetary Educational Institution of Higher Education
"NOVGOROD STATE UNIVERSITY
named after Yaroslav the Wise "
Institute of Medical Education

Department of Normal Physiology

APPROVED
Director of IMO
_____ V.R. Weber
«30» June 2020 y.

NORMAL PHYSIOLOGY

Academic discipline for the specialty 31.05.01 - "General Medicine"
Working programm

AGREED
Head of the educational department
_____ I.V. Bogdashova
«30» June 2020y.

Head of the Issuing Department
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Developed by
Associate Professor of the Department of NF _____ R. Ya. Vlasenko
«25» June 2020 y.

Adopted at the meeting of the department
Protocol No.10
Head of the Department of
NF _____ R. Ya. Vlasenko
« 29» June 2020 y.

Velikiy Novgorod
2020

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1 The purpose and objectives of the discipline

The purpose of mastering the discipline "Normal physiology": the formation of students' competence in the field of vital functions of a healthy and sick person, dialectical-materialistic worldview, development of physiological thinking, aimed at generalizing and understanding the data of various medical sciences from a general physiological point of view.

The objectives of the discipline are:

- formation of students' system of theoretical knowledge in the field of normal human physiology;
- actualization of students' ability to use theoretical knowledge to solve fundamental issues and applied problems of modern medicine;
- formation of students' understanding of the importance of knowledge and skills in the discipline in the study of the foundations of the vital activity of a healthy person and the physiological foundations of a healthy lifestyle;
- teaching students the most important methods and skills for analyzing physiological mechanisms at various levels of organization of living things, the work of functional systems that maintain homeostasis, allowing for an overall assessment of the results of studies of the physiological state of a person;
- stimulating students to independent activities to master the discipline and form the necessary competencies.

2 Place of discipline in the structure of EP specialty

The discipline is included in the basic part of Block 1 "Disciplines (modules)".

To study this academic discipline, the following knowledge, abilities and skills are required, formed by the previous disciplines:

Knowledge: the basics of the Latin language

Ability: using terms that are in most cases of Latin origin

Skills: understanding anatomical and physiological terminology

The study of the course is based on the knowledge gained during the study of disciplines: "Physics", "Biology", "Biochemistry", "Human Anatomy", "Histology, Embryology, Cytology".

Basic knowledge in the field of normal physiology, obtained during the study of this course, is used in mastering the following disciplines: "Pathological anatomy, clinical pathological anatomy", "Pathophysiology, clinical pathophysiology", "Microbiology, virology", "Pharmacology", "General hygiene", "Propedeutics of Internal Diseases", "General Surgery".

3 Requirements for the results of mastering the discipline

As a result of studying this discipline, the student forms and demonstrates the following general cultural and general professional competencies:
1) owns abstract thinking, is capable of analysis and synthesis (OK-1);
2) is capable of assessin gmorphofunctional and physiological states in the human body for solving professional problems (OPK-9)
As a result of mastering the discipline, the student must know, be able to and own:

OK-1 - the ability to abstract thinking, the ability to analyze and synthesize

Levels	Indicators	Ratingscale		
		3 (satisfactory)	4 (good)	5 (excellent)
A basiclevelof	knowledge of basic physiological processes and mechanisms of their regulation in the body	poorly guided in theoretical interpretations of basic physiological processes and mechanisms of their regulation in the body	demonstrates only theoretical understanding of basic physiological processes and mechanisms of their regulation in the body	demonstrates not only theoretical understanding, but also practical application of knowledge about basic physiological processes and mechanisms of their regulation in the body
	the ability to think abstractly and draw conclusions about changes in the functional state of a person	has difficulty in the process of abstract thinking and the formulation of conclusions about changes in the functional state of a person	insufficient substantiation of individual conclusions about changes in the functional state of a person, which does not significantly affect the formation of practical skills in the application of knowledge	a high level of substantiation of conclusions about changes in the functional state of a person, taking into account the formed necessary practical skills when applying knowledge in specific situations
	ability to master methods of research of physiological functions	demonstrates proficiency in research methods of physiological functions at a low level, insufficient to obtain any assessment results	demonstrates mastery of methods of research of physiological functions at a level sufficient to conduct a partial assessment of a specific situation, without generalizing the results	demonstrates proficiency in methods of research of physiological functions at a level sufficient to conduct a comprehensive analysis and assessment of a specific situation, summarizing the results

OPK-9 - the ability to assess morphofunctional and physiological states in the human body for solving professional problems

Levels	Indicators	Ratingscale		
		3 (satisfactory)	**4 (good)**	**5 (excellent)**
A basiclevelof	knowledge of basic physiological mechanisms and conditions, as well as methods of their regulation in the body of a healthy person	poorly guided in theoretical interpretations of basic physiological mechanisms and states, as well as ways of their regulation in the body of a healthy person	demonstrates only a theoretical understanding of the basic physiological mechanisms and conditions, as well as the ways of their regulation in the body of a healthy person	demonstrates not only theoretical understanding, but also the practical application of knowledge about basic physiological mechanisms and conditions, as well as ways of their regulation in the body of a healthy person
	the ability to assess the morphological and functional characteristics of the main organ systems and the physiological states of the human body	has difficulty in assessing the morphological and functional characteristics of the main organ systems and physiological conditions of the human body	allows minor inaccuracies in the process of assessing the morphological and functional characteristics of the main organ systems and physiological states of the human body	competently evaluates the morphological and functional characteristics of the main organ systems and physiological states of the human body, is able to generalize the results
	owns the methods of anthropometric and physiometric research	demonstrates proficiency in anthropometric and physiometric research methods at a low level, insufficient to obtain any assessment results	demonstrates mastery of the methods of anthropometric and physiometric research at a level sufficient to conduct a partial assessment of a specific situation without generalizing the results	demonstrates mastery of the methods of anthropometric and physiometric research in full, sufficient for a comprehensive analysis and assessment of a specific situation, summarizing the results

