SYLLABUS OF THE EDUCATIONAL COMPONENT

CRIOVETERINARY

Specialty	**211 Veterinary Medicine**	**Compulsory discipline**	**selective**
Educational program	**Veterinary Medicine**	**Faculty**	**of veterinary medicine**
Educational level	**Second (Master's) level**	**Department**	**of Animal Physiology and Biochemistry**

LECTURER

Olga Denysova

Higher education – specialty biologist, teacher of biology and chemistry
Academic degree – Candidate of Biological Sciences 03.00.19 Cryobiology
Academic title – Associate Professor of the Department of Animal Physiology and Biochemistry
Work experience – more than 18 years
Indicators of professional activity related to the course:

- author of more than 15 methodological developments;
- Co-author of a practical guide to biological chemistry;
- Co-author of a textbook on the basics of cryobiology and cryomedicine;
- co-author of more than 50 thematic publications;
- participant in scientific and methodological conferences.

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The following individuals are involved in teaching the discipline:

GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT	
Objective	**to provide students with knowledge** about the role and importance of cryoveterinary medicine in modern veterinary medicine, focusing on the main achievements, tasks, and prospects for the development of this field; **to familiarize students with and help them master the basic principles** for developing universal protocols for cooling and warming biological objects, studying the condition of cells and tissues of various origins in their intact state and after exposure to cryopreservation factors; **forming modern ideas** about the effect of low temperatures on organisms of various animal species, emphasizing the importance of this knowledge for practical application in veterinary medicine; **developing the ability to analyze** and evaluate the impact of cryopreservation on biological materials, preparing students for professional activities in the field of cryoveterinary medicine.
Format	**lectures, practical classes, independent work, individual assignments, teamwork**
Details of learning outcomes and forms of assessment	• **Ability to think abstractly, analyze and synthesize, conduct research at the appropriate level, learn and master modern knowledge, develop strategies for safe, sanitary animal husbandry, know the terminology of ethology and zoopsychology, and be able to use it correctly in their work (GC1, GC 3, GC 7, GC 10, SC10, PLO1) / individual assignments, training** • **Ability to apply knowledge in practical situations, make informed decisions, communicate with representatives of other professional groups at various levels, formulate conclusions about the effectiveness of selected methods and means of keeping, feeding and treating animals, preventing infectious and non-infectious diseases, as well as production and technological processes at enterprises for keeping, breeding, or exploiting animals (GC 2, GC 3, GC 7, GC 8, GC 10, CS1, PLO7, PLO14)/individual tasks** • **Ability to use tools, special devices, instruments, laboratory equipment, and other technical means to perform the necessary manipulations during professional activities, develop quarantine and health measures, methods of therapy, prevention, diagnosis, and treatment of diseases of various etiologies, and to carry out educational activities among industry workers and the general public (GC2, GC7, SC1, SC2, PLO6, PLO19) / individual assignments, abstract** • **implementation of environmental protection mechanisms, application of knowledge of biosafety, bioethics, and animal welfare in professional activities, knowledge of the rules and requirements of biosafety, bioethics, and animal welfare in the course of professional activities (GC 12, GC 3, GC 7, SC11, SC19, PLO17, PLO19) / training, individual assignments**
Scope and forms of control	**3 ECTS credits (90 hours): 14 hours of lectures, 30 hours of practical classes; ongoing assessment (2 sections); final assessment – differentiated test.**
Teacher requirements	**timely completion of assignments, active participation, teamwork**
Enrollment requirements	**in accordance with the curriculum**

COMPLIANCE WITH EDUCATION STANDARDS AND EDUCATIONAL PROGRAM

Competencies	GC 1. Ability to think abstractly, analyze, and synthesize. GC 2. Ability to apply knowledge in practical situations. GC 3. Knowledge and understanding of the subject area and profession. GC 7. Ability to conduct research at the appropriate level. GC 8. Ability to learn and master modern knowledge. GC 9. Ability to make informed decisions. GC 10. Ability to communicate with representatives of other professional groups of different levels (with experts in other fields of knowledge/types of economic activity). GC 12. Commitment to environmental protection SC 1. Ability to establish the characteristics of the structure and functioning of cells, tissues, organs, their systems and apparatus of animals of different classes and species – mammals, birds, insects (bees), fish and other vertebrates. SC 2. Ability to use tools, special devices, instruments, laboratory equipment, and other technical means to perform the necessary manipulations during professional activities SC 6. Ability to select, package, fix, and send samples of biological material for laboratory research. SC 11. Ability to apply knowledge of biosafety, bioethics, and animal welfare in professional activities.	**Program learning outcomes**	PLO 1. Know and competently use veterinary medicine terminology. PLO 2. Use information from domestic and foreign sources to develop diagnostic, therapeutic, and business strategies. PLO 3. Determine the essence of physical, chemical, and biological processes that occur in the body of animals under normal and pathological conditions. PLO 7. Formulate conclusions about the effectiveness of selected methods and means of keeping, feeding, and treating animals, preventing infectious and non-infectious diseases, as well as production and technological processes at enterprises for keeping, breeding, or exploiting animals of various classes and species. PLO 14. Understand the essence of the processes of production, storage, and processing of biological raw materials.

