

Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Veterinary Medicine
Department of Internal Medicine, Pharmacy and Biochemistry

Work program (syllabus) of the educational component

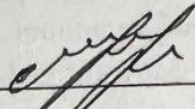
Organic Chemistry with Clinical Biochemistry (mandatory)

Specialty	H6 Veterinary medicine
Educational program	Veterinary medicine
Level of higher education	Second Master's level of higher education

Розробники: _____

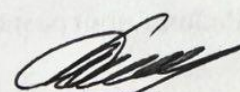
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(прізвище, ініціали) (вчений ступінь та звання, посада)


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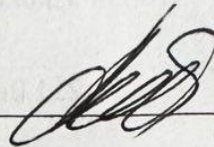
Морозов Б.С., к.вет.н, старший викладач

(прізвище, ініціали) (вчений ступінь та звання, посада)

Розглянуто, схвалено та затверджено на засіданні кафедри внутрішніх хвороб, фармації та біохімії	протокол від 09.06.2025 р. № 17
	Завідувач кафедри  (підпис) Нечипоренко О.Л. (прізвище, ініціали)

Погоджено:

Гарант освітньої програми _____

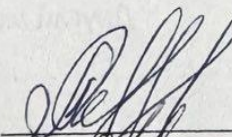
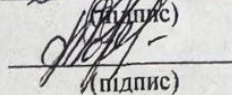

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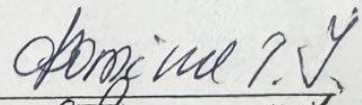
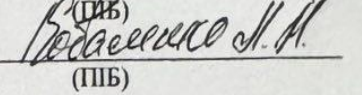
Олександр Чекан
(ПІБ)

Декан факультету, де реалізується освітня програма _____

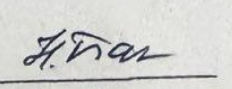
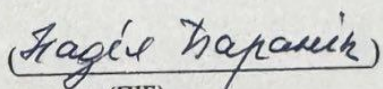
Людмила Нагорна
(ПІБ)

Рецензія на робочу програму надана: _____


(підпис)

(підпис)


(ПІБ)

(ПІБ)

Методист відділу якості освіти,
ліцензування та акредитації _____


(підпис)

(ПІБ)

Зареєстровано в електронній базі: дата: 02.07 2025 р.

Developers: _____

(signature) (last name, initials) (academic degree and title, position)

_____**Morozov B.S., Doctor of Philosophy**
(signature) (last name, initials) (academic degree and title, position)

Reviewed, approved and ratified at a meeting of the Department of Internal Medicine, Pharmacy and Biochemistry	protocol dated 09.06.2025. No. 17
	Manager departments _____ Nechiporenko O.L. (signature) (last name, initials)

Agreed:

Educational program guarantor _____**Halyna RIABENKO**
(signature) (Full name)

Dean of the faculty where the educational program is implemented _____**Liudmyla NAHORNA**
(signature) (Full name)

Review of the work program provided by:

_____	(signature)	(Full name)
_____	(signature)	(Full name)

Methodologist of the Department of Educational Quality, licensing and accreditation _____
(signature) (Full name)

Registered in the electronic database: date: _____2025.

Information on reviewing the work program (syllabus):

Academic year in which changes are made	Number of the appendix to the work program with a description of the changes	Changes reviewed and approved		
		Date and number of the minutes of the department meeting	Head of the Department	Educational program guarantor

1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

1.	Name OK	OK 8.Organic Chemistry with Veterinary Biochemistry		
2.	Faculty/department	Veterinary Medicine/Internal Medicine, Pharmacy and Biochemistry		
3.	Status OK	Mandatory		
4.	Program/Specialty(s) that include OK for	Specialties H6 "Veterinary Medicine"		
5.	OK can be offered for	-		
6.	Semester and duration of study	1st year 2nd semester (weeks 1-15)		
7.	Number of ECTS credits	3		
8.	Total hours and their distribution	Contact work (classes)		
		Lectures	Practical/seminar	Laboratory
	90			150
9.	Language of instruction	English		
10.	Teacher/Educational Component Coordinator	Teacher: PhD, Senior Lecturer Morozov Bogdan Stanislavovych		
11.1	Contact information	Workplace: room 25, veterinary medicine building E-mail: MorozovBS@meta.ua Tel. (066) 3130411 Consultation hours: every Wednesday from 12:00 to 13:00		
11.	General description of the educational component	The educational component includes sections on organic chemistry and veterinary biochemistry, which are necessary for a deep understanding of the essence of biochemical processes that occur in the animal body normally and during pathology of the organism. The subject of this course is chemical laws and reactions that underlie the physiological and biochemical functions of a living organism. The study of the discipline involves students' practical mastery of laboratory methods of research of samples of biological material of animals, the ability to interpret their results and substantiate the established diagnosis.		

