

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL
SCIENCES OF UKRAINE**

**Department of Vertebrate Biomorphology
named after Academician V. H. Kasianenko**



“ APPROVED ”

Dean of the Faculty of Veterinary Medicine,
Mykola Tsvilikhovskiy
_____ 20__

“ APPROVED ”

at meeting of Vertebrate Biomorphology
named after Academician
V. H. Kasianenko Department
Minutes # 11 dated May 28, 2024
Head of the Department,
Oleg Melnyk

” REVIEWED ”

Guarantor of the AP "Veterinary Medicine",
specialty 211 "Veterinary Medicine"
Nataliia GRUSHANSKA

CURRICULUM OF ACADEMIC DISCIPLINE

“CYTOLOGY, HISTOLOGY & EMBRYOLOGY”

Field of knowledge **Veterinary Medicine**

Specialty **211 – Veterinary Medicine**

Academic programme **Veterinary Medicine**

Faculty of Veterinary Medicine

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Description of the discipline “Cytology, Histology & Embryology”

Academic degree, specialty, academic programme	
Academic degree	<i>Master's</i>
Specialty	<i>211 «Veterinary Medicine»</i>
Academic programme	<i>Veterinary Medicine</i>
Characteristics of the discipline	
Type	Compulsory
Total number of hours	180
Number of ECTS credits	6
Number of modules	6
Form of assessment	Credit, Exam
Indicators of discipline for full-time form of study	
	Full-time education
Year of study	1, 2
Semester	2, 3
Lectures	60 hrs.
Practical classes	30 hrs.
Laboratory classes	60 hrs.
Self-study	30 hrs.
Number of hours per week for full-time students	5 hrs.

1. Aim, objectives, competences and expected learning outcomes of the discipline

The discipline "Cytology, Histology, Embryology" **aim** is the students' cognition of the patterns of the structure of the animal organism at the cellular, tissue and organ levels of the structural organization and its individual development.

The discipline "Cytology, Histology, Embryology" **objectives** (outcomes):

Students will be able to use light microscope and will know some histological techniques.

Students will be able to describe general ultrastructural features and functions of cells and their extracellular matrix.

Students will be able to describe the characteristic structural features and function of each of the basic tissues.

Student will be able to describe the characteristic structural features and function of the animal's organs.

Students will know the ultrastructure of germ cells, histophysiology of fertilization, early embryonic development of vertebrates, differentiation of germs layers and axial organs.

Student will be able to identify the basic tissues and the most important organs when shown glass slides.

Student will be able to apply the information described above to successfully complete the clinical discipline that follow.

Acquisition of competencies:

Integral competence (IC):

The ability to solve complex tasks and problems in the field of veterinary medicine, which involves research and/or implementing innovations and is characterized by uncertainty of conditions and requirements;

General competences (GC):

7. Ability to conduct research at the appropriate level;

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

Special (professional) competencies (PC):

1. The ability to establish the features of the structure and functioning of cells, tissues, organs, their systems and apparatus of the animals' organism of different classes and species - mammals, birds, fish and other vertebrates;

2. The ability to use tools, special devices, instruments, laboratory equipment and other technical means to carry out the necessary manipulations during professional activities;

Expected Learning Outcomes (ELO):

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

3. To determine the essence of the physicochemical and biological processes that occur in animals' organism in normal and pathological conditions

5. Establish a link between the clinical manifestations of the disease and the results of laboratory tests.

3. Program and structure of the discipline for:

– full-time form of study

Modules and topics	Hours					
	weeks	total	including			
			lectures	pract	lab	self.st.
Content Module 1. Cytology						
Topic 1. Insight into Histology. Cell theory	1-2	7	2	1	2	1
Topic 2. Overview of eukaryotic cells. Cell theory. The chemical composition of cells	2-3	6	2	1	2	-
Topic 3. Structure of Eukaryotic Cell	3-4	7	2	1	2	1
Topic 4. Structure of Eukaryotic Cell	4-5	7	2	1	2	1
Topic 5. Structure of Eukaryotic Cell. Cell division	5-6	6	2	1	2	1
<i>Quiz 1</i>	6	2				1
Total for content module 1		30	10	5	10	5
Content Module 2. Embryology						
Topic 6. The structure, function and development of germ cells	6-7	7	2	1	2	1
Topic 7. Gametogenesis. General characteristics of embryogenesis	7-8	7	2	1	2	1
Topic 8. Differentiation of Germ Layers and Axial Organs. Embryogenesis of vertebrates	8-9	7	2	1	2	1
Topic 9. Embryogenesis of birds and mammals	9-10	7	2	1	2	1
<i>Quiz 2</i>	11	2				1
Total for content module 2		25	8	4	8	5
Content Module 3. General Histology						
Topic 10. General characteristics of tissues. Epithelia	10-11	6	2	1	2	1
Topic 11. Extracellular matrix. Connective tissue	11-12	6	2	1	2	-
Topic 12. Proper Connective Tissue	12-13	6	2	1	2	1
Topic 13. Supportive tissues	13-14	7	2	1	2	1
Topic 14. Muscle Tissue	14-15	7	2	1	2	-
Topic 15. Nervous tissue	15	6	2	1	2	1
<i>Quiz 3</i>	15	2				1
Total for content module 3		35	12	6	12	5