4 The structure and content of the discipline

4.1 Labor intensity of the discipline and forms of certification

Academic work (AW)	Total	Distribution by semester	Distribution by semester	Competency codes
		3	4	
The complexity of the discipline in credit units (CU) **incl. exam**	7	4	3 1	
Distribution of labor intensity by type of EW in academic hours (AH): **- lectures** **-practical lessons** **-classroom IWS** **- extracurricular IWS**	 36 117 51 99	 18 72 30 54	 18 45 21 45	 OC-1, OPC-9
Certification:	exam	Differ. credit	exam	

* - differential credits are taken during classroom hoursIWS

4.2 The content and structure of the sections of the academic discipline

Section 1 - Genera lPhysiology
1.1. Introduction to the subject of physiology. General properties of living things.
1.2. General physiology of excitable tissues.
1.3. Physiology of the nerve, synapse, muscle.
1.4. Physiology of the central nervous system.
1.5. Vegetative regulation of physiological functions.
1.6. Humoral-hormonal regulation of physiological functions.

Section 2 - Physiology of the circulatory system and blood
2.1. Physiology of theheart.
2.2. Physiology of the circulatory system.
2.3. Research methods of the cardiovascular system.
2.4. Physiology of blood.

Section 3 - Physiology of respiration, digestion, metabolism and excretory systems
3.1. Respiratoryp hysiology.
3.2. Physiology of digestion.
3.3. Metabolism and thermoregulation.
3.4. Excretion physiology.

Section 4 - Physiology of Sensory Systems and Purposeful Human Behavior
4.1. Sensory systems (analyzers) and their role in the life of the body.
4.2. Physiological mechanisms of pain.
4.3. Physiology of higher nervous activity.
4.4. The functional system of the behavioral act and its main components.
4.5. Physiology of adaptation.

The calendar plan, the names of the discipline sections with an indication of the labor intensity by type of educational work are presented in the discipline's technological map (Annex B).

4.3. Organization of the study of the academic discipline

Methodological recommendations for organizing the study of the discipline, taking into account the use of active and interactive forms of conducting training sessions in the educational process, are given in Annex A.

5. Control and assessment of the quality of mastering the discipline

Quality control of students' mastering of the discipline and its components is carried out continuously throughout the entire period of study using a point-rating system (PRS), which is mandatory for use by all structural divisions of the university.
To assess the quality of mastering the discipline, three forms of control are used:

current - regularly throughout the semester - solving test tasks, oral questioning on the relevant topics of practical classes, defense of reports on the given topics;

midterm - on the 9th week of each semester - solving test tasks, colloquium tasks; accounting of the total results based on the results of current control for the corresponding period, including points for completing the tasks of the colloquium, systematic work. Midterm control is carried out in two stages;

semester - at the end of the discipline
– differential credit in the form of an interview (3 semester)

On diff. credit the student is assessed according to the following criteria:

"5" - 180 - 200 points;
"4" - 140 - 179 points;
"3" - 100 - 139 points;
"2" - less than 100 points.

exam, which takes place in three stages:

1- test control,
2 - practical skills,
3 - oral answer on ticket issues (4 semester).

A student enters the exam only if he / she achieves at least 50 points per semester
min - 50 points
max - 100 points

Assessment of the quality of mastering the discipline is carried out using the fund of evaluation tools for all forms of control in accordance with the Regulations "On the organization of the educational process for the main educational programs of higher professional education" and the Regulations "On the Fund of evaluation tools".
The content of the types of control and their schedule are reflected in the technological map of the discipline (Annex B).

6. Educational-methodological and informational support of the discipline is represented by a map of educational-methodological support (Annex B)

7. Logistics of the discipline

For the implementation of the educational process in the discipline, it should be carried out in an audience equipped with multimedia means (lectures). Appropriate equipment is required for practical training.

Material and technical support for the implementation of the educational process. Special rooms are classrooms for lecture-type classes, seminar-type classes, group and individual consultations, monitoring and intermediate certification, as well as rooms for independent work and rooms for storage and preventive maintenance of educational equipment.Special rooms are equipped with specialized furniture and technical teaching aids that serve to present educational information to a large audience. To conduct lecture-type lessons, sets of demonstration equipment and teaching aids are offered, providing thematic illustrations.Premises for independent work of students are equipped with computer equipment with the ability to connect to the Internet.It is supposed to use elements of distance learning, allowing students to master the skills and abilities provided by professional activity. Students are provided with access (remote access), including in the case of using e-learning, distance learning technologies, to modern professional databases and information reference systems, the composition of which is determined by the work program.

Annex A

Methodical recommendations

Methodical recommendations establish the order and methodology for studying the theoretical and practical material of the discipline:

Annex A.1 - Methodological recommendations for organizing the study of discipline sections
Annex A.2 - Examples of test items for midterm certification
Annex A.3 - Methodological recommendations for independent work
Annex A.4 - Questions for differential credit
Annex A.5 - Methodological support of the exam

Annex A.1

Methodical recommendations for organizing the study of discipline sections

Section 1 - General Physiology

Purpose: To acquaint the student with the fundamental principles of life, the features of the excitation process, the structure and function of the nerve and synapse, the features of the functioning of muscle tissue, the concept of the integrative activity of the neuron, the mechanisms of the propagation of excitation in the nervous system, the mechanisms of inhibition in the central nervous system, the functions of various parts of the central nervous system, the functions of hormones endocrine glands.

Key concepts: irritability, adaptation, biomembrane, self-regulation, functional system, irritability, excitability, rest potential, action potential, laws of irritation, nerve fiber, nerve, synapse, mediator, tetanus, optimum and pessimum of the frequency of irritation, contracture, neuron, reflex, reverse afferentation, reflex ring, nerve center, tone, dominant, plasticity, summation, transformation, reverberation, irradiation, convergence, inhibition, hyperpolarization block, depolarization block, sympathetic, parasympathetic, metasympathetic divisions of the ANS, autonomic reflexes, hormone, membrane reception, cytoplasmic reception, synergism, antagonism, permissive effect, sensitization.

