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**Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
Agrarian and Technological Institute**

WORKING COURSE SYLLABUS

Veterinary radiobiology

Recommended by the Methodological Council for the Education Field:

36.05.01 Veterinary medicine

2022 г.

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The aim of mastering the discipline " **Veterinary radiobiology** " is formation of fundamental and professional knowledge of the general patterns and manifestations of the biological response of the animal body to ionizing effects, which forms the scientific basis for the hygienic regulation of the radiation factor, and allows you to develop ways and methods of controlling the body's radiation reactions.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

The development of the discipline "**Veterinary radiobiology**" is aimed at creating the following competencies (parts of competencies) for students:

Table 2.1. List of competencies formed by students during the development of the discipline (results of the development of the discipline)

Code	Competence	Indicators of competence accomplishment (within the discipline)
UK -8	The ability to create and maintain safe living conditions in everyday life and in professional activities for the preservation of the natural environment, ensuring the sustainable development of society, including in the event of a threat and occurrence of emergencies and military conflicts.	UK-8.1 Analyzes the factors of harmful influence on the vital activity of elements of the habitat. (technical means, technological processes, materials, buildings and structures, natural and social phenomena);
		UK -8.2 Identifies dangerous and harmful factors within the scope of the task being performed;
		UK-8.3 Identifies and eliminates problems related to safety violations in the workplace;
		UK-8.4 Explains measures to prevent emergencies;
		UK -8.5 "Explains the rules of conduct in the event of emergencies of natural and man-made origin, as well as in the event of military conflicts;"
		UK-8.6 Provides first aid, participates in recovery activities.
GPC-2	The ability to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological state of the animal organism.	GPC-2.1 Has knowledge of the influence of natural, socio-economic, genetic and economic factors on the animal body.
		GPC-2.2 He is able to establish the presence and reliability of cause-and-effect relationships between the effects of certain etiological factors on the animal's body and the development of diseases.

		GPC-2.3 Possesses methods of preventive and curative correction of the effects of adverse environmental factors that can cause deterioration of animal health.
GPC -4	The ability to use methods of solving problems using modern equipment in the development of new technologies in professional activity and to use modern professional methodology for conducting experimental research and interpreting their results.	GPC-4.1 Possesses the conceptual and methodological apparatus of basic natural sciences at a level sufficient for full-fledged professional activity at the modern level.
		GPC-4.2 He knows the methods of solving problems using modern equipment.
		GPC-4.3 He is ready to use modern methodology in the development and conduct of experimental research.
		GPC-4.4 Uses modern professional methodology in interpreting research results.
GPC -6	The ability to analyze, identify and assess the risk of the risk of the occurrence and spread of diseases.	GPC-6.1 Has knowledge in the field of etiology and pathogenesis of animal diseases of different species.
		GPC-6.2 Has the skills to diagnose non-infectious, infectious and invasive diseases, identify pathogens of infectious and invasive diseases in animals.
		GPC-6.3 He knows the patterns of the occurrence and spread of diseases in animal populations, factors predisposing to diseases and the causes of possible complications.
PC -8	Ability to choose methods of non-drug therapy, including physiotherapy methods for the treatment of animals.	PC-8.1 He is able to choose and justify his choice of methods of non-drug therapy, including physiotherapy methods, for the treatment of animals;
		PC-8.2 He is able to evaluate the effectiveness of the chosen method in the treatment of the patient and, if necessary, adjust the treatment method or change the chosen method to another one.
PC -9	The ability to carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules.	PC-9.1 Able to carry out therapeutic, including physiotherapy, procedures using special equipment in compliance with safety rules;

