NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
Department of Physiology of Vertebrates and Pharmacology

APPROVED

Veterinary Medicine Faculty
«4 » VI 2025

CURRICULUM OF ACADEMIC DISCIPLINE

«Veterinary toxicology»

Area of knowledge 21 Veterinary Medicine

Specialty 211 – «Veterinary Medicine»

Academic programme «Veterinary Medicine»

Faculty of Veterinary Medicine

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Description of the discipline «Veterinary toxicology»

Veterinary toxicology is a science that studies poisons that cause or can cause diseases of domestic, domestic and wild animals, birds, fish and useful insects (etiology), their mechanism of action (pathogenesis), stages of chemical and biochemical transformations in the body (biotransformation), ways and terms of absorption, accumulation in organs and tissues and excretion from the body (toxicokinetics), pathoanatomical changes, development of methods of diagnosis, treatment and prevention of poisoning and rules of veterinary and sanitary examination of livestock products. Also, the toxicological characteristics of combat poisons are currently being updated.

Academic degree, specialty, academic programme	
Educational degree	*Master's*
Specialization	*211 «Veterinary medicine»*
Academic program	*«Veterinary medicine»*
Characteristics of the discipline	
Type	*Compulsory*
Total number of hours	*120*
Number of ECTS credits	*4*
Number of content modules	*3*
Form of assessment	*Semester test*
Indicators of the course for full-time form of study	
Course (year of study)	4
Semester	8
Lecture classes	*30 hr.*
Laboratory classes	*30 hr.*
Individual assignments	*60 hr.*
Number of weekly classroom hours for the full-time form of study	*4 hr.*

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

The knowledge acquired by students for studying the discipline "Veterinary Toxicology" will be needed for mastering other disciplines at the Faculty of Veterinary Medicine and in the future for the professional activity of a veterinary medicine doctor.

Task. After completing the course, the student should have a clear idea of:

- principles of therapeutic decision-making (choice of appropriate drugs, assessment of benefits and risks from the use of drugs, monitoring of the course of therapy);

- study of the nature, action and definition of poisons, including poisonous plants, treatment of poisoning; identification and mechanisms of action of toxic elements, including toxic plants; diagnosis, treatment and prevention of toxicosis; basics of toxicity testing;

- study of policy formation and implementation at the local, national, regional and international levels through legislation, regulation and operational strategy; relevant state policy on veterinary medicine, human and animal health;

- study of clinical cases and instructions, so that the student can professionally carry out the reception of the patient and the corresponding physical examination: study the complete story of the client, based on clinical considerations, make differential and final diagnoses, establish diagnoses, develop treatment plans; communicate effectively with the client, colleagues, support staff, both verbally and in writing;

- careful use of veterinary drugs;

- sources and main properties of poisonous substances of plant, chemical, microbial and animal origin;

- general patterns of toxicokinetics (absorption, biotransformation, accumulation and excretion of poisons);

- pathogenesis (toxic dynamics) of animal poisoning;

- principles of diagnosis, treatment and prevention of poisoning;

- rules of veterinary and sanitary examination of livestock products in case of poisoning.

As a result of studying the academic discipline, the student should know:

- the main parameters of toxicometry of poisonous substances; classification of pesticides by production purpose;

- hygienic classification of pesticides according to toxicity parameters;

- physical and chemical properties of poisonous substances; ways of entry of poisonous substances into the body of animals and their toxicokinetics;

- the mechanism of the toxic effect of poisonous substances on the animal body;

- clinical signs and characteristic pathological-anatomical changes due to animal poisoning;

- rules for sampling feed and food material for chemical and toxicological studies;

- basic principles of diagnosis of animal poisoning;

- means of general and special (antidote) therapy;

- rules of veterinary and sanitary examination in case of animal poisoning.

be able:

- use appropriately known veterinary drugs;

- explain and apply in practice the concept of the period of elimination of drugs from the body, to prevent the ingress of drug residues into products of animal origin

intended for human consumption; know where to find relevant and relevant information on this issue;

- be able to apply medicines and biological agents appropriately to ensure the safety of the food chain and the environment;
- qualified diagnosis using modern chemical and toxicological research methods;
- treat animals in case of poisoning;
- carry out veterinary and sanitary evaluation of products obtained from animals that have suffered poisoning;
- to develop, organize and carry out animal poisoning prevention measures;

Acquisition of competencies:

Integral competence (IC):

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

General competencies (GC):

GC 2. Ability to apply knowledge in practical situations.