Test questions:

1. What tissues are called excitable?
2. What properties of living things do you know?
3. What is irritability?
4. What is rest potential?
5. What is action potential?
6. What is excitability?
7. List the functions of cell membrane proteins?
8. What is a nerve fiber?
9. What is a nerve?
10. What is a synapse?
11. What properties does a chemical synapse have?
12. What is the mechanism of muscle contraction?
13. What is tetanus?
14. What modes of muscle work do you know?
15. Describe the structure of the neuron?
16. What functions of a neuron do you know?
17. What is the CNS?
18. What is a reflex?
19. What is the nerve center?
20. What properties of nerve centers do you know?
21. Describe the braking mechanisms?
22. What ways of spreading excitement in the central nervous system do you know?
23. What are the features of the spinal cord functions?
24. What are the features of the midbrain functions?
25. What are the features of the functions of the medulla oblongata?
26. What are the features of the cerebellar functions?
27. What are the features of the functions of the reticular formation?
28. What are the features of the functions of the limbic system?
29. What are the features of the functions of the cerebral cortex?

30. What parts of the autonomic nervous system do you know, their functions?
31. What are the common functions of hormones?
32. Describe the mechanisms of membrane hormone reception?
33. Describe the mechanisms of cytoplasmic hormone reception?
34. What are the functions of thyroid hormones?
35. What are the functions of adrenal hormones?
36. What are the functions of gonadal hormones?
37. What are the functions of hypothalamic hormones?
38. What are the functions of the hormones of the adenohypophysis?
39. Characterize the placenta hormones?
40. Describe the functions of hormones of single glandulocytes of non-endocrine organs?

Section 2 - Physiology of the circulatory system and blood

Purpose: To acquaint students with the functional characteristics of the myocardium, blood vessels, to master the methods of functional assessment of the state of the circulatory system. To acquaint students with the concept of homeostasis, the composition and functions of blood, to be able to determine blood groups, to familiarize with the functioning of the blood coagulation and anticoagulant systems, to master the techniques of tonometry, pulsometry, electrocardiography.

Key concepts: myocardium, myocardial properties, excitability, conduction, contractility, automatism, tropic effects of the myocardium, heterometric myogenic regulation, homeometric myogenic regulation, Anrep phenomenon, Bowdich ladder, linear blood flow velocity, volumetric blood flow velocity, pulse, pulse pressure, vasopressors, vasodilators , electrocardiography, pulse, sphygmography, phlebography, plethysmography, pulse wave.

Control questions:

1. What are the physiological properties of the myocardium?
2. What are the features of the process of excitation in working and atypical cardiomyocytes?
3. Describe and indicate the value of the phases of excitability in contractile cardiomyocytes?
4. Name and describe the main types of regulation of the heart?
5. List the main groups of vessels according to the functional classification of Folkov?
6. What is hydrastatic pressure?
7. What is linear blood flow velocity?
8. What are the main factors regulating vascular tone and maintaining blood pressure?
9. What are the factors of venous return?
10. What is homeostasis?
11. Describe the composition of blood, its functions?
12. What is Rh-conflict?
13. Name and characterize the main stages of hemostasis?
14. Name and characterize the main stages of fibrinolysis?
15. Describe the mechanisms of regulation of the hemostasis system?
16. What is the Korotkov method for measuring blood pressure?
17. What is pulse?
18. Describe the origin of the ECG waves?
19. What ECG leads do you know?
20. What is the ECG analysis algorithm?

Section 3 - Physiology of respiration, digestion, metabolism and excretory systems

Purpose: To acquaint students with the mechanisms of respiration, to master the methods of functional assessment of the state of the respiratory system, to acquaint students with the processes of digestion in various parts of the digestive tube, with the processes of plastic and energy metabolism in the human body, the processes of thermoregulation, the process of urination, methods of measuring energy consumption and assessing urine formation , thermometry.

Key concepts: eipnea, apnea, tachypnea, bradypnea, tidal volume, reserve volumes, vital capacity of the lungs, residual volume, partial pressure of respiratory gases, spirography, spirometry, saliva, gastric juice, pancreatic juice, bile, secretion phases, peristalsis, rhythmic segmentation, propulsive wave, pendulum movements, digestive enzymes, assimilation, dissimilation, Rubner wear factor, nitrogen balance,nitrogen equilibrium, basal metabolism, working metabolism, general metabolism, specific dynamic action of food, respiratory coefficient, calorimetry, heat production, heat transfer, homeothermy, heterothermy, poikilothermia, conduction, radiation, convection, evaporation, excretion, filtration, reabsorption, secretion, excretion threshold , threshold and nonthreshold substances, primary and secondary urine, external barriers, histo-hematological barriers, permeability coefficient, blood-brain barrier, blood-ophthalmic barrier, aero-blood barrier, renal, hepatic barrier, buffer systems, acidosis, alkalosis, pH blood.

Controlquestions:

1. List and characterize the main stages of breathing?
2. What are the main volumes and capacities of the lungs?
3. What are the mechanisms of gas exchange in the lungs and tissues?
4. What are the mechanisms of transport of respiratory gases by blood?
5. What is the Bohr effect?
6. What types of breathing regulation do you know?
7. Describe the Goering-Breuer reflex?
8. How do you define digestion?
9. Describe the digestion in the oral cavity?
10. What is the characterization of digestion in the stomach?
11. What is the characterization of digestion in the duodenum?
12. Specify the composition and function of bile?
13. Specify the composition and intestinal juice?
14. Open the suction mechanisms?
15. What are the main theories of hunger and satiety?
16. What is the mechanism of sensory and metabolic saturation?
17. What is metabolism?
18. What is the importance of carbohydrates in the body?
19. What is the importance of fat in the body?
20. What is the importance of proteins in the body?
21. What is basic exchange, working exchange, general exchange?
22. What types of calorimetry do you know?
23. What is Respiratory Rate?
24. What are the mechanisms of heat production?
25. What are the heat transfer mechanisms?
26. Where is the thermoregulation center located?
27. What are the requirements for thermometry?
28. Describe the mechanisms of filtration and its regulation?
29. What is primary urine? Describe the mechanisms of reabsorption and its regulation?

