NATIONAL UNIVERSITY OF BIORESOURCES AND ENVOROMENTAL SCIENCES OF UKRAINE

Department of Physiology of Vertebrates and Pharmacology

APPROVED
Faculty of Veterinary Medicine

" " _____ 2025

CURRICULUM OF ACADEMIC DISCIPLINE

Animal physiology

Field of knowledge "Veterinary medicine"
Speciality 211 "Veterinary medicine"
Academic programme «Veterinary Medicine»
Faculty of Veterinary Medicine
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Kyiv - 2025

Description of the discipline «Animal Physiology»

The discipline "Animal Physiology" aims to provide students with theoretical and practical knowledge of the functioning of individual organs and their systems and the organism as a whole, basic physiological principles and laboratory techniques, emphasizing the intricate interaction between structure and function, and key processes such as adaptation, homeostasis, and self-regulation. Students will explore the course of physiological processes in various animal species and learn methods for managing physiological functions to maintain health, improve animal welfare, enhance productivity, and optimize the quality of livestock products.

Throughout this course, students will become familiar with the complex processes occurring within animal organisms, including their interrelationships and regulatory mechanisms. The discipline fosters a holistic understanding of the physiological mechanisms that maintain the constancy of the internal environment (homeostasis) and enable the organism's adequate response to changes in the external environment, as well as the mechanisms that ensure overall organismal functioning.

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Academic degree, speciality, academic programme		
Academic degree	Master	
Speciality	211 "Veterinary medicine"	
Academic programme	"Veterinary Medicine"	
Characteristics of the discipline		
Type	mandatory	
Total number of hours	210	
Number of ECTS credits	7	
Number of modules	6	
Course project (work) (if included in the working curriculum)	-	
Form of assessment	Exam	
Indicators of the discipline for full-time and part-time university study		
	Full-time	Part-time
Year of study	2	
Semester	3, 4	
Lectures	60 hours.	
Laboratory classes	90 hours.	
Self-study	60 hours.	
Number of hours per week for full-time students	5 hours.	

1. Aim, competences and expected learning outcomes of the disciplin

The aim and objectives of this discipline are to equip students with theoretical and practical knowledge concerning the course of physiological processes in various animal species. It aims to teach them methods for managing physiological functions to maintain health, enhance productivity, and improve the quality of livestock products.

The uniqueness of this discipline lies in its integration of contemporary national and international knowledge in animal physiology. The foundation of this training is a comprehensive approach that combines theoretical, practical, and innovative learning orientations. For studying this academic discipline, students will utilize educational and methodological materials authored by the scientific and pedagogical staff of the Department of Vertebrate Physiology and Pharmacology at the Faculty of Veterinary Medicine, NUBiP of Ukraine. Certified electronic learning courses are used for processing educational materials..

Acquired Competencies:

Integral Competence (IC): The ability to solve complex problems and challenges in the field of veterinary medicine, which involves conducting research and/or implementing innovations, and is characterized by uncertainty in conditions and requirements..

General competences (GC):

GC1. Ability for abstract thinking, analysis, and synthesis.

GC 2. Ability to apply knowledge in practical situations.

GC 11. Ability to evaluate and ensure the quality of work performed.

Special (professional) competences (SC):

SC1. 1. Ability to identify the peculiarities of the structure and functioning of cells and tissues in various classes and species of animals – mammals, birds, insects (bees), fish, and other vertebrates.

SC2. Ability to use instruments, specialized devices, equipment, laboratory apparatus, and other technical means for performing necessary manipulations during professional activities.

SC3. Ability to adhere to occupational safety, aseptic, and antiseptic rules during professional activities.

Programme learning outcomes (PLOs):

PLO1. Know and accurately utilize veterinary medical terminology.

PLO3. Determine the essence of physicochemical and biological processes occurring in animal organisms under normal and pathological conditions.

PLO5. Establish the correlation between clinical manifestations of the disease and the results of laboratory tests.

Day One Competencies

1. Demonstrate understanding of the ethical and legal frameworks governing veterinary practice, including professional conduct, animal welfare, owner relations,

public health, and the societal and environmental impacts of professional activities.

2. Understand scientific research methodologies, the contribution of fundamental and applied research to science, and the implementation of the 3Rs principle (Replacement, Reduction, Refinement) in animal research and care.

4. Promote and monitor the health and safety of themselves, patients, animal owners, colleagues, and the environment during professional activities. This includes demonstrating knowledge of quality assurance principles and applying risk management principles in practice.

8. Work effectively as part of a multidisciplinary team in providing veterinary services and recognize the contributions of all team members.

9. Exhibit critical thinking skills, including the ability to review and evaluate scientific literature and presentations.

12. Utilize professional capabilities to advance veterinary knowledge and implement the "One Health" concept to promote the health, safety, and well-being of animals, humans, and the environment, thereby contributing to the achievement of the UN Sustainable Development Goals.

15. Regularly engage in self-reflection and peer assessment processes to enhance personal performance and the effectiveness of the entire team..

19. Develop appropriate patient treatment plans and administer treatment in the best interest of each animal under care, utilising available resources. This includes providing sound professional judgment regarding animal and human health, and environmental considerations.

20. Provide emergency and first aid care to common animal species. Prioritize and allocate resources effectively according to each specific situation.

24. Utilise basic diagnostic equipment and effectively conduct animal examinations according to the specific case, adhering to proper health and biosecurity practices and current regulatory documents. This also involves understanding the contribution of digital tools and artificial intelligence to the theory and practice of veterinary medicine.

