MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

STATE BIOTECHNOLOGICAL UNIVERSITY

Faculty of Veterinary Medicine

"Approved by "
Head of the Department of
Normal and Pathological
Morphology

____ ___ (Byrka O.V.)
(signature) (surname and initials)

"25" June 2025

Department of Normal and Pathological Morphology
(name of the department)

WORKING PROGRAM

OF THE EDUCATIONAL DISCIPLINE

MC "Cytology, histology, embryology"

(code and name of the discipline)

Level of Higher Education: The second level of higher education (master's)
(title)

Field of Study: 21 Veterinary Medicine
(code and title)

Specialty: 211 Veterinary Medicine
(code and title)

Educational Program: educational and professional program "Veterinary Medicine"
(title)

Kharkiv – 2025

Compilers: Candidate of Veterinary Sciences, Associate Professor Byrka O.V.,
Doctor of Veterinary Sciences, Professor Kushch M.M.
(academic rank, position, surname and initials)

The working program of the educational discipline was approved at the extended meeting of the Department of Normal and Pathological Morphology.

Protocol dated: "25" June 2025 No.10.

Approved by:

Program guarantor _____ Veterinary Medicine _____
(name of the program)

"25" June 2025 (_____ _____) Naumenko S.V.
(signature) (name)

Extended validity period until:

" __ " _____ 20 __ . Protocol від № ___ of" ____ " _____ 20 ___ .
Head of the Department _____ _____ (_____)
name of the Department (signature) (surname, name)

" __ " _____ 20 __ . Protocol від № ___ of" ____ " _____ 20 ___ .
Head of the Department _____ _____ (_____)
name of the Department (signature) (surname, name)

" __ " _____ 20 __ . Protocol від № ___ of" ____ " _____ 20 ___ .
Head of the Department _____ _____ (_____)
name of the Department (signature) (surname, name)

1. Description of the Educational Discipline

<table>
<tr><td rowspan="2">Indicators</td><td colspan="5">Characteristics of the Educational Discipline</td></tr>
<tr><td colspan="5">Full-time Education</td></tr>
<tr><td rowspan="2">Number of Credits:8</td><td colspan="5">Status of the Discipline:</td></tr>
<tr><td colspan="5">Mandatory</td></tr>
<tr><td rowspan="3">Number of Parts: 4</td><td colspan="5">Year of Study:</td></tr>
<tr><td>1 -th</td><td colspan="2">2 -th</td><td colspan="2">2-th</td></tr>
<tr><td colspan="5">Semester</td></tr>
<tr><td rowspan="10">Total Hours: 240</td><td>2</td><td colspan="2">3</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Lectures</td></tr>
<tr><td>20 hours.</td><td colspan="2">14 hours.</td><td colspan="2">-</td></tr>
<tr><td colspan="5">Laboratory</td></tr>
<tr><td>38 hours.</td><td colspan="2">30 hours.</td><td colspan="2">-</td></tr>
<tr><td colspan="5">Independent Study Hours</td></tr>
<tr><td>62 hours.</td><td colspan="2">46 hours.</td><td colspan="2">-</td></tr>
<tr><td colspan="5">Educational practice</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2">30 hours.</td></tr>
<tr><td rowspan="2">Hours for full-time study: auditorium – 102;

Independent Study Hours – 108.</td><td colspan="5">Type of control:</td></tr>
<tr><td>Credit (undifferentiated)</td><td>Final exam</td><td colspan="2">Credit (differentiated)</td><td></td></tr>
</table>

2. Purpose and objectives of the discipline

The purpose of the discipline "Cytology, Histology, Embryology" is to provide applicants with thorough knowledge and practical skills in the microscopic structure of the animal body, on the use of histological methods in hematological studies, biopsy, cell proliferation and differentiation during tissue regeneration, periodization of embryonic development, diagnosis of the causes of embryonic mortality, preservation of germ cells for artificial insemination, embryo transplantation, as well as examination of livestock products.

The task of studying the discipline. The general educational tasks of the discipline are to form medical thinking, professional skills and professional worldview of the future master of veterinary medicine. The study of this discipline will reveal interdisciplinary connections, contribute to the structuring of acquired knowledge, and stimulate the desire for constant self-improvement.

Applied tasks of the discipline are aimed at studying the submicroscopic and microscopic structure of cells, tissues and organs of animals, their formation and development during embryogenesis, identification and analysis of differences in their structure, generalization of the identified features, justification of their changes under the influence of biotic and abiotic factors of nature. The discipline lays the foundations of a scientific structural and functional approach to the analysis of the vital activity of an animal organism under norms and pathologies.

The subject of study of the discipline is submicroscopic and microscopic features of the structure of cells, tissues and organs of the animal organism, as well as the structure of germ cells, embryo and fetus during embryonic development.

The basic disciplines for the successful assimilation of the program material of the discipline are *(from the structural and logical scheme of the educational program for compulsory disciplines)* biochemistry, zoology, anatomy. To understand the microscopic structure of the body of animals and their changes, regeneration processes under the influence of factors of animate and inanimate nature, in the process of ontogenesis, applicants should be able to connect the study of the discipline with knowledge from the following academic disciplines: physiology, feeding, obstetrics, surgery, internal non-communicable diseases.

This discipline provides the formation of the following program learning outcomes: *(from the educational program for compulsory disciplines)*

PRN1. Know and correctly use the terminology of veterinary medicine.