30. What substances are classified as threshold, non threshold?
31. What is ground clearance?
32. What organs are classified as excretory organs other than the kidneys?
33. What are the main mechanisms of regulation of urinary processes?
34. What is the characteristic of the general analysis of the urine of a healthy person?
35. What is the characterization of the hemato-encephalic barrier?
36. Characterize the hemato-ophthalmic barrier?
37. Characterize the aero-hematological barrier?
38. Describe the function of the skin and mucous membranes?
39. How is the renal barrier characterized?
40. How is hepatic barrier characterized?
41. What is the characterization of the hemoglobin buffer system?
42. What is the characterization of the protein buffer system?
43. What is the characterization of the bicarbonate buffer system?
44. How is the phosphate buffer system characterized?
45. Describe the causes of alkalosis?
46. Describe the causes of acidosis?

Section 4 - Physiology of Sensory Systems and Purposeful Human Behavior

Purpose: To acquaint students with the features of the functioning of sensory systems (skin analyzer, visual, auditory, olfactory, vestibular, visceral, proprioceptive, motor analyzers), the concept of higher nervous activity, modern mechanisms of purposeful human behavior, modern ideas about adaptation.

Key concepts: analyzer, sensory system, primary-feeling, secondary-feeling, receptor potential, generator potential, receptor section, conduction section, cortical section of the analyzer, higher nervous activity (HNA), types of HNA, motivation, emotions, memory, sleep, general adaptation syndrome.

Control questions:

1. What are the general properties of receptors?
2. Describe the features of the skin analyzer function?
3. Describe the features of the function of the visual analyzer?
4. Describe the features of the auditory analyzer function?
5. Describe the features of the function of the vestibular analyzer?
6. Describe the features of the olfactory analyzer function?
7. Describe the features of the visceral analyzer function?
8. Describe the features of the proprioceptive analyzer function?
9. Describe the features of the motor analyzer function?
10. What is higher nervous activity?
11. List the rules for developing a conditioned reflex?
12. What types of HNA braking do you know?
13. Describe the types of HNA according to Pavlov?
14. What are the nodal blocks of the functional system of the behavioral act according to Anokhin?
15. What theories of motivation do you know?
16. Describe the mechanisms of development of emotions?
17. What are the components of emotional arousal?
18. Describe the mechanisms of short-term memory?
19. What theories of long-term memory do you know?
20. What are the modern concepts of sleep mechanisms?

21. What are the mechanisms of development of the general adaptation syndrome according to G. Selye?

Evaluation of practical, control works and testing

The mark "5" is given for the work done completely without errors and shortcomings.
The mark "4" is given for the work completed in full, but if there is no more than one gross and one non-gross error and one defect, no more than three shortcomings.
The mark "3" is given if the student has correctly completed at least 2/3 of the entire work or made no more than one gross error and two shortcomings, no more than onea blunder and one blunder, no more than three blundersone blunder and three shortcomings, in the presence of four - five shortcomings.

The mark "2" is given if the number of errors and shortcomings has exceeded the norm for mark "3" or less than 2/3 of the work has been done correctly.

Annex A.2

Examples of test items for midterm certification

1. The ability of the myocardium to pass into an excited state under the influence of an irritant is called:

1. Irritability
2. Contractility
3. Automation
4. Excitability

2. Slow diastolic depolarization is characteristic of cells:

1. Typical cardiomyocytes
2. Pacemakers of the conducting system
3. Myocytes and skeletal muscles

3. The absolute refractoriness of a typical ventricular cardiomyocyte lasts:

1.1s
2. 0.001s
3.0.03s
4. 0.27

4. The general pause of the heart at a heart rate of 75 beats / min continues:

1. 0.3s
2. 0.8s
3. 0.4s
4. 0.5s

AnnexA.3

Methodical recommendations for independent work

Independent work of students ensures the continuity and systemic nature of cognitive activity, develops the creative activity of future specialists, contributes to a deeper assimilation of the studied discipline, orients the student to the ability to apply the obtained theoretical knowledge in practice.

Independent work of students includes:

- independent study of theoretical material in the sections of the work program and testing of knowledge on self-control issues given for each topic;
- organization of independent work to master the system of knowledge, abilities and skills within the scope of the program; be able to work with textbooks, teaching aids, Internet resources.

In the process of independent work, the highest quality processing and transformation of the information obtained at lectures and practical classes into deep and solid knowledge, skills and abilities occurs, carried out in the following forms:

1. Elaboration of the lecture material based on the recommended literature, including educational information resources;
2. Preparation for practical training - study of equipment, progress of work and discussion of the results of the workshop, study of methods for assessing the functional state of a healthy person;
3. Preparation for classroom control works;
4. Performing extracurricular individual assignments in the form of writing abstracts and preparing reports using multimedia tools;
5. Preparation for midterm controls, tests and examinations;
6. Participation in the student scientific circle, preparation of reports for student conferences.