GC 7. Ability to conduct research at the appropriate level.

GC 9. Ability to make informed decisions.

GC 12. Efforts to preserve the environment.

Professional (special) competencies (PC):

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

PC 6. Ability to select, pack, fix and send samples of biological material for laboratory research.

PC 7. Ability to organize and conduct laboratory and special diagnostic studies and analyze their results.

PC 8. Ability to plan, organize and implement measures for the treatment of animals of various classes and species suffering from non-contagious, infectious and invasive diseases.

PC 13. The ability to develop strategies for the prevention of diseases of various etiologies.

First day competencies

1. Act in a way that shows understanding of the ethical and legal framework within which veterinarians should work, including professional-, animal welfare-, client-, public health-, societal- and environmental -related aspects

2. Understand scientific research methods, the contribution of basic and applied research to science and implementation of the 3Rs principle (Replacement, Reduction, Refinement)

3.Promote, monitor and contribute to maintaining health and safety of oneself, patients, clients, colleagues and the environment in the veterinary setting; demonstrate knowledge about the principles of quality assurance; apply principles of risk management in practice

8 Work effectively as a member of a multi-disciplinary team in the delivery of services and recognise the contribution of all team members

9 Be able to review and evaluate literature and presentations critically Вміти критично мислити, здійснювати перегляд та оцінку літератури та презентацій

10 Understand and apply principles of One Health to ensure veterinary Good Clinical Practice, and research-based and evidence-based veterinary medicine

11 Demonstrate ability to critically analyse evidence, cope with incomplete information, deal with contingencies, and adapt knowledge and skills to varied scenarios and contexts

12 Use of professional capabilities to contribute to the advancement of veterinary knowledge and the One Health concept, in order to promote the health, safety and welfare of animals, people and the environment, as well as the United Nations Sustainable Development Goals

16 Obtain an accurate and relevant history of the individual animal or animal group, and its/their husbandry and environment

19 Develop appropriate treatment plans and administer treatment in the interests of the animals under their care with regard to the resources available and to appropriate public health and environmental considerations

22 Collect, preserve and transport samples, select appropriate diagnostic tests, interpret and understand the limitations of the test results

24. Use basic diagnostic equipment and carry out an examination effectively as appropriate to the case, in accordance with good health and safety practice and current regulations. Understand the contribution of digital tools and artificial intelligence in veterinary medicine

28 Report suspected adverse reactions through the appropriate channel

29 Recommend and evaluate protocols for biosecurity, and apply these principles correctly

38 Advise on and implement preventive and eradication programmes appropriate to the disease and species, in line with accepted animal health, animal welfare, public health and environmental health standards

Expected learning outcomes (ELO):

ELO 3. To determine the essence of physico-chemical and biological processes that occur in the body of animals in normal and pathological conditions.

ELO 4. Collect anamnestic data during registration and examination of animals, make decisions regarding the choice of effective methods of diagnosis, treatment and prevention of animal diseases.

ELO 7. Formulate conclusions regarding the effectiveness of selected methods and means of keeping, feeding and treating animals, prevention of contagious and non-contagious diseases, as well as production and technological

processes at enterprises for keeping, breeding or exploiting animals of various classes and species.

ELO 15. Know the rules of storage of various pharmaceuticals and biological preparations, ways of their enteral or parenteral use, understand the mechanism of their action, interaction and complex action on the animal body.

2. Program and structure of the course

Names of content modules and topics	Number of hours			
	Total	including		
		Lect.	Lab.	Indep.
Module 1.				
Definition, content, tasks and objects of veterinary toxicology. The concept of poisons and poisoning. Parameters of toxicology of poisonous substances. Classification of poisonous substances. General scheme and order of chemical and toxicological research	4	2	2	
Toxicodynamics and toxicokinetics. Diagnosis and prevention of poisoning. Treatment of animals for poisoning	2	2		
Toxicological characteristics of organophosphorus compounds and organochlorine compounds	26	2	4	20
Modular control	**2**		**2**	
Total for content module 1	**34**	**6**	**8**	**20**
Module 2.				
Toxicological characteristics carbamic acid derivatives and phenoxy acid	4	2	2	
Toxicological characteristics of derivatives of phenol, dipyridylium, formaldehyde and cyanides	4	2	2	
Toxicological characteristics of compounds, containing mercury and lead	4	2	2	
Toxicological characteristics of compounds, containing copper and arsenic	4	2	2	
Toxicological characteristics of synthetic pyrethroids, neonicotinoids, zoocides and fluoride. Chlorine and its compounds.	24	2	2	20
Modular control	**2**		**2**	
Total for content module 2	**48**	**10**	**18**	**20**
Module 3.				