		PC -9.2 He is able to take into account the species, age and individual characteristics of animals undergoing treatment using special equipment, choose acceptable methods of fixing the patient during the procedure, the conditions of the procedures and their duration.
PC -21	The ability to carry out inspections of the veterinary and sanitary condition and microclimate of livestock premises in accordance with the plan of antiepidemiological measures, the plan of prevention of non-infectious animal diseases, the plan of veterinary and sanitary measures	PC-21.1 He is able to detect deviations in the parameters of the microclimate in livestock premises from the normative
		PC-21.2 He is able to detect violations of the veterinary and sanitary condition of livestock premises, determine their cause and possible consequences
		PC-21.3 He is able to use the information obtained during the inspection of the veterinary and sanitary condition and microclimate of livestock premises for risk analysis of non-infectious, infectious and invasive diseases

3. COURSE IN HIGHER EDUCATION

The discipline "**Veterinary radiobiology**" refers to the mandatory part of block B1 of the Educational Program of Higher Education.

As part of the Educational Program of Higher Education, students also master other disciplines and /or practices that contribute to achieving the planned results of mastering the discipline "**Veterinary radiobiology**".

Table 3.1. List of Higher Education Program components disciplines that contribute to expected learning outcomes

Competence code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
UK -8	The ability to create and maintain safe living conditions in everyday life and in professional activities for the preservation of the natural environment, ensuring the sustainable development of society, including in the event of a threat and occurrence of	History Inorganic and analytical chemistry Organic chemistry Biological physics Physical and Colloidal Chemistry Life safety Biological chemistry	Parasitology and invasive diseases Epizootology and infectious diseases Organization of veterinary affairs General and Veterinary Ecology Veterinary sanitation Veterinary deontology

	emergencies and military conflicts.	Veterinary Microbiology and Mycology Virology and biotechnology	Laboratory diagnostics of infectious and invasive diseases Organization of state veterinary supervision
GPC -2	The ability to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological state of the animal organism.	Biology with the basics of ecology Veterinary genetics Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Breeding with the basics of private animal husbandry Animal health and welfare Pathological physiology	Pathological anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Forensic veterinary examination and dissection of animals Immunology General and Veterinary Ecology Veterinary sanitation Fodder plants Zoopsychology Здоровье и благополучие животных Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology

			Endocrinology Nephrology Veterinary ophthalmology Animal Dentistry
GPC -4	The ability to use methods of solving problems using modern equipment in the development of new technologies in professional activity and to use modern professional methodology for conducting experimental research and interpreting their results.	Inorganic and analytical chemistry Organic chemistry Biological physics Computer science Physical and Colloidal Chemistry Cytology, Histology and Embryology Biological chemistry Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Breeding with the basics of private animal husbandry Pathological physiology	Clinical diagnostics Pathological anatomy Operative surgery with topographic anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Maths Immunology Veterinary sanitation Processing technology for livestock products Medicinal and poisonous plants Fodder plants The basics of intellectual work Personality psychology and professional self-determination Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages

			<p>Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry</p>
GPC -6	<p>The ability to analyze, identify and assess the risk of the risk of the occurrence and spread of diseases.</p>	<p>Biology with the basics of ecology Life safety Veterinary Microbiology and Mycology Virology and biotechnology Animal health and welfare Feeding animals with the basics of forage production</p>	<p>Clinical diagnostics Pathological anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Veterinary and sanitary examination Organization of veterinary affairs Forensic veterinary examination and dissection of animals Introduction to the specialty General and Veterinary Ecology Veterinary sanitation Processing technology for livestock products Medicinal and poisonous plants Fodder plants</p>

			<p>Animal health and welfare Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Organization of state veterinary supervision Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Veterinary ophthalmology Animal Dentistry</p>
PC -8	Ability to choose methods of non-drug therapy, including physiotherapy methods for the treatment of animals.	<p>Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Feeding animals with the basics of forage production Pathological physiology</p>	<p>Internal diseases General surgery Private Veterinary Surgery Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery</p>

			Veterinary ophthalmology Animal Dentistry
PC -9	The ability to carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules.	Animal anatomy Life safety Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Pathological physiology	General surgery Private Veterinary Surgery Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
PC -21	The ability to carry out inspections of the veterinary and sanitary condition and microclimate of livestock premises in accordance with the plan of antiepidemiological measures, the plan of prevention of non-infectious animal diseases, the plan of veterinary and sanitary measures	Veterinary Microbiology and Mycology Virology and biotechnology Animal health and welfare	Veterinary sanitation Здоровье и благополучие животных

4. COURSE WORKLOAD AND TRAINING ACTIVITIES

Course workload of the discipline "Veterinary radiobiology" is 3 credits.