2. Program and structure of the discipline:

- full-time study;

Modules and topics	Number of hours			
	full-time			
	total	including		
		l	lab	s.st.
1	2	3	4	5
Module 1: Introduction. Physiology of excitable tissues.				
Topic 1: Introduction to animal physiology. History of the development of physiological science, subject, methods, research techniques, the organism and its properties.	8	2	2	4
Topic 2. General properties of excitable tissues.	14	2	4	8
Topic 3. Muscle physiology	6	2	4	
Topic 4. Physiology of the nerve fibre.	6	2	4	
Module test	2		2	
Total for module 1	**36**	**8**	**16**	**12**
Module 2. Physiology of digestive system and blood				
Topic 5. General characteristics of digestion. Digestion in the oral cavity.	12	2	2	8
Topic 6: Digestion in the one-chambered stomach	4	2	2	
Topic 7. Digestion in the ruminant forestomach and abomasum.	4	2	2	
Topic 8: Digestion in the small and large intestine. Absorption. Defecation. Peculiarities of digestion in different animal species.	6	2	2	
Topic 9. Blood – he internal environment of the body.	16	2	8	8
Topic 10. Formed elements of the blood. Blood types	10	2	8	
Module test	2		2	
Total for module 2	**54**	**12**	**26**	**16**
Module 3: Physiology of the cardiovascular system and respiration.				
Topic 11. Physiology of blood circulation. Physiological properties of the heart muscle.		2	4	4
Topic 12. Electrocardiography. Regulation of the heart.		2	4	
Topic 13. Physiology of the vascular system. Features of blood circulation in different organs. Lymph and lymph circulation		2	4	
Topic 14: Respiratory physiology.		2	6	4
Module test			2	
Total for module 3	**33**	**8**	**20**	**8**
Module 4. Physiology of metabolism, energy, excretion and lactation.				

Topic 15. Physiology of metabolism. Metabolism of proteins.		2		4
Topic 16. Metabolism of fats and carbohydrates.		2		
Topic 17. Mineral metabolism. Water metabolism. Regulation of water metabolism.		2		
Topic 18. Vitamins.		2		
Topic 19: Energy metabolism. Thermoregulation		2	2	
Topic 20: Physiology of excretion. Physiology of the skin		2	2	4
Topic 21: Physiology of lactation.		2	2	
Module test			2	
Total for module 4	**30**	**14**	**8**	**8**
Module 5. Physiology of the endocrine system, central nervous system and reproduction.				
Topic 22. General physiology of the endocrine system		2		4
Topic 23. Endocrine function of endocrine glands and their regulation.		2	2	
Topic 24. Physiology of the central nervous system systems		2	2	
Topic 25. Physiology of the spinal cord and brain		2	2	4
Topic 26. Physiology of reproduction.		2		
Module test			2	
Total for module 5	**26**	**10**	**8**	**8**
Module 6. Central nervous system. Higher nervous activity. Analysers.				
Topic 27: Physiology of higher nervous activity		2	2	8
Topic 28: Types of higher nervous activity		2	2	
Topic 29. General properties of analysers Physiology of visual and skin analysers		2	4	
Topic 30. Physiology of the auditory and olfactory senses, vestibular, taste analysers		2	2	
Module test			2	
Total for module 6	**29**	**8**	**12**	**8**
Total hours	**210**	**60**	**90**	**60**

3. Topic of lectures

No	Topic	Hours
	Module 1: Introduction. Physiology of excitable tissues	
1.	Lecture 1: Introduction to animal physiology. History of the development of physiological science, subject, methods, research techniques, the organism and its properties.	2
2.	Lecture 2. General properties of excitable tissues. Excitation, excitability, and irritability. Stimuli and their classification. Signs of excitation. Generation of excitation. The relationship between stimulus strength and duration. Phases of excitability. Functional lability. Optimum and pessimism of frequency and strength of irritation. Parabiosis and its phases. Brief history of the study of biocurrents. Types (categories of biocurrents). Mechanism of excitation (Theories of bio currents).	2
3.	Lecture 3. Muscle physiology. Structural features of muscles. Properties of skeletal muscles. Mechanism of muscle contraction. Types of muscle contractions. Muscle force and work. Muscle fatigue. Properties of smooth muscles	2
4.	Lecture 4. Physiology of the nerve fibre. The concept of nerve fibres and features of their structure. Properties of nerve fibres. Synapses.	2
	Module 2. Physiology of digestion and blood	
5.	Lecture 5. General characteristics of digestion. Digestion in the oral cavity. The essence of digestion. Functions of the digestive system. Digestion in the oral cavity. Features of salivation in different animals. Swallowing	2
6.	Lecture 6: Digestion in the one-chambered stomach General patterns of gastric digestion. Composition and properties of gastric juice. Regulation of gastric juice secretion. Gastric secretion in response to different types of feed. Motor function of the stomach and its regulation. Mechanism of gastric content transfer into the small intestine. Vomiting: mechanism and physiological significance.	2
7.	Lecture 7. Digestion in the forestomachs and abomasum of ruminants. General information about digestion in the forestomachs of ruminants. Reflex of the esophageal groove. Functions of the forestomachs. Microorganisms of the forestomachs and their role in digestion. Carbohydrate digestion in the forestomachs. Nitrogenous compound digestion in the forestomachs. Lipid digestion in the rumen. Gas formation in the rumen. Rumination period. Motility of the forestomachs. Digestion in the abomasum.	2
8.	Lecture 8: Digestion in the small and large intestine. Absorption. Defecation. Features of digestion in different species of animals. Digestion in the small intestine. Luminal and membranous (contact) digestion. Intestinal motility. Digestion in the large intestine. Absorption. Faeces formation and defecation. Features of digestion in farm animals of different species, including horses, pigs and birds	2
9.	Lecture 9. Blood is the internal environment of the body. Blood functions. The amount of blood. Composition and physical and chemical properties of blood. Composition of blood plasma. Buffer systems of blood. Blood proteins and their importance. Hemoglobin. Blood cells and their functions.	2
10.	Lecture 10. Blood types. Blood coagulation. Haematopoietic system. Blood groups. Blood compatibility. Blood transfusion. Phases of blood coagulation. Haematopoiesis and its regulation.	2