Annex A. 4

Differentiated credit questions

1. Definition of concepts: irritation, irritability; excitability, agitation; arousal threshold; functional lability.
2. Electrogenesis of the action potential. General characteristic of states of static polarization, depolarization, repolarization.
3. The structure and classification of nerve fibers.
4. The mechanism of conduction of excitation in myelinated and nonmyelinated fibers. The laws of the conduction of excitation along the whole nerve.
5. Parabiosis: origin, phases.
6. Ultrastructure and physiological properties of the synapse.
7. Stages and mechanisms of synaptic transmission.
8. Classification of receptors for pre- and postsynaptic membranes; their functional differences.
9. Fundamental ways of pharmacological effects on synaptic transmission.
10. Physical and physiological properties of muscles.
11. Types of muscle contractions.
12. Comparative characteristics of the structure and functions of skeletal and smooth muscles.
13. Definition of the concept of "reflex". The structure of the arch of the somatic spinal reflex. Reflex ring concept. Reflex classification.
14. Concepts: nerve center, nerve nucleus. Multilevel organization of nerve centers.
15. General diagram of the functional system (according to P.K. Anokhin).
16. Principles of the propagation of excitement in the nerve centers.
17. Physiological role and types of inhibition in the central nervous system.
18. Human spinal reflexes.
19. Central (Sechenov, thalamic) inhibition of spinal reflexes.
20. The structure and function of the neuron.
21. Mediator systems of the brain: type of mediator, areas of synthesis and transport, physiological action.
22. General principles of the structure of the autonomic reflex arc. ANS functions.
23. The structure and physiological characteristics of the parasympathetic part of the autonomic nervous system.
24. The structure and physiological characteristics of the sympathetic part of the autonomic nervous system.
25. The structure and physiological characteristics of the metasympathetic part of the autonomic nervous system.
26. Localization of α- and β-adrenergic receptors; physiological effects caused by their excitement.
27. Localization of dopamine receptors; physiological effects caused by their excitement.
28. Localization of M-, N- cholinergic receptors; physiological effects caused by their excitement.
29. Localization of spinal and bulbar autonomic centers.
30. What are the common functions of hormones?
31. Mechanisms of membrane hormone reception.
32. Mechanisms of cytoplasmic hormone reception.
33. Thyroid hormone function.
34. Functions of adrenal hormones.
35. Functions of hormones of the sex glands.
36. Functions of hypothalamic hormones.
37. Functions of the hormones of the adenohypophysis.
38. Pancreatic hormone function.
39. Functions of pineal gland hormones.
40. Physical and physiological properties of the myocardium.
41. Conductive system of the heart.

42. Significance of excitability phases in contractile cardiomyocytes.
43. Name and describe the main types of regulation of the heart.
44. List the main groups of vessels according to the functional classification of Folkov
45. What are the main factors in the regulation of vascular tone and blood pressure maintenance?
46. What are the factors of venous return?
47. Describe the composition of blood, its functions.
48. Describe the functions of the shaped elements.
49. Describe the function of blood plasma proteins.
50. What is the division of blood into groups.
51. Describe the rules for blood transfusion.
52. What is Rh-conflict.
53. Name and characterize the main stages of hemostasis.
54. Name and characterize the main stages of fibrinolysis.
55. Describe the mechanisms of regulation of the hemostatic system.
56. What is the method of measuring blood pressure according to Korotkov.
57. Describe the origin of the ECG waves.
58. Characterize the ECG leads.
59. ECG analysis algorithm.

Criteria for assessing students' knowledge on differential credit

The mark "5" - 180 - 200 points - the student demonstrates complete knowledge and understanding of the theoretical content of the topic of the interview, owns the terminology on the topic and has a high level of motivation to learn.

The mark "4" - 179 - 140 points - the student demonstrates complete knowledge and understanding of the theoretical content of the interview, but does not know enough terminology on the topic and has an average level of motivation to learn.

The mark "3" - 100 - 139 points - the student demonstrates knowledge and understanding of the theoretical content of the interview with insignificant gaps, poor knowledge of the terminology on the topic and has a low level of motivation to learn.

The mark "2" - less than 100 points - the student does not demonstrate knowledge and understanding of the theoretical content of the interview, does not know the terminology on the topic, there is no motivation for learning.

Annex A.5

Methodological support of the exam

Stage 1 - Test control

1. Duration in seconds (at a heart rate of 70 beats per minute):

Valve status	Single heart cycle	Atrial systole	Ventricles
A)	0,5	0,1	0,3
B)	0,8	0,1	0,33
C)	0,7	0,2	0,4
Д)	0,8	0,11	0,29
E)	0,8	0,2	0,47

2. Ventricular systole (rapid expulsion phase)

Valve status	Muscle flaps	Folded	Crescent
A)	open	closed	closed
B)	closed	open	closed
C)	open	closed	open
Д)	open	open	closed
E)	open	open	closed

3. The anterior hypothalamus contains the center:
   A) physical thermoregulation
   B) thirst
   C) sleep and wake up
   D) chemical thermoregulation

4. The daily body temperature in humans normally ranges from:
   A) 35.6-36.6^{0}C
   B) 36.5-36.9^{0}C
   C) 36.4-37.5^{0}C
5. When the ambient temperature drops, the vessels of the internal organs:
   A) narrow down
   B) expand
   C) do not change the lumen
6. The idea of the reflex nature of the activity of the higher parts of the brain was first put forward by:
   A) I.P. Pavlov
   B) I.M.Sechenov
   C) P.K. Anokhin
   Д)C.S. Sherrington
   E) R. Descartes
7. He was the first to experimentally substantiate the reflex nature of the activity of the higher parts of the brain:
   A) I.P. Pavlov
   B) I.M.Sechenov
   C) P.K. Anokhin
   Д) A.A. Ukhtomsky
   E) M.N. Shaternikov

Stage 2 - Practical skills

List of basic clinical and physiological techniques to be mastered at the level of knowledge.

1. Modern automated methods for studying the composition and properties of blood. Photohemometry.
2. Determination of osmotic resistance of erythrocytes.
3. Technique of blood collection.
4. Counting erythrocytes, calculating a color index, counting leukocytes, determining Rh blood belonging, determining the time of blood coagulation and stopping bleeding in a clinical blood test.
5. Determination of the speed of propagation of the pulse wave.
6. Plethysmography.
7. Rheography.
8. Electroencephalography.
9. Audimetry.
10. Research of color vision.
11. Evaluation of the clinical blood test.
12. Characteristics of indicators in the clinical analysis of urine.
13. Rules for blood transfusion.

A list of the main clinical and physiological techniques to be mastered at the skill level.