PRN3. Determine the essence of physicochemical and biological processes that occur in the animal body in normal and pathological conditions.

3. Program of the discipline

Chapter 1: *Basics of cytology. General embryology.*

Topic 1. *Introduction to Cytology.*

Summary of the topic 1. The importance and tasks of cytology, histology and embryology in the training of a doctor of veterinary medicine and the development of veterinary medicine, their connection with other biological sciences. History of the development of cytology, embryology, histology, their

formation as a science. Cell theory, its general biological significance. The concept of a cell as a living elementary self-regulating multilevel system of an integral organism. Chemical composition and physicochemical properties of living matter. Cell membrane (elementary biological membrane), their structural, chemical and functional characteristics.
Recommended Reading (link) 1, 2, 3, 4.

Topic 2. *The general principle of the structure of a somatic cell. Nucleus*.
Summary of topic 2. Structural components of the cell: nucleus, cytoplasm, plasmolema. Microscopic and ultramicroscopic structure of the interphase nucleus, its chemical composition. Cell nucleus as a system of genetic determination and protein synthesis.
Recommended Reading (link) 1, 2, 3, 4.

Topic 3. *Cytoplasm, membrane and non-membrane organelles.*
Summary of topic 3. Structure and functions of plasmolemma. The concept of organelles. Classification of organelles. Membrane organelles: mitochondria, Golgi complex, endoplasmic reticulum, lysosomes. Peroxisomes – their structure and importance. ribosomes, microtubules, microfilaments, centrosome (cell center), microvilli, cilia, flagella, myofibrils, tonofibrils, neurofibrils.
Recommended Reading (link) 1, 2, 3, 4.

Topic 4. *Inclusion of the cytoplasm. Non-cellular structures of the body. Cell life and reproduction.*
Summary of topic 4. Classification of inclusions: trophic, secretory, pigmented. Non-cellular structures: symplast, syncytium, intercellular substance. Methods of cell division. Mitosis, mitotic cycle: interphase, prophase, metaphase, anaphase, telophase. Structure of mitotic chromosomes, the concept of karyotype. Types of cell cycles. Intracellular mechanisms of cell cycle regulation. Biological significance of mitosis. Endoreproduction. Amitosis. Other manifestations of cell life: metabolism and energy, irritability, adaptation, variability, growth, aging, death, apoptosis.
Recommended Reading (link) 1, 2, 3, 4.

Topic 5. *Progenesis. Gameti.*
Summary of topic 5. Applied value of embryology. Structure of sperm and their biological features. Isolation of adrosmermia and gynecospermia. Classification and comparative morphology of oocytes: oligolecithal, mesolecytic and polylecithal eggs.
Recommended Reading (link) 1, 2, 3, 4.

Topic 6. *Development of germ cells (gametogenesis).*
Summary of topic 6. Spermatogenesis. Ovogenesis.
Recommended Reading (link) 1, 2, 3, 4.

Topic 7. *Embryogenesis. Fertilization. Crushing.*
Summary of the topic 7. Morphology, physiology and biology of fertilization. Zygote as a unicellular embryo. Crushing, varieties of zygote crushing depending on the structure of the egg and the conditions of development of the organism. Blastula: structure, types.
Recommended Reading (link) 1, 2, 3, 4.

Topic 8. *Gastrulation. Embryogenesis of birds and placental mammals.*
Summary of the topic 8. The formation of germ layers and the laying of axial organs - neural tube, notochord, primary intestine. Types of gastrulation. Meaning of germ layers. Bird development (chicken embryo development): formation of the extraembryonic organs of birds. The stage of development of the chicken embryo. Critical periods of development. Embryonic development of mammals: fertilization, crushing, gastrulation. Formation of extraembryonic membranes, sources of their formation and importance. Placenta: structure, meaning, types. Periods of intrauterine development of mammals (on the example of cattle). Critical periods of development.
Recommended Reading (link) 1, 2, 3, 4.

Chapter 2: *General Histology.*
Topic 9. *Tissues. Epithelial tissues.*
Summary of the topic 9. Definition of the concept of "tissue" of an animal organism. Genetic, morphological and functional characteristics of tissues. Histogenesis. Modern ideas about the differenton organization of tissues. Epithelial tissues: general characteristics of epithelium, their morphological and ontophylogenetic classification, distribution in the body, structure and functional significance of the integumentary epithelium. Glandular epithelium. Features of the structure of glandular epithelial cells (glandulocytes). Classification of glands, phases and types of secretion. Regeneration of epithelial tissue.
Recommended Reading (link) 1, 2, 3, 4.
Topic 10. *Connective tissues (tissues of the internal environment).*
Summary of topic 10. General characteristics and classification. Mesenchyme. Blood, its constituent components, importance in the body. Plasma, its chemical composition and importance. Form elements, structure and functions of erythrocytes. Classification, structure and meaning of leukocytes. The concept of leukocyte formula. Features of the structure of poultry blood cells. Lymph, its constituent components, meaning. Hematopoiesis. Reticular tissue. Loose fibrous connective tissue: cells, intercellular substance: fibers and amorphous component. The concept of the macrophage system, its composition and importance in immune reactions. Dense collagen and elastic fibrous connective tissue. Fat, pigment, mucous tissue, endothelium. Cartilage tissues. Bone tissue: development, structure, functions and classification. Coarse fibrous bone tissue. Lamellar bone tissue. Microscopic structure of tubular bone as an organ. Bone regeneration.
Recommended Reading (link) 1, 2, 3, 4.
Topic 11. *Muscle tissue.*
Summary of topic 11. General characteristics and classification of muscle tissues. Their functional unity with the elements of nervous and connective tissues. Smooth (unstriated) muscle tissue: histogenesis, microscopic and electron microscopic characterization of smooth muscle cells, distribution in the body. Specialized muscle tissue. Striated muscle tissue: skeletal and cardiac muscle tissue, their origin. Microscopic and ultramicroscopic structure of

muscle fiber. The structure of the muscle as an organ. Regeneration of muscle tissue.
Recommended Reading (link) 1, 2, 3, 4.