	Module 3: Physiology of the cardiovascular system and respiration.	
11.	Lecture 11. Physiology of blood circulation. Physiological properties of the heart muscle. The concept of the circulatory system and its development in phylogeny. The heart is the central organ of the circulatory system. Cardiac cycle. Periods and phases of heart activity. Mechanical and sound phenomena during heart contraction. Physiological features of the heart muscle. Automation of the heart. Conducting system. Electrical phenomena in the heart.	2
12.	Lecture 12: Electrocardiography. Regulation of the heart. Electrocardiography. Biocurrents of the heart. Echocardiography. Regulation of heart function. Intracardiac mechanisms of regulation. Extracardiac regulation. Reflex regulation. Humoral regulation.	2
13.	Lecture 13. Physiology of the vascular system Features of blood circulation in different organs. Lymph and lymph circulation. The vascular system. Circles of blood circulation. The concept of haemodynamics. Blood flow velocity. Functional groups of vessels. Arterial blood pressure. Arterial pulse. Venous blood flow. Regulation of vascular blood flow. The vascular system. Circles of blood circulation	2
14.	Lecture 14: Respiratory physiology. The concept of respiration. Stages of respiration. The mechanism of respiration. The respiration rate. Vital capacity of the lungs. Regulation of respiration. Respiratore features under changes in atmospheric air pressure. Respiration in birds.	2
	Module 4. Physiology of metabolism, energy, excretion and lactation	
15.	Lecture 15: Physiology of metabolism. Protein metabolism. Metabolism as a fundamental condition of life. The essence of metabolism. Types of metabolism. Methods of studying metabolism. General regulation of metabolism. Protein metabolism and its regulation	2
16.	Lecture 16. Metabolism of lipids and carbohydrates. Key stages of lipid metabolism. Regulation of lipid metabolism. Stages of carbohydrate metabolism and its regulation.	2
17.	Lecture 17. Mineral metabolism. Water exchange. Regulation of water balance. Physiological significance of macro- and microelements. Water metabolism and its regulation.	2
18.	Lecture 18: Vitamins. Vitamins. Water-soluble, fat-soluble vitamins. Antivitamins.	2
19.	Lecture 19: Energy metabolism. Thermoregulation Energy metabolism in animals and its regulation. Body temperature and its regulation	2
20.	Lecture 20: Physiology of excretion. Physiology of the skin. The essence of the excretory process. Excretory organs. Structural features of the urinary system. Mechanism of urine formation. Regulation of kidney function. The role of kidneys in maintaining water-salt homeostasis and acid-base balance. Quantity, properties, and composition of urine. Urine excretion and its regulation. Peculiarities of urine composition and urination in domestic poultry..	2
21.	Lecture 21: Physiology of lactation. Growth and development of the mammary glands (mammogenesis). The structure of the mammary gland. Lactation. Milk production (characteristics of the secretory process). Species-specific features of mammary gland secretory function in female animals. Characteristics of the milk ejection reflex.	2

	Physiological basis for increasing milk production of animals	
	Module 5: Physiology of the endocrine system, central nervous system and reproduction.	
22.	Lecture 22. General physiology of the endocrine system Concept and general characteristics of endocrine glands. General characteristics of hormones. General properties of hormones. Physiological action of hormones. Mechanisms of action of hormones	2
23.	Lecture 23. Endocrine function of endocrine glands and their regulation. Pituitary gland, thyroid gland. Parathyroid glands. Endocrine function of the pancreas. Adrenal glands. Gonads. Thymus. Pineal gland.	2
24.	Lecture 24. Physiology of the central nervous system Evolution of the nervous system. Structure and functions of neurons. Structure and function of neuroglia. Reflex activity of the nervous system. Classification of reflexes. Afferent feedback. Nerve centres and their properties.	2
25.	Lecture 25. Physiology of the spinal cord and brain Structure and functions of the spinal cord. Methods of studying the functions of the spinal cord. Reflex function of the spinal cord. Conductive function of the spinal cord. General characteristics of the autonomic nervous system. Centres of regulation of autonomic functions. Effects of excitation of the autonomic nervous system.	2
26.	Lecture 26. Physiology of reproduction. Reproduction – one of the fundamental characteristics of living organisms ensuring species preservation. Reproductive organs of males and females and their functions. Sexual reflexes. The sexual cycle. Mating and fertilisation in animals. Pregnancy. Labor/Birth. Reproduction of birds.	2
	Module 6: Central nervous system. Higher nervous activity. Analysers.	
27.	Lecture 27: Physiology of higher nervous activity. Cerebral Cortex: Structure, functions, and research methods. Reflexes: Classification and rules for the formation of conditioned reflexes. Types of inhibition in the cerebral cortex. Insight. Dynamic stereotype. Instinct. Signal systems of reality. Sleep and hypnosis..	2
28.	Lecture 28: Types of higher nervous activity. Types of higher nervous activity. Biological significance of conditioned reflexes. Dynamic stereotype. Practical application of the doctrine of higher nervous activity in animal husbandry. Animal training.	2
29.	Lecture 29. General properties of analysers Physiology of visual and skin analysers. Evolution of analysers. General structure of analysers. Classifications and methods of studying analysers. General properties of analysers. Visual analyser. Skin analyser.	2
30.	Lecture 30. Physiology of the auditory, olfactory, vestibular, gustatory analysers Auditory analyzer. Equilibrium (Vestibular) analyzer. Olfactory analyzer. Gustatory (Taste) analyzer. Motor analyzer. Interoceptive analyzer. Interaction of analyzers.	2