Content Module 4. Special Histology (Comparative Organology). Cardiovascular System. Lymphoid Organs. Endocrine System						
Topic 16. Cardiovascular System	1-2	7	2	1	2	1
Topic 17. Lymphoid Organs (Central organs)	2-3	7	2	1	2	1
Topic 18. Lymphoid Organs (Peripheral organs)	3-4	7	2	1	2	1
Topic 19. Endocrine System	4-5	7	2	1	2	1
<i>Quiz 4</i>	5	2				1
Total for content module 4		25	8	4	8	5
Content Module 5. Special Histology (Comparative Organology). Integumentary System. Digestive System. Respiratory System. Urinary System.						
Topic 20. Integumentary System	5-6	6	2	1	2	1
Topic 21. Digestive System (head gut)	6-7	6	2	1	2	-
Topic 22. Digestive System (anterior, middle and posterior gut)	7-8	6	2	1	2	1
Topic 23. Digestive System (extramural glands of the digestive system)	8-9	6	2	1	2	-
Topic 24. Respiratory System	9-10	7	2	1	2	1
Topic 25. Urinary System	10-11	7	2	1	2	1
<i>Quiz 5</i>	10	2				1
Total for content module 5		35	12	6	12	5
Content Module 6. Special Histology (Comparative Organology). Reproductive System. Nervous System. Sense organs						
Topic 26. Female Reproductive System	11-12	6	2	1	2	1
Topic 27. Male Reproductive System	12-13	7	2	1	2	-
Topic 28. Nervous System	13-14	6	2	1	2	1
Topic 29. Sense organs (eye)	14-15	7	2	1	2	1
Topic 30. Sense organs (ear)	15	7	2	1	2	1
<i>Quiz 6</i>	15	2				1
Total for content module 6		30	10	5	10	5
Total hours		180	60	30	60	30

3. Topics of laboratory and practical classes

№	Topic titles	Hours
1	Microscope. How to use microscope. Histological laboratory	2
2	Paraffin technique. Hematoxylin and eosin staining	2
3	General morphology of eukaryotic cells. Mitochondria. Endoplasmic reticulum. Golgi complex	2
4	Centrioles. Cytoplasmic inclusions (nutritive, secretory, pigment)	2
5	Nucleus. Mitosis. Amitosis	2
6	Structure of spermatozoa in mammals and bird. Structure of mammal oocyte	2
7	Fertilization. Syncaryon. Zygote cleavage in Lancet fish and Amphibia. Blastula	2
8	Unequal cleavage. Blastula	2
9	Frog's neurula. Gastrulation in birds	2
10	Germ layers and axial organs of chick embryo	2
11	Fetal membranes of birds and mammals. Placenta	2
12	Surface epithelia	2
13	Blood of mammals, birds, amphibians	2
14	Mesenchyme and mucous connective tissue. Reticular tissue. Adipose tissue	2
15	Loose connective tissue. Dense connective tissue	2
16	Cartilage and bone tissue	2
17	Smooth muscle tissue. Skeletal and cardiac muscle tissue	2
18	Neurons. Chromatophilic substance. Neurofibrils	2
19	Neuroglia. Nerve fibers (unmyelinated and myelinated). Synapses	2
20	Heart. Elastic and muscular arteries	2
21	Muscular vein. Blood capillaries	2
22	Red bone marrow. Thymus. Bursa of Fabricius	2
23	Lymph node. Spleen. Palatine tonsils	2
24	Hypophysis	2
25	Adrenal glands. Thyroid gland. Parathyroid gland	2
26	Skin with hair. Skin without hair. Eyelid	2
27	Mammary gland (lactating and non-lactating)	2
28	Horn skin derivatives. Hooves	2
29	Tooth crown and root. Development of tooth	2
30	Tongue (filiform and foliate papilla). Salivary glands	2
31	Esophagus	2
32	Glandular stomach	2
33	Avian stomach	2
34	Compound stomach (rumen, reticulum, omasum)	2
35	Duodenum, jejunum, colon	2
36	Liver. Pancreas	2
37	Trachea. Mammal's and bird's lung. Blood/air barrier (scheme)	2
38	Kidney. Ureter. Scheme of nephron	2
39	Ureter. Urinary bladder	2

40	Ovary. Corpus luteum. Uterine tube (oviduct)	2
41	Uterus. Vagina	2
42	Testis. Epididymis testis. Prostate	2
43	Spinal cord. Cerebral cortex. Cerebellum	2
44	Dorsal root ganglia. Nerve	2
45	Posterior wall of eyeball. Cornea. Organ of Corti	2