Topic 12. *Nerve tissue.*
Summary of topic 12. Development, morphological and functional characteristics of nervous tissue. Classification, microscopic and ultrastructural structure of neurons. Neuroglia, its origin, classification, structure, meaning. Nerve fibers. Synapses. Nerve endings - motor and secretory; sensitive endings - receptors. Nerve (nerve trunk). The concept of a reflex arc.
Recommended Reading (link) 1, 2, 3, 4.

Topic 13. *Features of the microscopic structure and functioning of cells, tissues of birds, insects (bees), fish.*
Summary of topic 13. Features of the microscopic structure of cells. Features of cell functioning. Features of the microscopic structure of epithelial tissues. Features of the microscopic structure of musculoskeletal tissues. Features of the microscopic structure of muscle tissues. Features of the microscopic structure of nervous tissue.
Recommended Reading (link) 1, 2, 3, 4.

Chapter 3: *Special histology. Part 1.*

Topic 14. *Introduction to special histology. Nervous system.*
Summary of topic 14. The concept of an organ. General patterns of the structure of tubular and parenchymal organs. The role of the nervous system in the implementation of the integrity of the body, its connection with the external environment. Embryonic development and general characteristics of the structure of the nervous system. Microscopic structure of the spinal cord, cerebellum and cerebral hemispheres, medulla oblongata, spinal ganglia. The structure of the membranes of the spinal cord and brain. Blood-brain barrier.
Recommended Reading (link) 1, 2, 3, 4.

Topic 15. *Senses.*
Summary of topic 15. The concept of analyzers. Classification of sensory organs. Organ of vision: eyeball, its development and structure. Vision analyzer. Organ of hearing and balance.
Recommended Reading (link) 1, 2, 3, 4.

Topic 16. *Heart-vessel system.*
Summary of the topic 16. The importance of the cardiovascular system. Embryonic development, microscopic structure of arteries, veins and vessels of the microcirculatory bed. Features of the structure of lymphatic vessels. Embryonic development, microscopic and electron microscopic structure of the membranes of the heart. Features of the structure and function of the conduction system of the heart.
Recommended Reading (link) 1, 2, 3, 4.

Topic 17. *Organs of hematopoiesis and immunological protection.*
Summary of the topic 17. General structure and functional characteristics of hematopoietic organs and immunological protection. Central and peripheral

organs: red bone marrow, thymus, Fabricius' bag. Their embryogenesis, structure, meaning. Cellular interactions in immune responses. 1. Lymph nodes, spleen, pharyngeal lymphoid ring, lymphoid formations of the digestive tract, their embryogenesis, structure, meaning. Features of the structure of the hematopoietic organs and immunological protection in birds.
Recommended Reading (link) 1, 2, 3, 4.

Topic 18. *Endocrine glands.*
Summary of topic 18. General morphological and functional characteristics. Central chains of endocrine glands: hypothalamus, pituitary gland, pineal gland, their microscopic, electron microscopic structure and functional significance. Embryonic development, structure and functional significance of the thyroid gland, parathyroid gland, adrenal glands. Dissociated endocrine system.
Recommended Reading (link) 1, 2, 3, 4.

Topic 19. *Leather and its derivatives.*
Summary of topic 19. The importance of skin, embryonic development, structure. The structure and development of hair, skin glands. Mammary gland, its development, structure. Morphology of milk secretion.
Recommended Reading (link) 1, 2, 3, 4.

Chapter 4: *Special histology. Part 2.*

Topic 20. *Digestive organs.*
Summary of topic 20. General morphofunctional characteristics of the digestive organs. Embryonic development and scheme of the structure of the alimentary canal. Organs of the oral cavity, their histological structure and importance. The structure of a short-crowned and long-crowned tooth. Microscopic structure of the tongue. Salivary glands: parotid, mandibular, sublingual, their histological structure and meaning. Development, histological structure of the pharynx, esophagus. Development, histological structure of the wall of the chambers of the proventricle and single-chambered stomach. Development, histological structure and functional significance of the small and large intestines. Development, structure and functional importance of the liver and pancreas. Gastroenteropancreatic endocrine system. Features of the structure of the digestive organs depending on the type of nutrition.
Recommended Reading (link) 1, 2, 3, 4.

Topic 21. *Respiratory organs.*
Summary of topic 21. The importance of the respiratory system. Development, microscopic and ultramicroscopic organization of the airways and respiratory department.
Recommended Reading (link) 1, 2, 3, 4.

Topic 22. *Urinary organs.*
Summary of topic 22. General characteristics of the excretory organs, their embryogenesis and functional significance. Microscopic structure of the kidney and its blood supply. Juxtaglomerular complex. Renal pelvis, ureter, bladder.
Recommended Reading (link) 1, 2, 3, 4.