4. Topic of laboratory classes

No	Class topic.	Hours
	Module 1: Introduction. Physiology of excitable tissues.	
1.	Laboratory class 1: Introductory lesson. Laboratory safety regulations.	2
2.	Laboratory class 2. Analysis of the reflex arc of conditioned and unconditioned reflexes. Preparation of a neuromuscular preparation.	2
3.	Laboratory class 3. Effect of different stimuli on neuromuscular Specimen. Determination of the threshold of excitability. Types of muscle contraction.	2
4.	Laboratory class 4. Bioelectrical phenomena in tissues. Experiments of Galvani. Currents of rest, damage, action. Currents of human hands.	2
5.	Laboratory class 5. Effect of load on muscle function. Dynamometry.	2
6.	Laboratory class 6. Phases of parabiosis.	2
7.	Laboratory class 7. The effect of direct current on the nerve. The polar law. Physiological electrotonus.	2
8.	Laboratory class 8: Module test	2
	Total for module 1	**16**
	Module 2. Physiology of digestion system and blood	
9.	Laboratory class 9: Observation of feed and water intake by animals. Determination of the quantity and viscosity of saliva obtained from animals under the influence of various stimuli (rusks, milk, hydrochloric acid). The role of saliva in the act of swallowing.	2
10.	Laboratory class 10. Phases of gastric juice secretion. Investigation of the effect of gastric juice on protein. Study of the action of chymosin.	2
11.	Laboratory class 11. Observation of infusoria of the rumen contents. Observation of the rumination process. Study of the motor function of the rumen.	2
12.	Laboratory class 12: Digestion in the intestine. Bile. Evacuation function of the stomach.	2
13.	Laboratory class 13. Red blood cell count.	2
14.	Laboratory class 14: White blood cell count. Observation of phagocytosis.	2
15.	Laboratory class 15: Preparation of blood smears from different species of animals. Leukocyte formula of animals of different species	2
16.	Laboratory class 16. Determination of hemoglobin concentration in the blood of different animal species. Calculation of the color index.	2
17.	Laboratory class 17. Hemolysis. Determination of the erythrocyte osmotic fragility	2
18.	Laboratory class 18: Preparation of heme crystals. Spectral analysis of blood.	2
19.	Laboratory class 19: Red blood cell sedimentation rate. Determination of the rate of blood clotting.	2
20.	Laboratory class 20. Blood types. Determination of blood compatibility in animals. Rh factor.	2
21.	Laboratory class 21: Module test	2
	Total for module 2	**26**
	Module 3: Physiology of the cardiovascular system and respiration.	
22.	Laboratory class 22. Registration of cardiac activity in a frog. Analysis of the mechanocardiogram. Extrasystole.	2
23.	Laboratory class 23: Cardiac automaticity. Stannius ligatures.	2
24.	Laboratory class 24. Effect of temperature on heart function. The effect of potassium, calcium ions and the hormone adrenaline on the isolated frog heart. The effect of the vagus nerve on the work of the frog heart.	2
25.	Laboratory class 25. Reflex cardiac arrest of the frog. Trigeminal reflex.	2
26.	Laboratory class 26. Electrocardiography. Blood pressure measurement. Comparative assessment of blood pressure in arteries and veins.	2
27.	Laboratory class 27: Auscultation and percussion of the heart muscle.	2

	Examination of the heartbeat, pulse.	
28.	Laboratory class 28. Demonstration of frog lung movements in the Donders apparatus. Function of the intercostal muscles. Observation of of ciliary epithelium movements. Analysis of inhaled and exhaled air.	2
29.	Laboratory class 29: Determination of vital capacity of the lungs. Determination of minute lung volume. Pneumography	2
30.	Laboratory class 30. Auscultation and percussion of the lungs. Counting the number of respiratory movements in animals of different species. Determination of the type of respiration in animals.	2
31.	Topic 31. Module test	2
	Total for Module 3	**20**
	Module 4. Physiology of metabolism, energy, excretion, lactation.	
32.	Laboratory class 32. Determination of the energy metabolism rate in farm animals. Measurement of body temperature.	2
33.	Laboratory class 33. Examination of urine of animals of different species. Macroscopic examination of urine. Microscopic examination of urine. Organised and unorganised urine sediments.	2
34.	Laboratory class 34 Determination of intramammary pressure in the mammary gland. Milk examination. Observation of milk fat globules under the microscope.	2
35.	Laboratory class 35. Module test	2
	Total for Module 4	**8**
	Module 5: Physiology of the endocrine system and central nervous system.	
36.	Laboratory class 36. The effect of adrenaline on the pupil of the eye. Hypophysectomy in frogs. The effect of adrenaline and pituitrin on chromatophores. The effect of insulin on blood glucose levels. Induction of molting in chickens using thyroid gland preparations.	2
37.	Laboratory class 37. Spinal reflexes. Determination of reflex latency. Receptive field. Effect of stimulus intensity on reflex latency..	2
38.	Laboratory class 38. Irradiation and summation of excitation in the spinal cord. Reflex muscle tone. Dominant excitation. Sechenov's inhibition. Inhibition of spinal reflexes in frogs..	2
39.	Laboratory class 39. Module test	2
	Total for module 5	**8**
	Module 6: Physiology of higher nervous activity and analysers.	
40.	Laboratory class 40. Methods of conditioning reflex formation. Formation of salivary-food, motor-defensive, and motor-food conditioned reflexes..	2
41.	Laboratory class 41. Inhibition of conditioned reflexes.	2
42.	Laboratory class 42. Visual analyzer. Fundus examination in animals (ophthalmoscopy). Pupillary light reflex. Reflexes induced by corneal stimulation. Determination of the near point of vision. Diagnosis of color vision deficiencies (color blindness). Blind spot in the eye (Mariotte's experiment). Visual illusions	2
43.	Laboratory class 43. Auditory analyzer. Determination of auditory acuity. Localization of the sound source. Bone and air conduction.	2
44.	Laboratory class 44. Cutaneous analyzer. Clinically significant reflexes. Determination of the spatial threshold of tactile sensitivity (esthesiometry). Vestibular analyzer. Examination of the otolith apparatus. Gustatory analyzer. Determination of the taste sensitivity threshold.	2
45.	Topic 45. Module test	2
	Total for module 6	**12**
	Total	**90**