STRUCTURE OF THE EDUCATIONAL COMPONENT (DISCIPLINES)

Section 1. HISTORY, TASKS OF CRYOVETERINARY MEDICINE. CRYOPROTEIN DAMAGE TO CELLS DURING FREEZING. CRYOPROTECTANTS AND CRYOCONSERVANTS.

Lecture 1.	Introduction to cryoveterinary medicine. History and achievements cryobiology and cryomedicine, which became the basis for the establishment of the discipline of "Cryoveterinary Medicine."	**Practical class 1 (PC 1)**	Phase transitions of water and their role in cryopreservation of biological objects.	**Independent work**	Analysis of key moments that led to the emergence of cryoveterinary medicine. **Tasks of cryoveterinary medicine: significance for veterinary medicine and biosafety.** Research into the main goals and applications of cryoveterinary medicine. **Mechanisms of cryodamage to cells: physicochemical processes during freezing.** Analysis of the effect of temperature and freezing rate on cell structures. **Types of cryodamage: mechanical, osmotic, and biochemical.** Study of various types of damage that can occur during freezing. Hypotheses explaining the mechanism of cryoprotective action of cryoprotectants. Basic requirements for
Lecture 2.	Physical basis of cryopreservation. **Phase transitions, heat exchange, and behavior of water during freezing.**	**PC 2**	Modeling of cryodamage to cells.		
Lecture 3	Cryoprotectants and their application. **Types of cryoprotectants (permeable and impermeable), mechanisms of action.**	**PC 3**	Study of cryoprotectants (permeable and impermeable)		
		PC 4	Experimental protocols for freezing cells and tissues using various		

			cryoprotectants.		cryoprotectants, physicochemical properties of effective cryoprotectants. **Mechanisms of action of cryoprotectants: how they reduce the risk of cell damage.** Research on the biochemical and physical aspects of cryoprotectants. **Cryopreservatives: comparison with cryoprotectants and their role in the preservation of biological materials.** Analysis of the differences between cryopreservatives and cryoprotectants. Toxicity and cytotoxicity of cryoprotective compounds.
Section 2. CRYOPRESERVATION OF BIOOBJECTS OF VARIOUS LEVELS OF ORGANIZATION AND CRYOSURGERY. THEORY AND PRACTICE.					
Lecture 4.	Hypothermic storage of biological materials. **Principles and practical approaches.**	**PC 5**	Hypothermic storage of cells and tissues: principles, methods, and experimental research.	**Independent work**	Methods of preparing samples for cryopreservation of reproductive material. Practical aspects of preparing sperm, eggs, and embryos. Cryopreservation of animal reproductive cells. Study of the characteristics of sperm from bulls, horses, rams, and dogs. Study of methods for cryopreserving sperm from different male species. The importance of long-term sperm storage for zoo animals and the preservation of species biodiversity. Features of fish sperm cryopreservation. The importance of fish sperm preservation for the national economy. Methods of cryopreservation and storage of poultry sperm. Cryopreservation of mouse eggs. Cryopreservation of cow, pig, and monkey embryos. Techniques for freezing and storing blood cells: protocols and results. Study of the specifics and protocols of cryopreservation of red blood cells. Evaluation of the effectiveness of different thawing methods: experimental studies. Comparison of the effects of different methods on cell viability. Development of new protocols for cryopreservation of stem cells. Practical application of new methods in the laboratory. Cryosurgery: performing operations and analyzing results. Practical aspects of performing cryosurgical procedures. Application of local cryotherapy methods in the treatment of injuries, surgical and accidental wounds. Application of cryotherapy for the treatment of burns and purulent wounds. Cryosurgical methods for the treatment of
Lecture 5.	Cryopreservation of blood cells and stem cells.	**PC 6**	Blood cell cryopreservation technologies: freezing and thawing protocols.		
Lecture 6.	Cryopreservation of animal reproductive material. **Techniques for cryopreservation of sperm, eggs, and embryos.**	**PC 7**	Methods of cryopreservation of stem cells and assessment of their viability.		
Lecture 7.	Cryosurgery in veterinary medicine. **Principles and methods.**	**PC 8**	Protocols for the preparation and cryopreservation of sperm from various species of mammals.		
		PC 9	Technologies for vitrification and cryopreservation of eggs and embryos.		
		PC 10	Species-specific approaches to cryopreservation of reproductive cells (cattle, pigs, horses, birds, fish).		
		PC 11	Theoretical and practical foundations of cryosurgery in veterinary medicine.		
		PC 12	Cryosurgical methods for treating neoplasms, burns, and purulent lesions in animals.		
		PC 13	Functioning of cryobanks: technologies for long-term storage and quality control of biological samples.		
		PC 14	Final integrative class: analysis of case studies of cryotechnology applications in veterinary medicine.		