Topic 23. *Genital apparatus of male and female.*

Summary of topic 23. Meaning and embryonic development. Microscopic and electron microscopic structure of the testicle in connection with spermatogenesis and incretory function. The epididymis, the vas deferens, their structure. Glands of the genital apparatus of the male. The ovary, its microscopic structure and functional significance. Fallopian tubes, uterus and vagina, clitoris, labia, urethra. Cyclical changes in the genitals. Histophysiology of egg formation. Sperm deposition and features of fertilization in birds.
Recommended Reading (link) 1, 2, 3, 4.

Topic 24. *Features of the microscopic structure of bird organs.*
Summary of the topic 24. The structure of the organs of the nervous system and sensory organs. The structure of the organs of the cardiovascular system; the organs of hematopoiesis and immunity. The structure of the endocrine glands. The structure of the skin and its derivatives. The structure of the digestive organs. The structure of the respiratory organs and excretion. The structure of the reproductive apparatus of males and females.
Recommended Reading (link) 1, 2, 3, 4.

4. Structure of the discipline

Name chapters and topics	Number of hours					
	Full-time					
	The total amount	classroom hours				Independent work
		altogether	including			
			lectures	laboratory	practical	
1	2	3	4	5	6	7
Chapter 1: Basics of cytology. General embryology.						
Topic 1. *Introduction to Cytology.*	**3**	**4**	**2**	**2**	**-**	**2**
Topic 2. *The general principle of the structure of a somatic cell. Nucleus.*	**5**	**3**	**1**	**2**	**-**	**1**
Topic 3. *Cytoplasm, membrane and non-membrane organelles.*	**9**	**5**	**1**	**4**	**-**	**1**
Topic 4. *Inclusion of the cytoplasm. Non-cellular structures of the body. Cell life and reproduction.*	**9**	**3**	**1**	**2**	**-**	**1**
Topic 5. *Progenesis. Gameti.*	**7**	**3**	**1**	**2**	**-**	**1**
Topic 6. *Development of germ cells (gametogenesis).*	**7**	**3**	**1**	**2**	**-**	**1**
Topic 7. *Embryogenesis. Fertilization. Crushing.*	**7**	**3**	**1**	**2**	**-**	**1**
Topic 8. *Gastrulation. Embryogenesis of birds and placental mammals.*	**7**	**4**	**2**	**2**	**-**	**2**
Together by section 1	**60**	**28**	**10**	**18**	**-**	**10**

Chapter 2: General Histology.						
Topic 9. *Tissues. Epithelial tissues.*	**12**	**6**	**2**	**4**	**-**	**6**
Topic 10. *Connective tissues (tissues of the internal environment).*	**16**	**10**	**2**	**8**	**-**	**6**
Topic 11. *Muscle tissue.*	**10**	**4**	**2**	**2**	**-**	**6**
Topic 12. *Nerve tissue.*	**10**	**4**	**2**	**2**	**-**	**6**
Topic 13. *Features of the microscopic structure and functioning of cells, tissues of birds, insects (bees), fish*	**10**	**4**	**2**	**2**	**-**	**6**
Together by section 2	**120**	**28**	**20**	**38**	**-**	**62**
Chapter 3: Special histology, p.1.						
Topic 14. *Introduction to special histology. Nervous system.*	**9**	**5**	**1**	**4**	**-**	**4**
Topic 15. *Senses.*	**7**	**3**	**1**	**2**	**-**	**4**
Topic 16. *Heart-vessel system.*	**7**	**3**	**1**	**2**	**-**	**4**
Topic 17. *Organs of hematopoiesis and immunological protection.*	**9**	**5**	**1**	**4**	**-**	**4**
Topic 18. *Endocrine glands.*	**7**	**3**	**1**	**2**	**-**	**4**
Topic 19. *Leather and its derivatives.*	**7**	**3**	**1**	**2**	**-**	**4**
Together by section3	**46**	**22**	**6**	**16**		**24**
Chapter 4: Special histology, p.2.						
Topic 20. *Digestive organs.*	**12**	**6**	**2**	**4**	**-**	**6**
Topic 21. *Respiratory organs.*	**7**	**3**	**1**	**2**	**-**	**4**
Topic 22. *Urinary organs.*	**7**	**3**	**1**	**2**	**-**	**4**
Topic 23. *Genital apparatus of male and female.*	**10**	**6**	**2**	**4**	**-**	**4**
Topic 24. *Features of the microscopic structure of bird organs.*	**8**	**4**	**2**	**2**	**-**	**4**
Together by section4	**90**	**22**	**14**	**30**	**-**	**22**
Hours in total	***210***	**102**	***34***	***68***	**-**	***108***

5. THEORETICAL LESSON (LECTURES)

№ salary	Topic name	Number of hours d/f
	Chapter 1: Basics of cytology. General embryology.	
1.1.	Introduction. Fundamentals of cytology. The general principle of the structure of a somatic cell. Nucleus.	2
1.2.	Cytoplasm. Membrane and non-membrane organelles. Cytoplasm incorporation. Non-cellular structures. Cell life and reproduction.	2
1.3.	Progenesis. Gametes. Gametogenesis.	2
1.4.	Embryogenesis. Fertilization. Cleavage. Gastrulation. Embryogenesis of birds and placental mammals.	2
	Chapter 2: General Histology.	