5. Topics of self-study topic

No	Topic	Hours
1.	**Introduction to animal physiology**. History of the development of physiological science. Subject matter, methods, and research techniques. The organism and its properties.	4
2.	**General properties of excitable tissues.** Excitation, excitability, and irritability. Stimuli and their classification. Signs of excitation. Conditions necessary for the development of excitation. Relationship between the intensity and duration of a stimulus. Phases of excitability. Functional mobility (lability). Optimum and pessimum of stimulus frequency and intensity. Parabiosis and its phases. Brief history of bioelectricity research. Types (categories) of bioelectric currents. Mechanism of excitation.	8
3.	**General characteristics of digestion.** Digestion in the oral cavity. The essence of digestion. Functions of the digestive system. Digestion in the oral cavity. Features of salivation in different animals. Swallowing	8
4.	**Blood is the internal environment of the body.** Functions of blood. Blood volume. Composition and physicochemical properties of blood. Composition of blood plasma. Blood buffer systems. Blood proteins and their significance. Hemoglobin. Blood cells and their functions.	8
5.	**Physiology of blood circulation.** Physiological properties of cardiac muscle. Concept of the circulatory system and its phylogenetic development. The heart as the central organ of the circulatory system. Cardiac cycle. Periods and phases of cardiac activity. Mechanical and acoustic phenomena during cardiac contraction. Physiological characteristics of cardiac muscle. Cardiac automatism. Conducting system. Electrical activity of the heart.	4
6.	**Physiology of respiration.** Concept of respiration. Stages of respiration. Mechanism of breathing. Respiratory rate. Vital capacity of the lungs. Regulation of respiration. Respiratory characteristics under altered atmospheric pressure. Respiration in birds.	4
7.	**Physiology of metabolism.** Protein metabolism. Metabolism as the fundamental condition of life. Essence of metabolism. Types of metabolism. General regulation of metabolism. Protein metabolism and its regulation.	4
8.	**Physiology of excretion.** Physiology of the skin. Essence of excretion. Excretory organs. Structural characteristics of the urinary system. Mechanism of urine formation. Regulation of renal function. Role of kidneys in maintaining water-salt homeostasis and acid-base balance. Quantity, properties, and composition of urine. Urine excretion and its regulation. Specifics of urine composition and excretion in domestic birds.	4
9.	**General physiology of the endocrine system.** The concept and general characteristics of endocrine glands. General characteristics of hormones. Physiological effects of hormones. Mechanisms of hormonal action	4
10.	**Central nervous system physiology.** Evolution of the nervous system. Structure and function of neurons. Structure and function of neuroglia. Reflex activity of the nervous system. Classification of reflexes. Reverse afferentation. Nerve centres and their properties.	4
11.	**Physiology of higher nervous activity.**	8

	The cerebral cortex. Structure, functions and research methods. Reflexes, their classification, rules for developing conditioned reflexes. Types of inhibition in the cerebral cortex. Insight. Dynamic stereotype. Instinct. Signal systems of reality. Sleep and hypnosis.	
	Total	**60**

6. Methods of assessing expected learning outcomes:

- oral or written survey;
- interview;
- test;
- defending laboratory/practical, design/graphical works, projects;
- peer-to-peer assessment, self-assessment.

7. Teaching methods:

- problem-based method;
- practice oriented studying method;
- case method;
- project education method;
- research-based method;
- learning discussions and debates method;
- team work, brainstorm method
-

8. Result assessment.

The knowledge of the higher education applicant is assessed using a 100-point grading scale, which is then converted into a national grade in accordance with the current "Regulations on Examinations and Credits at NUBiP of Ukraine.".