4. Topics for self-study

№	Topic titles	Hours
1.	Histological techniques	1
2.	Chemical properties of cell membrane	1
3.	Cell contacts, peroxisomes, microtubules, microfilaments	1
4.	Cilia and flagella	1
5.	Non-cellular structures of organism	1
6.	Structure of spermatozoa in birds	1
7.	Structure of amphibian and fish oocytes	2
8.	Stages of birds and mammals development	2
9.	Postembryonic hematopoiesis	1
10.	Ultrastructure of collagen fibers	1
11.	Ultrastructure of actin and myosin myofilaments	1
12.	Macroglia and microglia	1
13.	Reflex arc. Regeneration of nerve tissue.	1
14.	Structure of arterioles and venules	1
15.	Structural features of the avian immune organs	1
16.	Structure of tonsils and aggregated lymphoid nodules	1
17.	Diffuse neuroendocrine system. APUD system	2
18.	Structural features of skin in different species of domestic animals	1
19.	Development of liver and pancreas. Endocrine part of pancreas	1
20.	Structure of glands of the perianal region	1
21.	Outer and Inner breathing. The structure of birds' lung	1
22.	Histophysiology of the kidney	1
23.	Structural features of bird's ovary and oviduct	1
24.	Structural and functional features of autonomic nervous system	2
25.	Vestibular and auditory apparatus	2

5. Tools for assessing expected learning outcomes:

- exam;
- credit;
- module tests;
- presentation of laboratory and practical works.

6. Teaching methods

- verbal method (lecture, discussion, interview, etc.);
- practical method (laboratory, practical classes);
- visual method (illustration, demonstration);
- video method (remote, multimedia, web-based, etc.);
- self-study (completing assignments);
- individual research work.

7. Assessment methods:

- exam;
- credit;
- oral or written assessment;
- module tests;
- presentation of laboratory and practical works.

8. Distribution of points received by students

The assessment of students' knowledge and skills is conducted by means of a 100-point scale and is converted into national grades according to Table 1 of the current *Exam and Credit Regulations at NULES of Ukraine*.

Student's rating, points	National grading of exams and credits	
	exams	credits
90-100	excellent	pass
74-89	good	
60-73	satisfactorily	
0-59	unsatisfactorily	fail

To determine a student's rating in the discipline R_{DIS} (up to 100 points), the received assessment rating R_A (up to 30 points) is added to the academic performance rating R_{AP} (up to 70 points): $R_{DIS} = R_{AP} + R_A$.

9. Teaching and learning aids

- e-learning course of the discipline (<https://elearn.nubip.edu.ua>);
- lectures and presentations (in electronic form);
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time students;
- internship programmes of the discipline (if included in the curriculum).

10. Recommended sources of information

Basic literature

1. Хомич В.Т. Лекції з цитології, ембріології та гістології свійських тварин: Навчальний посібник. К.: ТОВ "Аграр Медіа Груп", 2012. 296 с.

2. Новак В.П., Пилипенко М.Ю., Бичков Ю.П. Цитологія, гістологія, ембріологія: підручник за заг. ред. В.П.Новака (2-е вид., змін. і доп.) К.: Дакор, 2008. 512 с.

3. Хомич В.Т., Мазуркевич Т.А., Дишлюк Н.В., Стегней Ж.Г. Практикум з цитології, гістології та ембріології свійських тварин: Навчальний посібник /За редакцією В.Т. Хомича.-К.:ЦП Компринт, 2017. 228 с.

4. Хомич В.Т., Мазуркевич Т.А., Дишлюк Н.В., Стегней Ж.Г. Цитологія, ембріологія і гістологія свійських тварин у запитаннях і відповідях. Навчальний посібник К.: Аграр Медіа Груп, 2013. 232 с.

5. Melnyk N. Histology, cytology and embryology. К., 2020. 370 с.

6. Ulrich D. Color atlas of embryology. Thieme, 1995. 383 p.

Supporting literature

1. Хомич В.Т., Рудик С.К., Левчук В.С. Морфологія сільськогосподарських тварин. К.: Вища освіта, 2003. 527 с.

2. Луцик О.Д., Іванова А.І., Кабак К.С. Гістологія людини. Львів: Мир, 1992. 400 с.

3. Banks W.J. Applied Veterinary Histology. 1993. 527 p.

4. Dellmann H.-D., Carithers J.R. Cytology and Microscopic Anatomy. 1996. 406 p.

5. Vacha W.J., Wood L.M. Color Atlas of Veterinary Histology. 1990. 269 p.

Information Resources

1. « LUMEN Histology from Loyola. Excellent slides plus explanatory text.

*** http://www.meddean.luc.edu/lumen/MedEd/Histo/frames/histo_frames.html

2. https://elib.vsmu.by/bitstream/123/9813/1/Miadzelets-AD_Selected%20themes%20of%20histology%20cytology%20and%20embryology%20core_2005.pdf