2.5.	Epithelial tissues.	2
2.6.	Connective tissues. General characteristics. Mesenchyme, blood, hematopoiesis, lymph, fat, pigment, mucous membrane, endothelium, reticular.	2
2.7.	Connective tissues. Loose connective tissue. Dense connective tissues.	2
2.8.	Connective tissues. Cartilaginous and bone tissues.	2
2.9.	Muscle tissue.	2
2.10.	Nerve tissue.	2
	Chapter 3: Special histology, p.1.	
3.11.	Introduction to special histology. Nervous system, sensory organs.Cardiovascular system, hematopoietic and immune organs.	2
3.12.	Cardiovascular system. Organs of hematopoiesis and immunological defence.	2
3.13.	Endocrine system. General body covering	2
4.14.	Digestive organs: oral cavity, oesophagus, stomach.	2
	Chapter 4: Special histology, p.2.	
4.15.	Digestive organs: intestines, liver, pancreas	2
4.16.	Respiratory and excretory organs.	2
4.17.	The reproductive system of the male and female.	2
	Total	**34**

6. LABORATORY CLASSES

№ salary	Name of the topic of the lesson	Number of hours d/f
	Chapter 1: Basics of cytology. General embryology.	
1.1	**General cytology.** Methods of histological research. Principles of the structure of a somatic cell. Structure of the cell nucleus. Somatic cells (neurons) from a section of the spinal ganglion of a cat. Somatic cells (hepatocytes) from a section of the liver of a sheep.	2
1.2	Membrane (mitochondria, Golgi complex) organelles.	2
1.3	Non-membrane (centrosome) organelles.	2
1.4	Cellular inclusions: glycogen inclusions, fatty inclusions, secretory and pigment inclusions.	2
1.5	Cell life. Mitosis of plant cells. Amitosis of bladder epithelial cells.	2
1.6	**General embryology.** Female germ cells: oligolecithal type egg, mesolecithal type egg. Male germ cells: sperm smear from a male and a female rooster.	2
1.7	Gametogenesis.	2
1.8	Fertilization of the egg (division of maturation of the egg).	2

1.9	Zygote cleavage (complete uniform cleavage of the zygote of horse roundworm, complete uneven cleavage of the frog zygote, of frog blastula). Gastrulation, its types.	2
1.10	Germ layers (total preparation of the chicken embryo, germ layers and axial organs). Germ membranes (trunk and amniotic folds, placenta).	2
	Chapter 2: General Histology.	
2.11	**General histology.** Epithelial tissues: single-layered squamous epithelium, single-layered single-row prismatic borderline epithelium, single-layered multi-row prismatic ciliated epithelium.	2
2.12	Glandular epithelium: stratified squamous non-keratinized epithelium.	2
2.13	Connective tissues: mesenchyme, the blood of mammals.	
2.14	Bird blood, reticular tissue.	2
2.15	Loose fibrous connective tissue. Dense connective tissue is collagenous, dense connective tissue is elastic.	
2.16	Cartilage tissue: hyaline, elastic, fibrous.	2
2.17	Bone tissue: lamellar bone tissue, development of bone tissue in place of hyaline cartilage tissue.	2
2.18	Muscle tissue: striated skeletal, striated cardiac muscle tissue, non-striated muscle tissue.	2
2.19	Nervous tissue: multipolar nerve cells, myelinated and unmyelinated nerve fibers, cross-section of a nerve.	2
	Chapter 3: Special histology, p.1.	
3.20	**Special histology-1.** Cerebral cortex, cerebellar cortex, giant pyramidal cells, spinal ganglion.	2
3.21	Anterior wall of the eye, posterior wall of the eye, spiral organ.	2
3.22	Artery, vein, vessels of the microcirculatory system.	2
3.23	Thymus, lymph node, spleen.	2
3.24	Cloacal sac, palatine tonsil.	2
3.25	Pituitary gland, thyroid gland, adrenal gland.	2
3.26	Hairy skin, lactating and non-lactating mammary glands.	2
	Chapter 4: Special histology, p.2.	
4.27	**Special histology-2.** Oral organs: filiform and leaf-shaped papillae. Submandibular salivary gland. Development of the tooth in the pig embryo. Early stage: laying of the epithelial tooth organ.	2
28	Esophagus. Single-chamber stomach. Multi-chamber stomach of small cattle: rumen, mesh, book.	2
29	Small intestine: duodenum, jejunum. Large intestine: rectum.	2
30	Liver. Pancreas.	2
31	Trachea, lungs.	2

32	Kidney, urinary bladder.	2
33	Testicle, epididymis, prostate gland.	2
34	Ovary, corpus luteum, uterus.	2
	Total	**68**