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assesment
Module 1: Introduction. Physiology of excitable tissues		
Laboratory class 1: Introductory lesson. Laboratory safety	Understand the subject and objectives of physiology. Be familiar with safety regulations for laboratory work..	**5**
Laboratory class 2. Analysis of the reflex arc of conditioned and unconditioned reflexes. Preparation of a neuromuscular preparation.	PLO1, 3, 5. Know the fundamental concepts of physiology that describe the functions occurring in the animal body: excitability, irritability, conductivity, contractility, excitation, stimulus, reflex arc, rheobase, useful time, chronaxie, and threshold stimulus strength.	**10**
Laboratory class 3. Effect of different stimuli on neuromuscular specimen.Determination of the threshold of excitability. Types of muscle contraction		**10**
		10
Laboratory class 4. Bioelectrical phenomena in tissues. Experiments of		**10**

Galvani. Currents of rest, damage, action. Currents of human hands.	Be able to determine tissue excitability, threshold stimulus strength, and lability. Be proficient in using centrifuges, pH meters, photoelectric colorimeters, and other modern laboratory equipment for conducting physiological studies of the animal organism. .	
Laboratory class 5. Effect of load on muscle function. Dynamometry.		**5**
Laboratory class 6. Phases of parabiosis.		**5**
Laboratory class 7. The effect of direct current on the nerve. The polar law. Physiological electrotonus		
Self-Study 1.	Use the knowledge gained to complete tasks	**5**
Self-Study 2.	Use the knowledge gained to complete tasks	**10**
Module test 1		**30**
Total for module 1		**100**
Module 2. Digestive and blood physiology		
Laboratory class 8: Observation of feed and water intake by animals. Determination of the quantity and viscosity of saliva obtained from animals under the influence of various stimuli (rusks, milk, hydrochloric acid). The role of saliva in the act of swallowing.	PLO1, 3, 5. To know the physiological principles of digestion in various sections of the gastrointestinal tract; the composition of digestive juices and their functional significance; the motor function of different parts of the gastrointestinal tract; the role of bile; the processes of nutrient absorption; the mechanism of vomiting; the process of defecation; the regulation of functions of different segments of the gastrointestinal tract; the functional importance and properties of the components of blood; and the processes of hematopoiesis. To understand the functions of the digestive system in the animal body; the functions of blood in the animal organism. To be able to investigate the motor function of the rumen; determine the number of erythrocytes, leukocytes, and thrombocytes; perform a leukocyte differential count; measure hemoglobin concentration, erythrocyte sedimentation rate (ESR), and color index; and determine	**5**
Laboratory class 9. Phases of gastric juice secretion. Investigation of the effect of gastric juice on protein. Study of the action of chymosin.		**5**
Laboratory class 10. Observation of infusoria of the rumen contents. Observation of the rumination process. Study of the motor function of the rumen.		**5**
Laboratory class 11: Digestion in the intestine. Bile. Evacuation function of the stomach.		**5**
Laboratory class 12. Red blood cell count.		**5**
Laboratory class 13: White blood cell count. Observation of phagocytosis.		**5**
Laboratory class 14: Preparation of blood smears from different species of animals. Leukocyte formula of animals of different species		**5**
Laboratory class 15. Determination of hemoglobin concentration in the blood of different animal species. Calculation of the color index.		**5**
Laboratory class 16. Hemolysis. Determination of the erythrocyte osmotic fragility		**5**

Laboratory class 17: Preparation of heme crystals. Spectral analysis of blood.	blood compatibility between donor and recipient. To use laboratory equipment, reagents, and modern devices for the analysis of blood parameters.	**5**
Laboratory class 18: Red blood cell sedimentation rate. Determination of the rate of blood clotting.		**5**
Laboratory class 19. Blood types. Determination of blood compatibility in animals.		**5**
Self-Study 1.	Use the knowledge gained to complete tasks	**5**
Self-Study 2.	Use the knowledge gained to complete tasks	**5**
Module test 2.		**30**
Total for module 2		**100**
Educational work		***(M1 + M2)/2*0.7 ≤ 70***
Semester credit		***30***
Module 3: Cardiovascular and respiratory physiology		
Laboratory class 20. Registration of cardiac activity in a frog. Analysis of the mechanocardiogram. Extrasystole.	PLO1, 3, 5. To know the functional significance of the heart and the circulatory system in animal organisms; the functional role of the components of the cardiac conduction system; the interrelationship between cardiac function and the activity of other systems and organs; the regulation of cardiac activity; the trigeminovagal reflex; the physiological basis of respiration. To understand the roles of minerals, vitamins, enzymes, and hormones in animal physiology and their influence on the biochemical processes within the animal body. To be able to assess the functional state of the myocardium and the circulatory system; perform electrocardiography; conduct auscultation and percussion of the heart; examine the pulse and the apex beat; assess the functional status of the respiratory system; perform auscultation and percussion of the lungs; determine vital lung capacity.	**10**
Laboratory class 21: Cardiac automaticity. Stannius ligatures.		**5**
Laboratory class 22. Effect of temperature on heart function. The effect of potassium, calcium ions and the hormone adrenaline on the isolated frog heart. The effect of the vagus nerve on the work of the frog heart.		**5**
Laboratory class 23. Reflex cardiac arrest of the frog. Trigeminovagal reflex.		**5**
Laboratory class 24. Electrocardiography. Blood pressure measurement. Comparative assessment of blood pressure in arteries and veins.		**10**
Laboratory class 25: Auscultation and percussion of the heart muscle. Examination of the heartbeat, pulse.		**5**
Laboratory class 26. Demonstration of frog lung movements in the Donders apparatus. Function of the intercostal muscles. Observation of of ciliary epithelium movements Analysis of inhaled and exhaled air		**5**
Laboratory class 27. Determination of vital capacity of the lungs. Determination of minute lung volume. Pneumography		**5**