Toxicological characteristics feed additives. Toxicological characteristics of urea and ammonium salts. Phytotoxicoses. Classification of poisonous plants. Toxicological characteristics of plants that accumulate nitrates and nitrites	6	4	2	
Toxicological characteristics of plants, containing alkaloids	4	2	2	
Toxicological characteristics of plants, containing glycosides of various groups, coumarins, oxalates, photosensitizing substances, ether oils	6	2	4	
Mycotoxicosis of animals. Mycotoxin-producing fungi and their distribution. Influence of mushrooms and their metabolites on feed quality. Biological effect of mycotoxins on the animal body. Classification of mycotoxicosis. Characteristic aspergillus and penicillin toxicosis. Characteristics of fusariotoxicosis. Mycotoxicoses of other groups	6	4	2	
Toxicological characteristics of combat poisons substances	22	2		20
Modular control	**2**		**2**	
Total for content module 3	**44**	**12**	**12**	**20**
Total hours	**120**	**30**	**30**	**60**

3. Topics of lectures

No.	Topic	Hours
1	Definition, content, tasks and objects of veterinary toxicology. The concept of poisons and poisoning. Parameters of toxicology of poisonous substances. Classification of poisonous substances. General scheme and order of chemical and toxicological research	2
2	Toxicodynamics and toxicokinetics. Diagnosis and prevention of poisoning. Treatment of animals for poisoning	2
3	Toxicological characteristics of organophosphorus compounds and organochlorine compounds	2
4	Toxicological characteristics carbamic acid derivatives and phenoxy acid	2
5	Toxicological characteristics of derivatives of phenol, dipyridylium, formaldehyde and cyanides	2
6	Toxicological characteristics of compounds, containing mercury and lead	2
7	Toxicological characteristics of compounds, containing copper and arsenic	2
8	Toxicological characteristics of	2

	synthetic pyrethroids, neonicotinoids, zoocides and fluoride. Chlorine and its compounds.	
9	Toxicological characteristics feed additives. Toxicological characteristics of urea and ammonium salts. Phytotoxicoses. Classification of poisonous plants. Toxicological characteristics of plants that accumulate nitrates and nitrites	4
10	Toxicological characteristics of plants, containing alkaloids	2
11	Toxicological characteristics of plants, containing glycosides of various groups, coumarins, oxalates, photosensitizing substances, ether oils	2
12	Mycotoxicosis of animals. Mycotoxin-producing fungi and their distribution. Influence of mushrooms and their metabolites on feed quality. Biological effect of mycotoxins on the animal body. Classification of mycotoxicosis. Characteristic aspergillus and penicillin toxicosis. Characteristics of fusariotoxicosis. Mycotoxicoses of other groups	4
13	Toxicological characteristics of combat poisons substances	2

4. Topics of laboratory classes

№	Topic title	Hours
1.	**Module 1.** General scheme and order of chemical and toxicological research	2
2.	Toxicological characteristics of organophosphorus compounds and organochlorine compounds	4
3.	***Modular control (Colloquium №1)***	2
4.	**Module 2.** Toxicological characteristics carbamic acid derivatives and phenoxy acid	2
5.	Toxicological characteristics of derivatives of phenol, dipyridylium, formaldehyde and cyanides	2
6.	Toxicological characteristics of compounds, containing mercury and lead	2
7.	Toxicological characteristics of compounds, containing copper and arsenic	2
8.	Toxicological characteristics of synthetic pyrethroids, neonicotinoids, zoocides and fluoride. Chlorine and its compounds.	2
9.	***Modular control (Colloquium №2)***	2
10.	**Module 3** Toxicological characteristics feed additives. Toxicological characteristics of urea and ammonium salts. Phytotoxicoses. Classification of poisonous plants. Toxicological characteristics of plants that accumulate nitrates and nitrites	2
11.	Toxicological characteristics of plants, containing alkaloids	2
12.	Toxicological characteristics of plants, containing glycosides of various groups, coumarins, oxalates, photosensitizing substances, ether oils	2

13.	Mycotoxicosis of animals. Mycotoxin-producing fungi and their distribution	2
14.	***Modular control (Colloquium №3)***	***2***