7. SELF-STUDY WORK

№ salary	Topic name	Number of hours d/f
	Chapter 1: Basics of cytology. General embryology.	
1.1	History of the development of cytology, histology, and embryology.	4
1.2	Chemical composition of cell protoplasm.	6
1.3	Cell life.	4
1.4	Intercellular contacts.	4
1.5	Embryogenesis of lancelet, fish, and amphibians.	4
1.6	Stages of embryonic development of a chick. Periods of intrauterine development of mammals.	4
1.7	Features of the formation and structure of the placenta in different species of domestic animals.	6
	Chapter 2: General Histology.	
2.8	Specialized structures of the apical surface of epithelial cells. Regeneration of epithelial tissues.	6
2.9	Embryonic and postembryonic hematopoiesis (hemocytopoiesis)	2
2.10	The intercellular substance of fibrous connective tissues.	2
2.11	Connective tissues with special properties.	2
2.12	Histogenesis and regeneration of cartilage tissue.	2
2.13	Histogenesis and regeneration of bone tissue.	2
2.14	Histogenesis and regeneration of muscle tissue	6
2.15	Histogenesis and regeneration of nervous tissue. Regeneration of nerve fibers. Nerve endings.	6
	Chapter 3: Special histology, p.1.	
3.16	The autonomic nervous system. Development of the nervous system.	4
3.17	The organ of hearing and balance. Histophysiology of hearing. Development of the inner ear.	6
3.18	Lymphatic vessels. Development and regeneration of the heart, blood vessels, and lymphatic vessels. Nutrition of blood vessels and lymphatic vessels.	4
3.19	Red bone marrow. Development of red bone marrow. Lymphoid formations associated with mucous membranes.	6
3.20	Interrenal and chromaffin endocrine system. Diffuse endocrine system.	6
3.21	Horny and special glandular derivatives of the skin.	4

	Chapter 4: Special histology, p.2.	
4.22	Teeth development. Esophageal groove of the stomach. Peritoneum. Development of the digestive system organs.	6
4.23	Histophysiology of voice formation. Development of the respiratory organs.	4
4.24	Blood vessels of the kidney. Development of the urinary organs.	4
4.25	Accessory sex glands. Development of the reproductive organs.	4
	Total	**108**

8.Teaching methods

(According to the structure of the academic discipline)

During the teaching of the subject, the applicant uses both classical teaching methods (lecture, laboratory lesson, independent work) and specific methods due to the peculiarities of this discipline (work with macroscopic preparations, independent preparation, production of educational and museum preparations).

All lectures are accompanied by multimedia presentations with a large number of visualizations in the form of slides, photographs, drawings, diagrams and with the use of educational films. This greatly helps to keep the attention of applicants and helps to increase the assimilation of the material. The practice of giving problem lectures is also used, when at the beginning of the lecture students are asked a certain problematic question and, as the lecture material is presented, answers are found to explain and solve it. This process is significantly facilitated by a constant dialogue between the lecturer and the audience, which helps to eliminate the passivity of applicants, encourage and involve them in active cooperation, and constantly monitor the level of residual knowledge.

When conducting laboratory classes, teachers try to explain the structure of individual organs and organ systems as a whole. This contributes to the high efficiency of learning and provides the acquired knowledge of a practical nature. These macropreparations, tabular funds of the department are also an integral part of the independent work of students in their free time. If necessary, they can get professional advice from the teacher on duty.

9.Control methods

- ❖ oral interview;
- ❖ test control;
- ❖ credit;
- ❖ exam.

During the current and final control, the means of assessing the results of learning in the discipline are standardized computer tests.

The final semester control (credit) is determined by the sum of the actually scored rating points from the current control and the individual educational and research task.

Current control is carried out during the semester by means of a survey (oral or test), as well as checking the quality of mastering the topics of independent work.

When choosing the criteria for assessing the assimilation of the discipline program by the applicant, the implementation of the program and the assimilation of the material in terms of lecture and laboratory classes, as well as the implementation of the independent work provided for by the program, were taken into account.

All types of control (oral interview, written interview, test interview) are closely related and organized in such a way as to stimulate the effective independent work of applicants and ensure an objective assessment of the level of their knowledge.

After completing the study of the discipline (part of the discipline), the final control is carried out in the form of an exam (test) and the applicant can score from 60 to 100 points inclusive during the semester at the control points.

10. Distribution of points received by applicants (credit)

In the process of studying the course, the success of applicants is determined by conducting ongoing and final controls (credit and exam).

Current testing, answers in class and control of independent work				Total points
Chapter 1	Chapter 2	Chapter 3	Chapter 4	
T__1-8	T__9-13	T__14-19	T__20-24	**60-100**
0-100	0-100	0-100	0-100	
Overall rating score (ORS = R+E)				**0-100**

T__, T__... T__– topics of chapters.

The grade that a higher education applicant receives for conducting an intermediate (current) control (CurC) consists of the points that the applicant receives during testing (T), which are 30%; the points that the applicant receives during activity in classes (Cl), which are 40%; and the points for mastering the independent work block (InW), which are 30%.

$$\text{CurC} = \mathbf{T} \times \mathbf{0,3} + \mathbf{Cl} \times \mathbf{0,4} + \mathbf{InW} \times \mathbf{0,3}$$

In each section of the educational component, current control is carried out (**current control** - CurC).

For applicants in the fall (spring) semester, when the final knowledge test is completed with an undifferentiated credit (UDC), the final sum of points (UDC points) is the arithmetic average of the points of the four current tests of the fall (spring) semester:

$$\text{UDC points} = (\text{CurC } \mathbf{1} + \text{CurC } \mathbf{2} + \text{CurC } \mathbf{3} + \text{CurC } \mathbf{4}) / \mathbf{4}$$

Based on the results of the semester control, the applicant's transcript is assigned a "pass/fail" grade on the national scale.