Laboratory class 28. Auscultation and percussion of the lungs. Counting the number of respiratory movements in animals of different species. Determination of the type of respiration in animals	To use laboratory equipment, reagents, and modern devices for investigating the functional condition of the cardiovascular and respiratory systems.	**10**
Self-Study 1.	Use the knowledge gained to complete tasks	**5**
Self-Study 2.	Use the knowledge gained to complete tasks	**5**
Module test 3		**30**
Total for module 3		**100**
Module 4. Physiology of metabolism, energy, excretion, lactation		
Laboratory class 29. Determination of the energy metabolism rate in farm animals. Measurement of body temperature.	PLO1, 3, 5. To know: the concept of basal metabolic rate and the factors that influence its value; the functions of the thermoregulatory center; the functions of the kidneys and their role in maintaining homeostasis; the functional features of the nephron; the structure and functional characteristics of the mammary gland; the processes of lactopoiesis. To understand: the physiological processes of metabolism and energy exchange occurring in the animal body; the mechanisms of physical and chemical thermoregulation; the mechanism of urine formation; the stages of milk synthesis and its components; the mechanisms of regulation of milk secretion and milk ejection. To be able to: measure body temperature in animals of different species; conduct studies of organoleptic, physicochemical parameters, and perform microscopy of urinary sediments in animals of different species; conduct studies of the organoleptic and physicochemical characteristics of milk. To use modern laboratory instruments, reagents, and equipment to determine the	**15**
Laboratory class 30. Examination of urine of animals of different species. Macroscopic examination of urine. Microscopic examination of urine. Organised and unorganised urine sediments.		**15**
Laboratory class 31. Determination of intramammary pressure in the mammary gland. Milk examination. Observation of milk fat globules under the microscope.		**15**

	level of energy metabolism, as well as the organoleptic and physicochemical parameters of animal urine and milk.	
Self-Study 1.	Use the knowledge gained to complete tasks	**10**
Self-Study 2.	Use the knowledge gained to complete tasks	**15**
Module test 4		**30**
Total for module 4		**100**
Module 5: Physiology of the endocrine system and central nervous system		
Laboratory class 32. The effect of adrenaline on the pupil of the eye. Hypophysectomy in frogs. The effect of adrenaline and pituitrin on chromatophores. The effect of insulin on blood glucose levels. Induction of molting in chickens using thyroid gland preparations.	PLO1, 3, 5. To know the functional characteristics of the endocrine glands, their hormones, and their physiological significance. To understand the regulation of the activity of the endocrine (ductless) glands.	**15**
Laboratory class 33. Spinal reflexes. Determination of reflex latency. Receptive field. Effect of stimulus intensity on reflex latency..	The basic mechanisms of hormone action. The role of hormones in regulating homeostasis and the adaptive responses of the organism. To know the physiology of the neuron and the mechanisms of interneuronal communication. The ascending and descending pathways of the central nervous system. The properties of neural centers. The reflex centers of the medulla oblongata and the midbrain. The types of inhibition in the central nervous system (CNS). The functions of the cerebellum and its role in the regulation of motor activity. The structure and functions of the cerebral cortex	**15**
Laboratory class 34. Irradiation and summation of excitation in the spinal cord. Reflex muscle tone. Dominant excitation. Sechenov's inhibition. Inhibition of spinal reflexes in frogs..		**15**
Self-Study 1.	Use the knowledge gained to complete tasks	**10**
Self-Study 2.	Use the knowledge gained to complete tasks	**15**
Module test 5		**30**
Total for module 5		**100**
Module 6: Physiology of higher nervous activity and analysers		
Laboratory class 35. Methods of conditioning reflex formation. Formation of salivary-food, motor-defensive, and motor-food conditioned reflexes..	PLO1, 3, 5. To know the physiological significance of the limbic system and basal ganglia in the coordination of movements and behavioral	**10**

Laboratory class 36. Inhibition of conditioned reflexes	responses of the organism. To understand the mechanisms of cortical regulation of organ and system functions. To be able to examine clinically relevant reflexes. To determine the types of higher nervous activity in animals of different species. To know the classification, main properties of analyzers (sensory systems), and the mechanisms of their functioning. To understand the fundamentals of the theory of sensory systems. To describe the functions of the visual, auditory, vestibular, and cutaneous analyzers. To comprehend theories of hearing, vision, and olfaction; the mechanisms of pain, tactile, and thermal sensitivity; the mechanisms of regulation of sensory systems; and the interaction between analyzers. To be able to assess visual and auditory acuity, perform ophthalmoscopy, esthesiometry, and determine temperature and tactile sensitivity. To apply modern techniques for studying sensory systems.	**10**
Laboratory class 37. Visual analyzer. Fundus examination in animals (ophthalmoscopy). Pupillary light reflex. Reflexes induced by corneal stimulation. Determination of the near point of vision. Diagnosis of color vision deficiencies (color blindness). Blind spot in the eye (Mariotte's experiment). Visual illusions		**10**
Laboratory class 38. Auditory analyzer. Determination of auditory acuity. Localization of the sound source. Bone and air conduction.		**10**
Laboratory class 39. Cutaneous analyser. Clinically significant reflexes. Determination of the spatial threshold of tactile sensitivity (esthesiometry). Vestibular analyzer. Examination of the otolith apparatus. Gustatory analyzer. Determination of the taste sensitivity threshold.		**10**
Self-Study 1.	Use the knowledge gained to complete tasks	**20**
Module test 6		**30**
Total for Module 6		**100**
Educational work		**(M1 + M2+ M3 + M4 + M5 + M6)/6*0.7 ≤ 70**
Exam		**30**
Total for the course		**(Academic work + exam) ≤ 100**

8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.3. Assessment policy

Deadlines and exam retaking rules	Assignments submitted past the deadline without valid reasons will be graded lower. Retaking module assessments is allowed only with the instructor's permission and upon presentation of valid justification (e.g. sick leave).
Academic integrity rules	Cheating during tests, credits, or exams is strictly prohibited, including the use of mobile devices..
Attendance rules	Class attendance is compulsory. In case of valid reasons (e.g., illness, international internship), individual study may be arranged in an online format with the approval of the faculty dean. Students with unexcused absences from laboratory sessions are not allowed to take module assessments. Students with unexcused absences from lectures are not permitted to take the final module or the exam..