Table 4.1. Types of academic activities during the period of the HE program mastering for **full-time** study

Types of academic activities	HOURS	Semesters			
		5	-	-	-
		5	-	-	-

Contact academic hours	72	72	-	-	-
including					
Lectures	18	18	-	-	-
Lab work	54	54	-	-	-
Seminars (workshops/tutorials)	-	-	-	-	-
Self-study	26	26	-	-	-
Evaluation and assessment (exam/pass/fail grading)	10	10	-	-	-
Course workload	Academic hour	108	108	-	-
	Credit unit	3	3	-	-

Table 4.2. Types of academic activities during the period of the HE program mastering for *part-time* study

Types of academic activities	HOURS	Semesters			
		5	-	-	-
Contact academic hours	18	18	-	-	-
including					
Lectures	-	-	-	-	-
Lab work	18	18	-	-	-
Seminars (workshops/tutorials)	-	-	-	-	-
Self-study	80	80	-	-	-
Evaluation and assessment (exam/pass/fail grading)	10	10	-	-	-
Course workload	Academic hour	108	108	-	-
	Credit unit	3	3	-	-

5. CONTENT OF THE DISCIPLINE

Table 5.1 Content of the discipline (module) by type of academic work

Name of the discipline section	Content of the section (topics)	Types of academic activities
Section 1. Physical bases of the action of ionizing radiation. Control methods and devices.	Topic 1.1 Physical bases of the action of ionizing radiation. Control methods and devices.	Lectures, Lab work.
Section 2. Biological effects of ionizing radiation and safety precautions when working in radiation-contaminated areas	Topic 2.1. Biological effects of ionizing radiation and safety precautions when working in radiation-contaminated areas	Lectures, Lab work.

Section 3. Target theory. Free radical theory	Topic 3.1. Target theory. Free radical theory	Lectures, Lab work.
Section 4. Damage repair. Somatic and inherited mutations	Topic 4.1. Damage repair. Somatic and inherited mutations	Lectures, Lab work.
Section 5. Features of the territory pollution with long-lived radioactive substances	Topic 5.1. Features of the territory pollution with long-lived radioactive substances	Lectures, Lab work.
Section 6. Transition of radionuclides into livestock products. Excretion from the body	Topic 6.1. Transition of radionuclides into livestock products. Excretion from the body	Lectures, Lab work.
Section 7. Standards for the content of radionuclides in agricultural facilities.	Topic 7.1. Standards for the content of radionuclides in agricultural facilities.	Lectures, Lab work.
Section 8. Calculation of doses of external and internal human exposure.	Topic 8.1. Calculation of doses of external and internal human exposure.	Lectures, Lab work.
Section 9. Radiation sickness of animals: acute and chronic.	Topic 9.1. Radiation sickness of animals: acute and chronic	Lectures, Lab work.
Section 10. The effect of ionizing radiation on the embryo and fetus	Topic 10.1. The effect of ionizing radiation on the embryo and fetus	Lectures, Lab work.
Section 11. Long-term effects of radiation. Genetic. action of ionizer. radiation.	Topic 11.1. Long-term effects of radiation. Genetic. action of ionizer. radiation.	Lectures, Lab work.
Section 12. Lack of modern knowledge about the effect of small doses	Topic 12.1. Lack of modern knowledge about the effect of small doses	Lectures, Lab work.
Section 13. Features of the action of ionizing radiation in small doses	Topic 13.1. Features of the action of ionizing radiation in small doses	Lectures, Lab work.
Section 14. Adaptive response. The answer of the "Witness".	Topic 14.1. Adaptive response. The answer of the "Witness".	Lectures, Lab work.
Section 15. Genome instability	Topic 15.1. Genome instability	Lectures, Lab work.
Section 16. Damage repair. Somatic and inherited mutations	Topic 16.1. Damage repair. Somatic and inherited mutations	Lectures, Lab work.

