



SYLLABUS OF THE EDUCATIONAL COMPONENT PHYSIOLOGY

Speciality: **222 "Medicine"**
Educational and professional program: **"Medicine"**
Component code in the educational program: **MC 15**
Higher education level: **second (master's degree)**
Form of education: **full-time (daytime)**
Year of study: **2**
Semester(s): **III (Autumn) and IV (Spring)**
Type of educational component: **mandatory**
Academic year: **2025-2026**

Volume: **8,5 credits ECTS (255 hours)**
Training sessions: **lectures, practical classes**
Final control: **exam**
Prerequisites: **Medical Biology; Medical and Biological Physics; Medical IT; Medical Chemistry; Bioorganic Chemistry; First Aid (Practice)**

Department/Unit: **Department of Physiology**, Nauky Ave. 4, Laboratory Building 3, 5th Floor

Head of the educational component: **assoc. prof. Iryna Karmazina**

E-mail: is.karmazina@knu.edu.ua

Page of the educational component in the Distance Learning System of KhNMU (Moodle):

<https://distance.knu.edu.ua/course/view.php?id=2794> (III semester)

<https://distance.knu.edu.ua/course/view.php?id=4321> (IV semester)

DESCRIPTION OF THE EDUCATIONAL COMPONENT

"Physiology" provides the training for Masters of Medicine, ensuring they possess a significant volume of theoretical and practical knowledge regarding the structural and functional features of the organism at various levels of organization.

PURPOSE OF THE COURSE: Mastery of knowledge regarding objective laws of body functions and their changes under environmental influences. Understanding functions of cells, tissues, organs, and systems for future professional activity. Ensuring understanding of health, healthy lifestyles, and prevention of functional disorders.

LEARNING OUTCOMES:

- Understand and explain the essence of physiological processes and organ functions.
- Knowledge of nervous and endocrine regulation and physiological interaction mechanisms.
- Formation of practical skills for assessing functional features of the body.
- Mastery of methods for determining basic physiological parameters.
- Studying mechanisms of a healthy person to identify causes of disorders in various diseases.

CONTENT OF THE EDUCATIONAL COMPONENT

List of lecture topics (50 hours):

Semester 3

1. Introduction to the course of physiology. Physiology of excitable structures. Biopotentials.
2. Physiology of nerve fiber and neuromuscular synapses.
3. Properties and mechanisms of skeletal and smooth muscle contraction/relaxation.
4. General physiology of the CNS. Properties of nerve centers.
5. The role of different levels of the CNS in the regulation of motor functions. The role of the spinal cord in the regulation of motor functions.
6. The role of the brainstem in the regulation of motor functions.
7. The role of the forebrain and cerebellum in the regulation of motor functions. 7. Autonomic nervous system and humoral regulation (hormones).
8. The role of the autonomic nervous system in the regulation of visceral functions.
9. Humoral regulation of visceral functions, the role of hormones in the regulation of body functions.
10. Physiology of sensory systems. Somatosensory system. Physiological foundations of pain and analgesia.

11. Physiology of visual and auditory sensory systems.
12. Physiological foundations of behavior. Mechanisms of formation and inhibition of conditioned reflexes. Modern mechanisms of memory and learning. The role of emotions and motivations in behavioral reactions.
13. Physiological foundations of higher nervous activity of a person. Typological properties of human HNA. Functional system of formation of a behavioral act (Acad. P.K. Anokhin).

Semester 4

1. Functional system of blood. Blood as a means of transport and the internal environment of the body.
2. Physiology of erythrocytes. Protective functions of blood. Blood groups.
3. Vascular-platelet and coagulation hemostasis. The role of anticoagulants and plasmins.
4. Functional circulatory system. Physiological properties of the heart muscle. Pumping function of the heart.
5. The role of vessels in blood circulation. Basic principles of blood circulation.
6. Regulation of blood movement through vessels. Regulation of systemic blood circulation.
7. Functional respiratory system. Main stages of respiration.
8. Regulation of respiration.
9. Functional digestive system. Role of taste and olfactory sensory systems. Digestion in the oral cavity and stomach.
10. Digestion in the duodenum.
11. Digestion and absorption in the intestines. Physiological basis of hunger and satiety.
12. Functional excretory system. Mechanisms of urine formation. Regulation of urine formation and excretion. Role of the kidneys in maintaining homeostasis.