1. Listening to heart sounds.
2. Palpation of the pulse.
3. Determination of blood pressure.
4. Analysis of the electrocardiogram of a healthy person.
5. Spirometry.
6. Calculation of the proper values of the basal metabolic rate.
7. Determination of visual acuity.
8. Determination of the field of view.
9. Determination of hearing acuity.
10. Determination of hemoglobin in a clinical blood test.
11. Electrocardiography (technique for taking an ECG).
12. Thermometry.
13. Research on human energy costs.
14. Methods for the quantitative assessment of the mechanisms of urine formation.
15. Determination of the blood group using tsoliclones.
16. Determination of the blood group using standard sera.
17. Principles of drawing up a food ration.

Stage 3 - Theoretical stage (oral answer on ticket questions).
List of exam questions

PHYSIOLOGY OF EXCITABLE TISSUE

1. Ultrastructure of biological membranes. Membrane-ion theory of the origin of biopotentials.
2. Excitable tissues. Excitability is the definition of a concept; measurement methods. Irritation threshold.
3. Characteristic of the state of static polarization. Membrane potential.
4. Characteristics of the state of depolarization. Action potential.
5. Characteristics of the states of repolarization and hyperpolarization. Negative and positive trace potentials.
6. Change in excitability during a single cycle of excitation. The essence and significance of the period of absolute refractoriness.
7. Functional lability (NE Vedensky). Optimum and pessium of the frequency and strength of irritation.
8. Structure, classification and properties of synapses.
9. Ultrastructure and properties of the synapse. Stages and mechanisms of synaptic transmission.
10. Laws of conduction of excitation along the nerve.
11. Comparative characteristics of skeletal and smooth muscles.
12. Change in excitability in different phases of the excitation process.

CNS PHYSIOLOGY

1. Mechanisms of propagation of excitement in the central nervous system. Properties of nerve centers.

2. Mechanisms of the propagation of excitation along the nerve fibers; fiber types; the Gaseer-Erlanger experiment.

3. Central braking. Types and mechanisms.

4. Methods of research of the central nervous system (electroencephalography, basic rhythms).

ANS PHYSIOLOGY

1. Comparative characteristics of the influences of the sympathetic and parasympathetic divisions of the autonomic nervous system on physiological functions.

2. Structural and functional features of the sympathetic and parasympathetic divisions of the ANS. Metasympathetic system.

3. The structure of the vegetative reflex arc. VNS mediators and receptors.

4. Hypothalamus: participation in the regulation of autonomic functions; hypothalamic-pituitary relationship.

PHYSIOLOGY OF HORMONES

1. Mechanisms of nuclear (cytoplasmic) reception of hormones.
2. Hormones of the placenta; their role in maintaining pregnancy and fetal development.
3. Mechanisms of cellular reception of hormones.
4. Hormones of the pituitary gland; their role in the regulation of the activity of the endocrine glands.
5. Direct and reverse hormonal connections; the role of the hypothalamus and pituitary gland.
6. Hormones of the sex glands (menstrual cycle; spermatogenesis).
7. Thyroid hormones.
8. Functions and classification of hormones. Forms of transport of hormones.
9. Adrenal hormones, classification, physiological action.
10. Endocrine functions of non-endocrine organs (heart, kidneys, digestive tract, lungs, placenta).
11. The neuroendocrine function of the hypothalamus. Hypothalamic-pituitary relationship.

PHYSIOLOGY OF THE HEART AND CIRCULATION

1. Capillary beds: features; types of capillaries; microcirculation; mechanisms of transcapillary exchange.
2. Auscultation of the heart and phonocardiography. Heart sounds: origin. The ratio of PCG and ECG is normal.
3. Methods for the study of cardiac activity. ECG analysis,
4. Physiological properties and characteristics of the heart muscle. Automatism of the heart.
5. Blood pressure: factors that provide a certain amount of blood and venous pressure. Arterial pulse.
6. Factors that ensure the movement of blood through the vessels of the systemic circulation; change in pressure in different parts of the vascular bed.
7. Physiological features of the small circle of blood circulation.
8. Electrocardiography; analysis of the electrocardiogram.
9. The role of the vasomotor center in the regulation of blood pressure.
10. Hemodynamic function of the heart. Phases of the cardiocycle.
11. Spreading excitement through the heart.
12. Nervous and humoral regulation of the heart. Extracardiac reflexes.
13. A functional system that maintains optimal blood pressure for metabolism.
14. Analysis of a single cardiac cycle; change in excitability in different phases.
15. ECG and its clinical significance.

BLOOD PHYSIOLOGY

1. Coagulant and anticoagulant blood systems. Natural and artificial anticoagulants.
2. Blood groups (ABO). Rhesus factor. Blood transfusion rules.
3. Composition and functions of plasma. Plasma proteins. Osmo-oncotic pressure; role in transcapillary exchange.
4. The composition of the blood. Characteristics of shaped elements.

RESPIRATORY PHYSIOLOGY

1. Respiratory center: structure and localization. Physiological mechanisms of the change of inhalation and exhalation.
2. Transport of oxygen by blood; hemoglobin; oxyhemoglobin dissociation curve. Oxygen capacity of blood.
3. Biomechanics of inhalation and exhalation. Pleural pressure. Pneumothorax.
4. Methods for studying external respiration. Lung vital capacity (lung volumes). Volume-flow curve; clinical significance.
5. Gas exchange in the lungs.
6. A functional system that maintains a constant blood gas composition.

PHYSIOLOGY OF DIGESTION

1. A functional system that ensures the constancy of nutrients in the blood.
2. Digestion in the oral cavity; composition and function of saliva; regulation of salivation.
3. Food motivation; physiological mechanisms of appetite, hunger and satiety.
4. Features of digestion in the large intestine; the role of bacterial flora.
5. Digestion in the duodenum; composition and function of bile; regulation of bile formation and bile secretion.
6. Digestion in the duodenum; external secretory activity of the pancreas; regulation of the formation and secretion of pancreatic juice; its composition and functions.
7. Digestion in the stomach: composition and properties of gastric juice; mechanism and phases of gastric secretion.
8. Digestion in the small intestine; parietal digestion; suction mechanism; the role of

gastrointestinal hormones.
9. The role of the liver in digestion. Composition and function of bile. Regulation of bile formation and bile secretion.
10. Motor function of the digestive apparatus; regulation. The mechanism of food transfer from the stomach to the duodenum.
11. The mechanism of hunger and satiety.
12. Composition of gastric juice. The role of hydrochloric acid in digestion. Phases of gastric secretion.