6. CLASSROOM INFRASTRUCTURE AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Material and technical support of the discipline

<i>Classroom for Academic Activity Type</i>	<i>Equipping the classroom</i>	Specialized educational/laboratory equipment, software and materials for the development of the discipline (if necessary)
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations.	-
Laboratory	An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment.	-
Self-studies	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and educational environment.	-

7. RECOMMENDED SOURCES FOR COURSE STUDIES

Main reading:

1. Radiobiology: textbook / N.P. Lysenko, V.V. Pak. Pak, L.V. Rogozhina, Z.G. Kusurova; Ed. by N.P. Lysenko and V.V. Pak. Pak. - 4th ed. - SPb. : Lan Publishing House, 2017. - 572 c. - (Textbooks for universities. Special literature). - ISBN 978-5-8114-1330-0.
2. Radiation hygiene: textbook / L.A. Ilyin, I.P. Korenkov, B.Y. Narkevich. - 5-th edition, revised and updated - Moscow : GEOTAR-Media, 2017. - 416 c. - ISBN 978-5-9704-4111-4.

Additional Reading:

1. Veterinary radiobiology: textbook / V.G. Plyushchikov, O.G. Semenov. - Electronic text data. - M. : RUDN, 2016. - 292 c. : ill. - ISBN 978-5-209-06898-3
2. Tests in radiobiology: tutorial / E.I. Troshin, Y.G. Vasiliev, I.S. Ivanov. - SPb. : Lan' Publisher, 2014. - 240 c. - (Textbooks for Universities. Special literature). - ISBN 978-5-8114-1685-1.

Resources of the Internet information and telecommunication network:

1. Electronic library system of RUDN and third-party Electronic library systems to which university students have access on the basis of concluded contracts:

- Electronic library system of RUDN - ELS RUDN <http://lib.rudn.ru/MegaPro/Web>
- ELS "University Library online" <http://www.biblioclub.ru>
- ELS Yurayt <http://www.biblio-online.ru>
- ELS "Student Consultant" www.studentlibrary.ru
- ELS "Lan" <http://eZlanbook.com/>
- ELS "Trinity Bridge" <http://www.trmost.com/>

2. Databases and search engines:

- electronic fund of legal and regulatory and technical documentation <http://docs.cntd.ru/>
- search engine Yandex <https://www.yandex.ru/>
- search engine Google <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>

Educational and methodological materials for independent work of students during the development of the discipline/ module*:

1. A course of lectures on the discipline "**Veterinary radiobiology**".
2. Laboratory workshop on the discipline "**Veterinary radiobiology**".

* - All educational and methodological materials for independent work of students are placed in accordance with the current procedure on the discipline page in the **Telecommunication educational and Information System!**

8. MID-TERM ASSESSMENT

Evaluation materials and a point-rating system* for assessing the level of competence formation (part of competencies) based on the results of mastering the discipline "**Veterinary radiobiology**" are presented in the Appendix to this Work Program of the discipline.

* - Assessment Materials and a Point Rating System are formed based on the requirements of the relevant local regulatory act of the RUDN.

DEVELOPER:

Associate professor, candidate of agricultural
sciences

Position, Basic curriculum

Signature

Gurina R.R.

Full name.

HEAD OF THE DEPARTMENT:

Department Technosphere safety

Name Basic Curriculum

Signature

Plyushikov V.G.

Full name.

HEAD OF THE HIGHER EDUCATION PROGRAM:

Director of the Department of Veterinary Medicine

Position, Basic curriculum

Signature

Vatnikov Yu.A.

Full name