5. Topics for self-study

№	Topic title	Hours
1.	Toxicological characteristics of organophosphorus compounds and organochlorine compounds	20
2.	Toxicological characteristics of synthetic pyrethroids, neonicotinoids, zoocides and fluoride. Chlorine and its compounds.	20
3.	Toxicological characteristics of combat poisons substances	20

6. Methods of assessing expected learning outcomes:

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

7. Teaching methods:

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

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

8.1. Distribution of points by types of educational activities

Topic	Results	Assessment
Module 1		
Topic 1. Definition, content, tasks and objects of veterinary toxicology. The concept of poisons and poisoning. Parameters of toxicology of poisonous substances. Classification of poisonous substances. General scheme and order of chemical and toxicological research	Know the subject and objectives of veterinary toxicology. Understand the concepts of poisons and poisoning, parameters of toxicology of poisonous substances, general scheme and order of chemical and toxicological research.	Up to 10 point for the essay; up to 10 point for the laboratory work
Topic 2 Toxicodynamics and toxicokinetics. Diagnosis and prevention of poisoning. Treatment of animals for poisoning	Know the basics of toxicodynamics and toxicokinetics.	Up to 10 point for the essay

	Understand the principles of diagnosis and prevention of poisoning, treatment of animals for poisoning	
Topic 3 Toxicological characteristics of organophosphorus compounds and organochlorine compounds	Know the toxicological characteristics of organophosphorus and organochlorine compounds.	Up to 10 point for the essay Up to 30 points for the laboratory and independent work
Modular control. Colloquium 1	Use the acquired knowledge when doing tasks	Up to 30 points for the tests
Module 2		
Topic 4 Toxicological characteristics carbamic acid derivatives and phenoxy acid	Know the toxicological characteristics of derivatives of carbamic acid and phenoxy acid	Up to 2 points for the essay, up to 10 points for the laboratory work
Topic 5 Toxicological characteristics of derivatives of phenol, dipyridylium, formaldehyde and cyanides	Know the toxicological characteristics of derivatives of phenol, dipyridylium, formaldehyde and cyanides	Up to 2 points for the essay, up to 10 points for the laboratory work
Topic 6 Toxicological characteristics of compounds, containing mercury and lead	Know the toxicological characteristics of compounds, containing mercury and lead	Up to 2 points for the essay, up to 10 points for the laboratory work
Topic 7 Toxicological characteristics of compounds, containing copper and arsenic	Know the toxicological characteristics of compounds, containing copper and arsenic	Up to 2 points for the essay, up to 10 points for the laboratory work
Topic 8 Toxicological characteristics of synthetic pyrethroids, neonicotinoids, zoocides and fluoride. Chlorine and its compounds.	Know the toxicological characteristics of synthetic pyrethroids, neonicotinoids, zoocides and fluoride, chlorine and its compounds.	Up to 2 points for the essay, up to 10 points for the laboratory work, up to 10 points for the independent work
Modular control. Colloquium 2	Use the acquired knowledge when doing tasks	Up to 30 points for the tests
Module 3		
Topic 9 Toxicological characteristics feed additives. Toxicological characteristics of urea and ammonium salts. Phytotoxicoses. Classification of poisonous plants. Toxicological characteristics of plants that accumulate nitrates and nitrites	Know the toxicological characteristics of urea and ammonium salts. Know the phytotoxicoses, classification of poisonous plants. Know toxicological characteristics of plants that accumulate nitrates and nitrites	Up to 5 points for the essay, up to 10 points for the laboratory work
Topic 10 Toxicological characteristics of plants,	Know the toxicological characteristics of plants,	Up to 3 points for the essay, up to 10

containing alkaloids	containing alkaloids	points for the laboratory work
Topic 11 Toxicological characteristics of plants, containing glycosides of various groups, coumarins, oxalates, photosensitizing substances, ether oils	Know the toxicological characteristics of plants, containing glycosides of various groups, coumarins, oxalates, photosensitizing substances, ether oils	Up to 4 points for the essay, up to 10 points for the laboratory work
Topic 12 Mycotoxicosis of animals. Mycotoxin-producing fungi and their distribution. Influence of mushrooms and their metabolites on feed quality. Biological effect of mycotoxins on the animal body. Classification of mycotoxicosis. Characteristic aspergillus and penicillin toxicosis. Characteristics of fusariotoxicosis. Mycotoxicoses of other groups	Know the mycotoxin-producing fungi and their distribution. Understand the influence of mushrooms and their metabolites on feed quality and biological effect of mycotoxins on the animal body. Know the classification of mycotoxicosis, characteristic aspergillus and penicillin toxicosis, fusariotoxicosis and mycotoxicoses of other groups	Up to 5 points for the essay.Up to 10 points for the laboratory work
Topic 13 Toxicological characteristics of combat poisons substances	Know the toxicological characteristics of combat poisons substances	Up to 3 points for the essay, up to 10 points for the independent work
Modular control. Colloquium 3	Use the acquired knowledge when doing tasks	Up to 30 points for tests
Total in the semester		**70**
Test		**30**
Total for the course		**100**