EXCHANGE OF SUBSTANCES, THERMAL REGULATION

1. A functional system that ensures constant blood temperature.
2. Basic energy exchange; determination methods; clinical significance.
3. Methods for determining energy consumption. Direct and indirect calorimetry.

PHYSIOLOGYOF EXCRETION

1. Regulation of kidney activity: the role of nervous and humoral factors.
2. Formation, quantity and composition of primary urine. Clinical methods for assessing filtration. Filtration regulation.
3. Mechanisms of secondary urine formation; composition; regulation of reabsorption in various parts of the nephron.
4. Clinical analysis of urine is normal.
5. A functional system that maintains a constant level of osmotic blood pressure. The mechanism of thirst.

SENSOR SYSTEMS (ANALYZERS)

1. General concepts: analyzer, sensory system, sensation (I.P. Pavlov, P.G.Snyakin.).
2. Classification of analyzers. General principles of the structure and function of analyzers.
3. Types and properties of receptors.
4. Visual analyzer: structure, cortical representation. Vision research methods.
5. The structure of the eye. Auxiliary apparatus of the eye. Eyemuscles.
6. Optical apparatus of the eye. Pupil; role in the visual act, regulation of the lumen.
7. Microstructure of the retina. Photochemical processes in the retina. Blindspot.
8. Central vision. Determination of visual acuity.
9. Peripheral vision. Determination of the field of view.
10. Refraction of the eye and its abnormalities.
11. Accommodation of the eye: mechanism, age-related changes; determination methods.
12. Auditory analyzer: structure, research methods.
13. The structure of the outer, middle and inner ear.
14. Vestibular analyzer: structure, research methods.
15. Taste analyzer: structure, research methods. Taste card of the tongue.
16. Olfactory analyzer structure, research methods. Odor classification.
17. Tactile (skin analyzer). Structure, research methods.
18. Pain analyzer, structure. Antinociceptive system.

PHYSIOLOGY of Higher Nervous Activity

1. Motivation as a component of afferent synthesis; classification; mechanisms of motivation.
2. The phenomenon of inhibition in higher nervous activity: types, mechanisms, meaning.
3. Types of HNA (according to Hippocrates; according to Pavlov; modern classification).
4. Conditioned reflexes; role, classification, rules of development.
5. Memory: physiological mechanisms, types, place in FS.

6. Classification of conditioned reflexes; mechanism for closing a temporary connection.
7. The central architectonics of a behavioral act (afferent synthesis, an acceptor of the result of an action, an inverse afferentation about the result of an action), according to P.K. Anokhin.
8. Emotions: neurophysiological mechanisms; types, role. Emotional stress; prevention.
9. Visual analyzer: structure, functions, research methods.
10. Mechanisms and types of memory.
11. Types of HNA. Fundamentals of psychophysiological testing.
12. Motivation: mechanisms of formation, types, role in purposeful behavior.
13. Physiological mechanisms and stages of sleep.
14. Sleep: modern understanding of the mechanisms and phases of sleep.
15. Sleep, neurophysiological mechanisms and stages of sleep. Basic EEG rhythms.
16. Physiological properties of receptors.
17. The functional system of the behavioral act (according to P.K. Anokhin).

Sampleexam ticket:

Yaroslav the Wise Novgorod State University

Department of Normal Physiology

Examination ticket № 30

Discipline normal physiology

For the specialty 31.05.01 - "General Medicine"

1. Blood plasma proteins, their characteristics and functional significance. Oncotic blood pressure and its role.
2. Laws of irritation (accommodation, polar law, repeated responses, lability, adaptation).
3. Features of regional blood circulation (coronary, pulmonary, cerebral, renal, hepatic).

Adopted at the meeting of the department on June 29, 2020Protocol No. 10
The head of the department is Associate Professor R.Ya. Vlasenko.

Criteria for assessing students' knowledge on the exam

Exam - an oral final interview on the examination card.

A rating of "5" is given when:
a) the student discovers the assimilation of the entire volume of program material,
b) highlights the main points in the studied material and does not find it difficult to answer the modified questions,
c) freely apply the acquired knowledge in practice,
d) does not make mistakes in reproducing the studied material.
A rating of "4" is given when:
a) the student knows all the studied material,
b) answers without much difficulty the teacher's questions,
c) knows how to apply the knowledge gained in practice,
d) does not make serious mistakes in oral answers, easily eliminates individual inaccuracies with the help of leading questions from the teacher.

Knowledge, assessed by points "5" and "4", as a rule, is characterized by a high conceptual level, deep assimilation of facts, examples and generalizations arising from them.

A rating of "3" is given when:

a) the student discovers the assimilation of the main material, but has difficulty in reproducing it on his own and requires additional and clarifying questions from the teacher,

b) prefers to answer questions of a reproductive nature and has difficulty in answering modified questions.

Knowledge, assessed with a rating of "3", is often at the level of ideas, combined with elements of scientific concepts.

Rating "2" is given when a student has separate ideas about the studied material, but still most of the material is not mastered.

The technological map of the discipline with the assessment of various types of educational activities by stages of control is given in Annex B.

Criteria for assessing the quality of mastering the discipline by students:

- "Satisfactory" mark - 175 - 244 points.
- "good" rating - 245 - 314 points.
- "excellent" mark - 315 - 350 points.

Annex B.