11. Distribution of points received by applicants (exam)

Current testing, answers in class and control of independent work				Total points	
Chapter 1	Chapter 2	Chapter 3	Chapter 4	According to the results of the chapters (R)	Exam (E)
T__1-8	T__9-13	T__14-19	T__20-24	((T1+T2+... T8)/n)x60%	Ex40%
0-100	**0-100**	**0-100**	**0-100**		
Overall rating score (ORS = R+E)				**60-100**	

T1, T2... T8 – topics of chapters, n – number of topics.

The final control of the academic performance of applicants is carried out in the form of an exam based on the results of computer testing. The exam grade for the educational component (discipline) is determined on a 100-point scale.

The exam grade (EG) is 40% of the total final grade (FG).

EG = ETS x 0,4

where: ES – exam score; ETS– exam testing scores, which account for 40% of the points scored during exam testing.

The final grade for the discipline is given on a 100-point scale. It is calculated as the average arithmetic value (AAV) of all the grades received by the student from the current control (CurC) of the assimilation of the material of the sections, with their subsequent conversion into points according to the following formula:

AAV = (CurC chapter1 + CurC chapter.2 + CurC chapter.3 + CurC chapter.4**) /** 4

CurCS = AAV x 0,6

where: CurCS – current control scores, which make up 60% of the total final score; AAV is the arithmetic average value of all grades received by the student from the current control

The applicant can score up to 60 points inclusive at the control points of the mastery of the sections within 2 semesters.

Thus, the final grade (FG) is calculated using the formula:

FG = EG + CurCS

The results of the tests are displayed in the DBTU Moodle system. All forms of control are included in the 100-point assessment scale.

12. Scale: national and ECTS and assessment criteria for determining the level of knowledge and skills

The control of students' knowledge and skills in the discipline is carried out in accordance with the use of the European system of transfer and accumulation of ECTS credits.

Basic provisions:

The total number of current control measures that a student must pass in the discipline is determined taking into account the number of credits in the discipline.

Based on the results of the current control measure, the student's level of assimilation of the educational material is assessed according to the national scale and the ECTS scale.

The number of points received by the student in the assessment of the final control is correlated with the marks on the national scale and the ECTS scale in accordance with Table

1. Rating scale

100-point scale	**National scale**	**interpretation**	**ECTS scale**
90 – 100	excellent	**Excellent -** excellent answer, the work is fulfilled with only a small number of errors	**A**
82 – 89	good	**Very well-** above average with a few errors	**B**
74 – 81		**Well -** in general the correct answer, the work with a certain number of serious errors	**C**
64 – 73	satisfactory	**Satisfactorily –** not bad, but with big number of errors	**D**
60 – 63		**Quite satisfactorily –** the work meets the minimum criteria	**E**
35– 59	unsatisfactory	**Unsatisfactorily –** with the possibility to pass again	**FX**
0-34		**Unsatisfactorily –** with compulsory passing of the work once again	**F**

Passing current tests is mandatory. A section is considered passed if the student has scored the minimum required number of points or more.

The results of the rating for the section are brought to the attention of students no later than the third working day after the control event and, in the absence of claims from the students, are considered final.

If the student does not agree with the decision to assign him rating points for the section, then he must immediately after their announcement file a written appeal to the head of the department and, within the specified period, take an oral attestation for the section before the commission. The composition of the appeal commission in each specific case is determined by the head of the department. The decision of the commission is final.

A student who did not appear for the current test has the right to take the missed current test during the assessment week.

The final rating of current performance in the discipline is calculated by averaging the ratings from all sections. The semester grade is given to the student taking into account the results of the final and current tests. The maximum number of points that a student can receive when studying a discipline is 100.

The exam involves a final test. If permission is granted for automatic exam enrollment, a student who has passed all current tests on time and has been certified with an "excellent" grade based on their results can receive a credit automatically. The semester grade in this case is the average grade for the sections.

The teacher is required to submit the completed credit and examination report to the academic department within the following deadline: for the exam - no later than the next business day after its completion.

The mastery of the independent work block is assessed on a scale according to the following regulations (Table 2)

Table 2.

Assessment criteria (100-point system, oral interview).

The level of formation of a student's knowledge and skills in the academic discipline, both during the final and current control, is assessed on a 100-point scale with subsequent conversion of grades into the national scale and the ECTS grading scale.

№	**Criteria**	Maximum number of points	Description
1	Completeness of the answer	30 points	The answer covers all the main aspects of the question, reveals its content in accordance with the curriculum.
2	Correctness and accuracy of presentation	20 points	The answer does not contain factual, logical or terminological errors.
3	Consistency and logic	10 points	The answer is logically structured, without inconsistent or chaotic fragments.
4	Language and style of presentation	10 points	The expression is competent, clear, using professional terminology.
5	Independent thinking	10 points	The student demonstrates the ability to draw his own conclusions, analyze, compare, give examples.
6	Additional knowledge (outside the main program)	10 points	The answer contains references to modern sources, interdisciplinary connections, and the latest data.

7	Ability to answer additional questions	10 points	The student confidently responds to the teacher's clarifying or in-depth questions, provides additional arguments or examples.

The conversion of grades on a 100-point scale to the national scale and ECTS scale is carried out according to the table:

Total points for all types of learning activities	**Mark according to ECTS scale**	**Mark according to national scale**
90 – 100	A	excellent
82 – 89	B	good
74 – 81	C	
64 – 73	D	satisfactory
60 – 63	E	
35 – 59	FX	unsatisfactory
0 – 34	F	

Activity in classes is assessed on a scale with a maximum of 100 points in accordance with the following regulations (Table 3)

Table 3.