8.2 Scale for assessing student's knowledge

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

8.3 Assessment policy

Deadlines and exam retaking rules	works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
Academic integrity rules	cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used

Attendance rules	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids

- e-learning course of the discipline *(https://elearn.nubip.edu.ua/course/view.php?id=4522);*
- lectures and presentations (in electronic form);
- textbooks, manuals, tutorials;
- guidelines for studying a discipline by full-time and part-time students;
- internship programmes of the discipline (if included in the curriculum).

10. Recommended sources of information

1. Veterinary toxicology: a course of lectures / I.M. Derkach, Dukhnytsky V.B., Boiko H.V., Ischenko V.D. – Kyiv : Comprint, 2023. 200 p.
2. Guidelines for laboratory classes of the discipline «Veterinary Toxicology» / I. M. Derkach, V. B. Dukhnytsky, G. B. Boyko, V. D. Ishchenko. – Kyiv : NULES of Ukraine, 2024. – 124 p.
3. Ветеринарна токсикологія: підручник / О.Т. Куцан [та ін.]. 2-ге видання, доповнене і перероблене, Видання присвячено 125-річчю Національного університету біоресурсів і природокористування України 100-річчю кафедри фармакології. - Київ : Видавничий центр НУБіП України, 2022. 413 с.
4. Ветеринарна мікотоксикологія : навч. посіб. / В. Б. Духницький та ін. - Київ: Компринт, 2015. 272 с.
5. Veterinary pharmacology / Dukhnicky V., Derkach I., Vosnuk T. - Київ : Видавничий центр НУБіП України, 2019. 286 с.
6. Fundamentals of prescription writing / I.M. Derkach – Kyiv : Comprint, 2022. 128 p.
7. Ветеринарна фармакологія: підручник / Хмельницький Г.О., Духницький В.Б. – Київ : Видавничий центр НУБіП України, 2017. 571 с.
8. Аптечний практикум (навчальний посібник для лабораторних занять з дисципліни «Ветеринарна фармакологія» для студентів ОС «Бакалавр» та «Магістр» / В.Б. Духницький, І.М. Деркач – Київ: ЦП Компринт, 2017, 162 с.
9. Сучасна фармакологічна термінологія у ветеринарній медицині/ В.Б. Духницький, І.М. Деркач – К.: ЦП Компринт, 2017, 202 с.
10. Довідник з ветеринарної фармакології / В.Б. Духницький, І.М. Деркач, В.Д. Іщенко, О.К. Гальчинська – Київ : ЦП «Компринт», 2019. 232 с.
11. Державна фармакопея України. Перше видання. – Х.: РЕРІГ, 2002. Ветеринарні препарати / О.І. Канюка, І.І. Харів, В.М. Гунчак, Д.Ф. Гуфрій. – Львів, 2006. 641 с.
12. Comparative and Veterinary Pharmacology / Cunningham F., Elliott J., Lees P. Springer Heidelberg Dordrecht London New York, 2010. 351 p.
13. Handbook of Veterinary Pharmacology / Walter H. Hsu. - Wiley-