List of topics of practical classes (118 hours):

Semester 3

1. Subject and tasks of physiology. Methods of physiological research. Research of mechanisms of transport of substances through the membrane. Registration of rest potential and action potential of nervous and muscular fibers.
2. Research of excitation conduction by nervous fibers and nervous-muscular synapse. Research of the action potential of integral nerves and muscles.
3. Research of mechanisms of contraction and relaxation of skeletal and smooth muscles.
4. General characteristics of biological regulation. Research of reflex arc. Synapses of the central nervous system. Research of processes of excitation and inhibition in the CNS.
5. Research of the role of the spinal cord in the regulation of motor functions of the body.
6. Research of the role of the brainstem in the regulation of the body's motor functions.
7. Research of the role of the forebrain and cerebellum in the regulation of motor functions. Regulation of the body's systemic activity.
8. Research of the mechanisms of nervous regulation of the visceral functions of the body.
9. Research of the mechanisms of humoral regulation of the visceral functions of the body.
10. Attestation class №. 1: "General principles of biological regulation of body functions".
11. Research of the somatosensory system. Research of the vestibular, gustatory and olfactory sensory systems.
12. Research of visual and auditory sensory systems.
13. Physiological foundations of behavior. Needs and motivations. Research of formation and inhibition of conditioned reflexes. Modern mechanisms of memory and learning. Research of the role of emotions and motivations in behavioral reactions (P.K. Anokhin).
14. Physiological foundations of higher nervous activity of a person. Research of typological properties of human HNA. EEG.
15. Attestation class №. 2: "Physiology of higher integrative functions and sensory systems of the body".

Semester 4

16. Functional blood system. Study of physicochemical properties of blood.

17. Research of the number of erythrocytes and hemoglobin in the blood. Study of blood group affiliation.
18. Protective functions of blood. Study of blood coagulation. Practical skills in the physiology of the blood system.
19. Functional circulatory system. Study of the physiological properties of the heart muscle. Study of the dynamics of cardiac excitation. Registration and analysis of the electrocardiogram.
20. Study of the pumping function of the heart.
21. The role of vessels in blood circulation. Study of blood pressure in humans.
22. Study of the regulation of heart activity and blood circulation. Practical skills in the physiology of the circulatory system.
23. Functional respiratory system. Study of external respiration. Study of diffusion and transport of gases by blood.
24. Study of respiratory regulation. Practical skills in the physiology of the respiratory system.
25. Attestation class №. 3: "Physiology of functional systems: blood, blood circulation and respiration".
26. Functional digestive system. Study of digestion in the oral cavity. The role of taste and olfactory sensory systems. Study of digestion in the stomach.
27. Study of digestion in the duodenum. Study of digestion in the intestines. Physiology of hunger and satiety. Practical skills in the physiology of digestion.
28. Study of energy metabolism and thermoregulation.
29. General characteristics of the excretory system. Mechanism of urine formation: glomerular filtration, tubular reabsorption, secretion. Excretory function of the kidneys. Concentration and dilution of urine. Regulation and self-regulation of the excretory system. The role of the kidneys in maintaining homeostasis: blood volume and blood pressure; maintenance of acid-base balance and ionic composition of the blood; the role of the kidneys in hematopoiesis and regulation of calcium metabolism.
30. Attestation class №. 4: "Physiology of metabolism and energy, digestion and excretion".

List of topics of independent work of the student (87 hours)

1. The main stages of the development of physiology. The history of the development of physiology in the 19th century. The contribution of the works of I.M. Sechenov, I.P. Pavlov, P.K. Anokhin, P.G. Kostyuk to the development of world physiology Ukrainian physiological school.
2. Formation of resting potential and action potential. Conduction of excitation by nerve fibers. Properties of skeletal muscles and mechanisms of their contraction. Physiology of smooth muscles.
3. Contours of biological regulation of functions. Synapses of the CNS. Excitation and inhibition in the central nervous system.
4. The role of different levels of the CNS in the regulation of motor functions of the body.
5. Research on fatigue and recovery during muscle work and adaptation of the body to physical exertion.
6. The role of the nervous system in the regulation of visceral functions of the body
7. The role of hormones in the regulation of the processes of mental, physical development, linear growth of the body.
8. Somatosensory system. Physiological foundations of pain and analgesia. Nociceptive and antinociceptive systems of the body.
9. Vestibular, olfactory and gustatory sensory systems.
10. Higher nervous activity. Physiological foundations of behavior. Features of human GNI.

Semester 4

11. Blood functions, physicochemical properties of blood. Protective functions of blood. Blood immunoglobulins, structure, functions. Types and mechanisms of hemostasis. Coagulants and anticoagulants.
12. Physiological properties of the heart muscle. Regulation of heart activity. Systemic circulation. Laws of hemodynamics, the role of vessels in blood circulation.

13. Systemic and pulmonary circulation. Dynamics of lymph circulation.
14. Regional circulation, coronary, bronchial, cerebral, renal, portal. Features of regional circulation and its regulation.
15. External respiration. Transport of gases by blood. Types of respiration.
16. Digestion in the oral cavity. The role of taste and olfactory sensory systems. Physiological foundations of hunger and satiety.
17. The role of the kidneys in the processes of excretion, mechanisms of urine formation. Contours of homeostasis regulation with the participation of the kidneys.
18. Individual IWS of choice: create diagrams of homeostasis parameter regulation circuits involving one of the visceral systems.

The IWS is aimed at deepening and consolidating the theoretical knowledge gained during classroom training and contributing to the formation of professional competencies. The results of the IWS are subject to control and are included in the final control of knowledge.