Technological map educational discipline "Normal physiology"
semester 3, 4, ZET 7, type of certification exam, academic hours 153, rating points 350

Number and name of the discipline section, KP / KR	Semiweekly	Laborintensity, ac. hour					A form of ongoing control having succeeded. (according to the FOS passport)	Maksim. number of rating points
		Auditory lessons				IWS		
		LEC	PR	Lab	AIWS			
UD "Normal physiology"	1-18	36	117		51	63		350
Section 1 General Physiology	1-9 (3 sem.)	9	36		12	30	- test (7) - work on PR (9) - interview (8) - colloquium No. 1 - colloquium No. 2 - presentation report 1 - presentation report 2	21 27 16 10 10 8 8
total								100
Section 2 Physiology of the circulatory system and blood	10-18 (3 sem.)	9	36		18	12	- test (5) - work on PR (5) - interview (8) - colloquium No. 3	20 45 24 11
total								100
injust 3 semester (DZ)								200
Section 3 Physiology of respiration, digestion, metabolism and excretory systems	1-9 (4 sem.)	9	24		11	11	- test (6) - work on PR (8) - interview (7) - colloquium No. 4 - colloquium No. 5 - presentation report 3	12 8 7 8 8 7
total								50
Section 4 Physiology of sensory systems and purposeful human behavior	10-18 (4 sem.)	9	21		10	10	- test (5) - work on PR (4) - interview (8) - colloquiumNo. 6	10 16 16 8

total								50
injust 4 semester								100
exam							- test control - practical skills - verbal response on ticket issues	10 10 30
total								50
injust 3 and 4 semesters								350

Criteria for assessing the quality of mastering the discipline by students:
- the mark is "satisfactory" - 175 - 244 points.
- the mark is "good" - 245 - 314 points.
- the mark is "excellent" - 315 - 350 points.

Annex C.

Map of educational and methodological support

Academic discipline "Normal physiology", the form of training - full-time.
The complexity of the discipline is 7 c.u. (252), of which lectures - 36, practical lessons - 117.
For the specialty - 31.05.01 "General Medicine". Qualifications: General practitioner
Supporting department - "Normal physiology", course 2, semesters - 3.4

Table 1- Provision of discipline with educational publications

Bibliographic description of the publication (author, title, type, place and year of publication, count pages)	**Qty. copiesat bibl.**	**Availabilityin EBS**
Textbooks and tutorials		
1. Selected Lectures on Normal Physiology: tutorial / M.M. Lapkin, E.A. Trutneva – M/: GEOTAR – Media, 2019. – 544 p.	50	
2. Physiology and foundations of anatomy: textbook. manual / ed. A.V. Kotova, T.N. Loseva. - M .: Medicine, 2011 .-- 1051 p.	166	
3. Normal physiology: textbook / ed. K.V. Sudakov- M .: GEOTAR - Media, 2015 .-- 880 p.	11	
4. Guide to practical exercises in normal physiology / ed. K.V. Sudakova, A.V. Kotova, T.N. Loseva. - M .: Medicine 2002 .-- 703 p.	129	
5. Degtyarev V.P. Normal physiology: textbook / V.P. Degtyarev, N.D. Sorokin. - M .: GEOTAR - Media, 2016 .-- 480 p.	5	

Table 2 - Information support of the academic discipline

Name of the software product, Internet resource	**Emailaddress**	**Note**
The working program of the academic discipline "Normal physiology"	www.novsu.ru	

Table 3 - Furtherreading

Bibliographic description * edition (author, name, type, place and year of publication, count pages)	Qty. copies in the bibl. NovSU	Availabilityin EBS
1. Human physiology: textbook. for a medical university. / V.M. Pokrovsky, G.F. Korotko, S.N. Avdeev et al: 2nd ed. - M: Medicine, 2007 .-- 654 p.	5	
2. Aghajanyan N.A. Normal physiology: a textbook for medical students; -Moscow .: Medical Information Agency, 2009. - 519 p .: ill.	25	
3. Gudkova L.K. Population Human Physiology: Anthropological Aspects.-Moscow: ed. LKI, 2008- 313 p.	F4-1 F6-1	
4. Physiology of the endocrine system / ed. J. Griffin and S. Oheda; -M .: BINOM.; 2008 - 496s.	2	
5. Kamkin A.G. Physiology Atlas. in 2 volumes [v.2] / A.G. Kamkin, I.S. Kiseleva.-M .: GEOTAR-Media, 2012.-448p.	1	
6. Kovalzon V.M. Fundamentals of somnology: physiology and neurochemistry of the wakefulness-sleep cycle / V.M. Kovalzon.-M .: Binom. Knowledge laboratory, 2011.-239p.	1	
7. Popov D.V., Vinogradova O.L., Grigoriev A.I. Human aerobic working capacity / Institute Medico-biologist. Problems of RAS, -M.: Nauka, 2012.-111p.	1	
8. Batuev A.S. Physiology of higher nervous activity and sensory systems: textbook for universities.-SPb: Peter, 2010.-317s.	2	
9. Fundamentals of the physiology of the heart: textbook. allowance / G.I. Evlakhov, A.P. Pugovkin et al. -S.-Pb .: Spetslit, 2015.-335 p.	1	
10. Human physiology: Atlas of dynamic schemes: textbook. allowance / K.V. Sudakov [and others]; ed. K.V. Sudakov. - 2nd ed. rev. add. - M .: GEOTAR - Media, 2015 .-- 416 p.	3	
11. Zilbernagl S. Visual physiology / S. Zilbernagl, A. Despopoulos; per. from eng. - M .: Binom. laboratory of knowledge, 2013 .-- 408 p.	1	

Educational and methodological support of the discipline 100%
Valid for the academic year 2020-2021

Head Department of Normal Physiology
Candidate of Medical Sciences, Associate Professor _____ R.Ya. Vlasenko

« 29» June 2020y.

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Table 3 - Furtherreading

Bibliographic description * edition (author, name, type, place and year of publication, count pages)	Qty. copies in the bibl. NovSU	Availabilityin EBS
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4. Physiology of the endocrine system / ed. J. Griffin and S. Oheda; -M .: BINOM.; 2008 - 496s.	2	
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8. Batuev A.S. Physiology of higher nervous activity and sensory systems: textbook for universities.-SPb: Peter, 2010.-317s.	2	
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Educational and methodological support of the discipline 100%
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Candidate of Medical Sciences, Associate Professor R.Ya. Vlasenko

«29» June 2020y.

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