Blackwell, 2008. 564 p.
14. Pharmacology / Franklin A. Ahrens. - Williams&Wilkins, 1996. 313 p.
15. Ветеринарно-санітарна експертиза з основами технології і стандартизації продуктів тваринництва / О.М. Якубчак та ін. - Київ: Біопром, 2005. 799 с.
16. Гудков І.М., Духницький В.Б., Радченко А.М. Військова ветеринарна радіобіологія і токсикологія. Київ: Аграр Медіа Груп, 2014. 498 с.
17. Державне підприємство «Науковий центр превентивної токсикології, харчової та хімічної безпеки імені академіка Л.І. Медведя Міністерства охорони здоров'я України». URL: http://medved.kyiv.ua/
18. Дудник С.В., Євтушенко М.Ю. Водна токсикологія: основні теоретичні положення та їхнє практичне застосування: монографія. Київ: Вид-во Українського фітосоціологічного центру, 2013. 297 с.
19. Духницький В.Б., Бойко Г.В., Іщенко В.Д. Отруєння тварин Т-2 токсином: монографія. Київ: Компринт, 2018. 572 с.
20. Духницький В.Б., Іщенко В.Д., Базака Г.Я. Отруєння курейнесучок моспіланом РП (ацетаміпридом) та актарою WG (тіаметоксамом): монографія. Київ: ФОП Ямчинський О.В., 2019. 188 с.
21. Ніженковська І.В., Вельчинська О.В., Кучер М.М. Токсикологічна хімія. Київ: Медицина, 212. 372 с.
22. Система контролю якості кормів та продукції тваринництва за показниками вмісту мікотоксинів: наук.-метод. рекомен. / Хмельницький Г.О., Духницький В.Б., Бойко Г.В., Іщенко В.Д. Київ: НАУ, 2006. 28 с.
23. Blackwell's Five-Minute Veterinary Consult Clinical Companion: Small Animal Toxicology 2nd Edition. Wiley-Blackwell, 2016. 992 p.
24. Blackwell's Five-Minute Veterinary Consult Clinical Companion: Equine Toxicology 1st Edition, Kindle Edition. Wiley-Blackwell, 2021. 552 p.
25. Concepts and Applications in Veterinary Toxicology: An Interactive Guide. Springer, 2020. 367 p.
26. Gupta C. R. Biomarkers in toxicology: 2nd Edition / Academic Press, 2019. 1246 p.
27. Gupta C. R. Veterinary Toxicology: Basic and Clinical Principles: 3rd Edition / Academic Press, 2018. 1238 p.
28. Marques Patricia Veterinary Toxicology. Delve Publishing, 2019. 491 p.
29. Handbook of comparative veterinary pharmacokinetics and residues of rescities and environmental contaminants [Електронний ресурс] // Veterinary books – Режим доступу до ресурсу: https://books.google.com.ua/books?id=nNbXUFMiD4AC&printsec=frontcover&hl=ru&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=fals
30. Гострі та невідкладні стани у практиці лікаря. URL: https://urgent.com.ua/en
31. Фармакологія та лікарська токсикологія. URL: https://pharmtox-j.org.ua/index.php/pharmtox-j
32. Ensley M. Toxicology, An Issue of Veterinary Clinics of North America:

Food Animal Practice. Elsevier. URL: Toxicology-Issue-Veterinary-Clinics-America-
ebook/dp/B08M446J7D/ref=sr_1_8?crid=1HYN868WTW31A&keywords=Veterinary+Toxicology&qid=169970

33. Dukhnitsky, V., **Derkach, I.,** Plutenko, M., Fritsky, I., & Derkach, S. (2019). Acute toxicity of the iron clathrochelate complexes. Regulatory Mechanisms in Biosystems, 10(3), 276–279. doi:10.15421/021942

34. Dukhnitsky, V.B., **Derkach, I.M.,** Derkach, S.S., Fritsky, I.O., & Plutenko, M.O. (2019). Chronic toxicity of the Iron (IV) clathrochelate complexes for white rats. Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Veterinary sciences, 21(95), 15–21. doi: 10.32718/nvlvet9503

35. Духницький В. Б., **Деркач І. М.,** Деркач С. С., Фрицький І. О., Плутенко М. О. Кумулятивні властивості клатрохелату феруму(IV) в організмі щурів. Вісник ПДАА. 2019. № 2. С. 238−245. doi: 10.31210/visnyk2019.02.32

36. Dukhnitsky, V. B., **Derkach, I. M.,** Derkach, S. S., Fritsky, I. O., Plutenko, M. O., & Lozovy, V. M. (2020). Investigation of the irritant effects and allergenic properties of the Iron(IV) clathrochelate complexes. Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Veterinary sciences, 22(97), 130–135. doi: 10.32718/nvlvet9721

37. Iron(IV) hexahydrazide clathrochelate complexes: the chronic toxicity study (2020) V.B. Dukhnitsky, L.H. Kalachniuk**, I.M. Derkach,** S.S. Derkach, I.O. Fritsky, M.O. Plutenko Ukrainian Journal of Ecology, 18-23, doi: 10.15421/2020_3