Consultations: online, with by pre-registration on the course page in the Distance Learning System.

Teaching methods: lectures with presentation, performance of practical work, using students' research of physiological functions in experiments on animals, isolated organs, cells, models based on virtual research presented in computer programs and other educational technologies, solving situational problems using interactive teaching methods, mini-conference with preparation of reports and abstracts.

EVALUATION

Current Learning Activities (CLA). Assessment of the success of education seekers is carried out in accordance with the Instructions for assessing the educational activities of higher education seekers at KhNMU (https://knmu.edu.ua/doc_block_type/instrukcyiyi-navchalnogo-proczesu/). The grade for a practical or final lesson is from 2 to 5 points. Submitting assignments late for unjustified reasons entails a reduction in the grade in accordance with the percentage of lateness from the moment of completing the assignment. Assignments are checked within 24 hours. Grades are posted in the electronic journal. Unsatisfactory grades are processed in accordance with the Regulations on the procedure for completing academic classes by students of KhNMU (chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

At the end of the semester, the semester average is converted into a multiple-point grade (70–120 points) in accordance with Table 1 of the Grading Instructions (see above). The arithmetic average of the CLA for both semesters constitutes the total learning activity (TLA).

Individual tasks (IT) are not a mandatory element, but at the student's request they can be completed and evaluated in ECTS points (no more than 10 points), which are added to the sum of points scored for current educational activities. At the meeting of the department, a list of individual tasks was approved (participation with reports in student conferences, specialized Olympiads, preparation of analytical reviews with presentations with plagiarism check) indicating the number of points for their completion, which can be added as an incentive.

Final control. The condition for admission to the exam is to score 70 points on the TLA. The exam score ranges from 50 to 80 points.

Grade in subject (GS). $GS = TLA + IT + \text{exam}$.

Appealing the results of the final control is carried out in accordance with the procedure established in KhNMU (https://knmu.edu.ua/wp-content/uploads/2021/05/polog_apel_kontrol.pdf).

POLICIES OF THE EDUCATIONAL COMPONENT

Recommendations for working on the course: actively participate in all forms of work in classes, devote 1-2 hours daily to independent work and preparation for classes, ask questions during classes, attend consultations, submit assignments on time, and complete all forms of control.

Attending classes. Attending lectures and practical classes is mandatory. The dress code for offline classes is a white medical gown. If a student is late for a lecture or practical class for more than 5 minutes, he/she may not be admitted to the class. Missed classes are made up in accordance with the Regulations on the Procedure for the Performance of Academic Classes by KhNMU Students (chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

Academic integrity. KhNMU stands on the positions of zero tolerance to manifestations of academic dishonesty. Any violations of the principles of academic integrity entail responsibility in accordance with the procedure established by KhNMU (https://knmu.edu.ua/wp-content/uploads/2021/05/polog_ad-1.pdf).

Use of electronic gadgets and artificial intelligence tools is only permitted with the teacher's permission.

Policy on persons with special educational needs. Students with special educational needs should contact their teacher to develop an individual educational trajectory.

Teacher Response Time: 24 hours.

Technical requirements for the course:

- access to a computer, laptop, tablet or smartphone
- Corporate Google account with your own photo
- skills in working with Google Workspace (Google Meet, Docs, Sheets, Slides, Forms) and Moodle

Technical support: ASM (ev.shevtsov@knmu.edu.ua), Google (tehotdelknmu@gmail.com), Moodle (al.korol@knmu.edu.ua)

RECOMMENDED SOURCES

1. Guyton A. C., Hall J. E., Textbook of Medical Physiology. - 14th ed. Elsevier. 2020. – 1152 p. ISBN: 9780323597128
2. Saladin: Anatomy & Physiology: The Unity of Form and Function (10th Edition) / Saladin K.S. – The McGraw–Hill Companies, 2023.
3. Medical physiology: principles for clinical medicine / edited by Rodney A. Rhoades, David R. Bell. – 6th ed. – Lippincott Williams & Wilkins, a Wolters Kluwer business, 2022. – 960 p.
4. Linda.S.Costanzo. BRS Physiology/Linda.S.Costanzo.– Lippincott Williams & Wilkins, 2022, 8th ed., 336 pages, ISBN 9781975153601
5. Walter F. Boron; Emile L. Boulpaep Medical Physiology (1st ed), Elsevier Health Sciences, January 12, 2021, 696 pages. ISBN: 978-0323655309

Additional references:

1. First Aid for the USMLE Step 1. 2023: A student to student Guide. McGraw-Hill – 890 p.
2. Kaplan. USMLE Step 1 Lecture Notes 2022 / Kaplan Test Prep, 2022, 2000 pages, ISBN 9781506272967
3. Fox, S.I., Human Physiology, 16th edition, 2021.
4. Linda.S.Costanzo. Physiology/Linda.S.Costanzo.– Elsevier, 2022, 7th ed., 528 pages, ISBN 9780323793339