ACTIVITY ASSESSMENT SCALE IN CLASSES

ECTS scale	**National scale**	**Points**	**Score interpretation**
A	**Excellent**	**90-100**	the student works actively during classes, provides complete answers to the teacher's questions and shows a deep mastery of the material, is able to express his own opinion when discussing situational tasks, demonstrates the ability to independently and reasonedly present the material, analyze phenomena and facts, make independent generalizations and conclusions, correctly completes educational tasks, has a full synopsis of theoretical material, regularly visits the Moodle system
B	**Very well**	**82-89**	the student works actively during the lessons, the questions are covered in full, the presentation of the material is logical, substantiated by facts, with references to literary sources, the coverage of the questions is completed with conclusions, the student has shown the ability to analyze facts and events, as well as to complete educational tasks. However, there are inaccuracies in the answers, some minor errors, the presence of a full summary

			of the theoretical material, regular visits to the Moodle system
C	**Well**	**74-81**	the student works actively during the lessons, the questions are covered in full, the presentation of the material is logical, substantiated by facts, with references to literary sources, the coverage of the questions is completed with conclusions, the student has shown the ability to analyze facts and events, as well as to complete educational tasks. However, there are inaccuracies in the answers, some minor errors, there is insufficient reasoning when presenting the material, there is an incomplete synopsis of the theoretical material, partial access to the Moodle system
D	**Satisfactorily**	**64-73**	The student has generally mastered the essence of the issues on the topic, demonstrates knowledge of the lecture material and educational literature, tries to analyze facts and events, draw conclusions and solve situational problems. However, in class he behaves passively, responds only to the teacher's call, gives incomplete answers to questions, makes gross mistakes when covering theoretical material, incomplete notes on theoretical material, partial access to the Moodle system
E	**Quite satisfactorily**	**60-63**	the student lacks understanding of the main essence of the questions, conclusions, generalizations, demonstrated inability to solve situational problems, incomplete note-taking of theoretical material, partial access to the Moodle system
FX, F	**Unsatisfactorily**	**0-59**	lack of desire to participate in the discussion of issues, lack of notes, irregular visit to the Moodle system

Example: a student wrote the test tasks of the current control for 85 points. Multiply by 0.3. The result for the tests is 25.5 points. For independent work, the student received 88 points. Multiply by 0.3. The result for it is 26.4 points. For activity in classes - the student received 74 points. Multiply by 0.4. We get 29.6. In total, the number of points for the current control is 81.5 points. We average towards a larger number and get 82 points, which is equal to good B.

Regarding the final certification of the student, the result obtained for the student's current work (average value for 4 chapters, multiplied by 0.6) and the final test work (multiplied by 0.4) is taken into account.

Example: Chapter I – 83 points, Chapter II – 95 points, Chapter III – 73 points, Chapte IV – 88 points. The sum of the points for the sections is 339 / 4 = 84.75 (85) points – this is the average value. Next, 85 × 0.6 = 51 points. The student wrote the final exam with 91 points. 91×0.4 = 36.4 points. Therefore, the total number of points for the discipline is 51.0 + 36.4 = 87.4. We average towards a smaller number and get 87 points, which is equal to a good or B grade.

13.Methodological support

1. Slide presentations.
2. Collection of museum wet and dry macropreparations.
3. Collection of histopreparations.
4. Thematic photo/video library.
5. Photos.

14. Recommended Literature:

1. Albanese Francesco. Canine and Feline Skin Cytology. Springer International Publishing Switzerland, 2017. 535 p.
2. Burton AG Clinical atlas of small animal cytology. 2018. 380
3. Dellmann's Textbook of Veterinary Histology (6th Edition), Blackwell Publishing, Iowa, USA, 2006.
4. Francesco C., Freeman KP Veterinary Cytology: Dog, Cat, Horse, and Cow. Taylor & Francis Group, LLC, 2017. 240 p.
5. Hans-Georg Liebig. Veterinary Histology of Domestic Mammals and Birds 5th Edition, 5M Books, 2019.
6. Lorenzo R., Wiley J. Normal cell morphology in canine and feline cytology: an identification guide. Ressel & Sons Ltd, 2018.
7. Pawlina, Wojciech, and Ross, Michael H.. Histology: A Text and Atlas: With Correlated Cell and Molecular Biology. USA, Wolters Kluwer Health, 2018.
8. Raskin RE, Meyer DJ, Atlas of Canine and Feline Cytology . Saunders , Elsevier , St. Louis . 2016. 240.
9. Ross, Michael H, et al. Atlas of Descriptive Histology. GB, Sinauer, 2009.
10. Wolfgang Kuehnel. Color Atlas of Cytology, Histology, and Microscopic Anatomy, Thieme Stuttgart · New York, 2003.

15.Electronic Information Resources

Veterynary cytology https://veterinarycytology.org/

https://www.youtube.com/@francescocian226/videos

Electronic course of the discipline "Cytology, Histology, Embryology" for students in the specialty "Veterinary Medicine"

http://moodle.btu.kharkiv.ua/course/view.php?id=1681

16. Changes and additions
(to methodological support and recommended literature)

What is withdrawn from the work program	What is introduced into the work program	Date of consideration by the department