9. Teaching and learning aids

- e-learning course of the discipline (*https://elearn.nubip.edu.ua*) MANDATORY;
- Links to digital educational resources;
- Lecture notes and their presentations (in electronic format);
- Textbooks, study guides, practical manuals;

10. Recommended sources of information

Main

1. Mazurkevych A.I., Karpovsky V.I., Trokoz V.O., Kladnytska L.V., Zhurenko O.V., Krivoruchko D.I., et al. Physiology of farm animals. Textbook. K.: Publishing centre of NULES of Ukraine. 2020. 456 c.
2. Karpovskyi V.I., Trokoz V.O., Zhurenko O.V., Kladnytska L.V., Kryvoruchko D.I. Comparative animal physiology. Study guide. Kyiv: NUBiP of Ukraine, 2023. 262 c.
3. Mazurkevych A.I., Trokoz V.O., Karpovsky V.I. et al. Physiology of farm animals. Workshop. K.: Publishing Centre of NULES of Ukraine. 2021. 240 c.
4. Mazurkevych A.Y., Karpovskyi V.I., Trokoz V.O., Kladnytska L.V., Zhurenko O.V., Kryvoruchko D.I., and others. Physiology of farm animals Textbook. K.: Publishing centre of NULES of Ukraine. 2012. 456 c.
5. Karpovskyi V.I., Tomchuk V.A., Kladnytska L.V., Zhurenko O.V., Trokoz V.O., Kryvoruchko D.I., Zhurenko V.V. Workbook for laboratory work in the discipline "Animal Physiology" in 2 parts. K.: Editorial and publishing department of NUBiP of Ukraine, 2024. 174 c.

Auxiliary

1. Shuranova, L., **Zhurenko, O.,** Kryvoruchko, D., Zhurenko, V., & Kulbako, O. Vegetative regulation of glucose, calcium, phosphorus, and haemoglobin levels in the blood of laying hens. Ukrainian Journal of Veterinary Sciences, 2024. 15(4), 112-127. doi: 10.31548/veterinary4.2024.112.

2. **Zhurenko, O.,** Hryshchuk, I., Kryvoruchko, D., Zhurenko, V. Changes in unsaturated fatty acids in milk under vegetative regulation in dairy cattle. Scientific Journal 'Animal Science & Food Technologies', 2024, v. 15, n. 4, p. 49, doi. 10.31548/animal.4.2024.49

3. **Zhurenko, O.**, Kryvoruchko, D., Zhurenko, V., & Hryshchuk, I. Autonomic nervous system tone in poultry protein metabolism. Animal Science and Food Technology, 2024. 15(3), 30-44. doi: 10.31548/ animal.3.2024.30.

4. Króliczewska, B., Hryshchuk, I., Karpovskyi, V., **Zhurenko, O.,** & Todoryuk, V. Influence of autonomic nervous system tone on the content of cholesterol and lipoproteins of different density in the blood of cows. Ukrainian Journal of Veterinary Sciences, 2023. 14(3), 85-99. doi: 10.31548/veterinary3.2023.85.

5. Role of the autonomic nervous system in the regulation of phosphorus and calcium metabolism in cows. Ukrainian Journal of Veterinary Sciences, 2021. 12(2): 38-45, h ps://doi.org/10.31548/ujvs2021.02.004

6. Wang, Shanshan MBBS; Hicks, Madelyn Hsiao-Rei MD; Barrett, Emily PhD; Martsenkovskyi, Dmytro MD, PhD; Holovanova, Irina MD; Marchak, Olga MS; **Ishchenko, Liudmyla** PhD; Fiedler, Nancy PhD; Haque, Ubydul PhD. Sleep Duration, Insomnia, and Associated Factors Among Ukrainians 1 Year After Russia's Full-Scale Invasion. Psychosomatic Medicine 86(8):p 690-699, October 2024. | DOI: 10.1097/PSY.0000000000001337

7. Ganong W.F. Review of Medical Physiology. New York: Lange Medical Books McGraw-Hill, 2001. 732 p.

8. Loefiler K. Anatomie und Physiologie der Haustiere. Stuttgart, 2002. 614 p.

9. Cunningham J.G. Textbook of Veterinary Physiology. 4th ed. St. Louis: Saunders Elsevier, 2007. 592 p.

10. Sherwood L., Klandorf H., Yancey P.H. Animal Physiology: From Genes to Organisms. 2nd ed. Belmont, CA: Brooks/Cole Cengage Learning, 2013. 896 p.

11. Moyes C.D., Schulte P.M. Principles of Animal Physiology. 3rd ed. San Francisco: Pearson Benjamin Cummings, 2015. 792 p.

Information resources

http://biph.kiev.ua/en/Main_Page
http://www.nbuv.gov.ua/
http://dglib.nubip.edu.ua:8080/jspui/