		PC 15	Course summary: prospects for the development of cryoveterinary medicine and interdisciplinary connections.		malignant tumors in horses, cattle, and dogs. Prospects for the use of cryopreserved cells for the treatment of animals. Study of cryobank quality control methods. Practical aspects of assessing the effectiveness and safety of storage. Analysis of the effect of hypothermic storage on cells: experimental data. Conducting experiments to assess cell viability. Local hypothermia of organs and tissues. Development and implementation of protocols for the preservation of biological samples in cryobanks. Practical recommendations and protocols for storage. Practical application of cryopreservation in veterinary medicine: analysis of success stories. Review of specific examples of successful use of cryopreservation.

BASIC LITERATURE AND METHODOLOGICAL MATERIALS

Literature

1. Fundamentals of Cryobiology and Cryomedicine/ edited by G.F. Zhegunov and O.A. Nardid. Kharkiv: FLP–2019.–616 p.
2. Life in the Frozen State / ed. By B.J. Fuller, N. Lane, E.E. Benson. – Boca Raton, CRC Press, 2004. – 672 p.

Methodological support

1. Cryoveterinary medicine: a course of lectures for full-time students pursuing a second (master's) degree in veterinary medicine (specialty 211) / O.M. Denisova, G.F. Zhegounov, N.I. Gladka, K.R. Grebenyuk– Electronic data. – Kharkiv: DBTU, 2025. – 164 p.
2. Cryodamage to cells [Text]: teaching and methodological manual for second (master's) level higher education students majoring in 211 Veterinary Medicine and 162 Biotechnology and Bioengineering / G.F. Zhegunov, O.M. Denisova, N.I. Gladka; State Biotechnological University. – Kharkiv, 2024. – 26 p.
3. Speed and depth of freezing of biological objects [Text]: teaching manual for second (master's) level higher education students majoring in 211 Veterinary Medicine and 162 Biotechnology and Bioengineering / O.M. Denysova, G.F. Zhegunov, O.A. Nardid, N.I. Gladka; State Biotechnological University. – Kharkiv, 2024. – 29 p.
4. Methods of cryopreservation of animal erythrocytes: Methodological recommendations for independent work of 2nd year postgraduate students (field of knowledge 09 Biology, specialty 091 Biology) in the discipline "Cryoveterinary medicine" / Denysova O.M., Tykhvynska O.O., Shpakova N.M., Babiychuk L.O., Bozhkova Yu.O./ [Electronic resource] – Kharkiv: Institute of Cryobiology and Cryomedicine Problems of the National Academy of Sciences of Ukraine, 2022. – 25 p. (Ukraine)
5. Cryopreservation of biological objects [Text]: teaching and methodological manual for students of the second (master's) level of higher education in the specialties 211 Veterinary Medicine and 162 Biotechnology and Bioengineering / G.F. Zhegunov, O.M. Denisova, N.I. Gladka; State Biotechnological University. – Kharkiv, 2025. – 18 p.

EVALUATION SYSTEM

SYSTEM		POINTS	ACTIVITY TO BE EVALUATED
Final assessment (different credit, exam)	**100 points ECTS (standard)**	**up to 100**	**40 % - Final testing** **60 % - student's current work during the semester**
Final assessment (non-differential credit)	**100 points ECTS (standard)**	**up to 100**	**100 % - average grade for sections**

Rating of section	100 points total	up to 30	30 % - answers to test questions
		up to 30	30 % - the result of mastering the block of independent work
		up to 40	40 % - student activity in class (oral answers)

ACADEMIC ETHICS AND INTEGRITY STANDARDS

All participants in the educational process (including students) must adhere to the code of academic integrity and the requirements set forth in the provision "On the academic integrity of participants in the educational process of DBTU": to demonstrate discipline, good manners, respect for each other's dignity, kindness, honesty, and responsibility.