12.	Purpose of the educational component	The goal of the introductory course is to master the theoretical and practical foundations of organic chemistry and clinical biochemistry, which will allow the student to form a complex of chemical knowledge and skills aimed at the active formation of professional skills necessary for understanding the peculiarities of the functioning of the animal body.
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13.	Prerequisites for studying OK, connection with other educational components of OP	1. The educational component is based on knowledge of chemistry (terminology, basic laws and concepts, atomic structure, types of chemical bonds), physics (understanding the basic laws of chemical reactions), and experimental techniques (knowledge of chemical glassware, concentrations). 2. The educational component is the basis for the OK "Veterinary pharmacology of medicinal and poisonous plants", "Veterinary toxicology", "Clinical and laboratory diagnostics of animal diseases", "System of analysis of hazardous factors and control at critical points"
14.	Academic Integrity Policy	Compliance with academic integrity for higher education applicants involves: independent completion of educational tasks, tasks of current and final control of learning outcomes; references to sources of information when using ideas, statements, and information; compliance with copyright legislation; provision of reliable information about the results of one's own educational or scientific activities. Violations of academic integrity when studying the OC "Organic Chemistry with Clinical Biochemistry" are considered: academic plagiarism, academic fraud (copying, cheating, passing off someone else's work as your own), use of electronic devices during the final knowledge control For violation of academic integrity, students may be held accountable for the following academic responsibilities: Academic plagiarism– score 0, re-execution of the task. Academic fraud– cancellation of points received; re-taking the assessment; re-performing work not completed independently; Use of electronic devices during the final knowledge test– suspension from work, score 0, re-passing the final control
15.	Keywords	https://cdn.snau.edu.ua/moodle/course/view.php?id=2065 hydrocarbons (alkanes, alkenes, alkynes, arenes), isomerism (structural, spatial, optical), functional groups, halogen derivatives, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, esters, amides, nitro compounds, amino acids, peptide bond, proteins: structure and properties, carbohydrates: mono-, di-, polysaccharides, lipids: fats, fatty acids, phospholipids, heterocyclic compounds, animal metabolism, enzymatic reactions, liver, kidney, pancreatic enzymes, nitrogen metabolism (residual nitrogen, urea), dysproteinemia, hypoproteinemia, glycemia (hypo-, hyper-), ketosis, acidosis, alkalosis

2. LEARNING OUTCOMES BY EDUCATIONAL COMPONENT AND THEIR RELATIONSHIP WITH PROGRAM LEARNING OUTCOMES

Learning outcomes for OK: After studying the educational component, the student is expected to be able to...	Program learning outcomes that the OC aims to achieve (indicate the number according to the numbering given in the OP) ¹				How is the DRN assessed?
	PRN2	PRN4	PRN9	PRN15	
DRN 1. Understand the chemical nature of physiological processes in the animal body involving organic substances, which determines their subordination to basic chemical laws	x				Interactive testing to check the assimilation of theoretical material, exam
DRN 2. Establish the relationships between the chemical and biological processes that occur in the animal body normally and pathologically.		x			Taking a comprehensive written test, exam
DRN 3. Be able to use laboratory equipment and chemical reagents in compliance with the rules for their safe storage and use when conducting specialized research				x	Protection of laboratory reports
DRN 4. Formulate conclusions, recommendations, advice on the maintenance, feeding and treatment of animals or establish a diagnosis based on the results of laboratory tests			x		Defense of laboratory reports, exam

¹Must comply with the Matrix of ensuring program learning outcomes by the relevant components of the educational program, indicated for mandatory educational components of OP I and II levels, for all (mandatory and selective OK) OP III

3. CONTENT OF THE EDUCATIONAL COMPONENT (COURSE PROGRAM)

[illegible]

alcohols by their dehydration, from halogen derivatives. Chemical properties of alkenes. Addition reaction: halogens, hydrogen halides, water. Reaction with aromatic hydrocarbons. Oxidation reaction – Wagner. Preparation of esters. Polymerization reactions. Acetylene hydrocarbons. Alkynes.General characteristics. SP – hybridization of the carbon atom. The structure of acetylene from an electronic point of view. The nomenclature is rational and systematic. Preparation of compounds with a triple bond: from carbide, from dihalogen derivatives. Addition, substitution, di- and trimerization reactions. Application in industry. Laboratory work No. 2.Extraction and study of saturated and unsaturated hydrocarbons Aromatic hydrocarbons. Arenes.Features of the structure of the benzene molecule. Aromaticity, Hückel's rule. Nomenclature: ortho, meta, para positions. Preparation of aromatic compounds. Wurtz-Fittig reaction, dehydrogenation of carbocyclic compounds. Physical properties. Chemical properties. Substitution rule; orientants of the first and second kind. Nitration, halogenation, oxidation reactions. Laboratory work No. 3.Obtaining and studying the properties of aromatic compounds. Laboratory work No. 4.Study of the properties of halogenated hydrocarbons.			2	4	2,3,4,7,10
			2		5.11
			2	4	
			2		5,6,11
Topic 3. Oxygen-containing organic compounds Alcohols.Functional group. Classification of alcohols. Saturated monohydric alcohols. Nomenclature: radical, systematic, carbinal. General methods of preparation: from halogen-containing, from unsaturated, by reduction of carbinals. Physical properties. Chemical properties. Substitution of the hydroxyl group by halogen, reaction with acids (production of esters), intermolecular and intramolecular dehydration. Use of monohydric alcohols. Dihydric	2		2		2,3,4,7

alcohols. Production. Physical and chemical properties. Laboratory work No. 5. Extraction and study of the properties of alcohols.			2	2	
Phenols. Phenol and its derivatives: Structure, isomerism, nomenclature. Methods of preparation. Physical and chemical properties of phenol: reactions of the functional group and the benzene ring. Polycondensation of phenol and methanal. Phenol-formaldehyde resins and their applications. Concept of di- and triatomic phenols. Laboratory work No. 6. Phenol and its derivatives			2	4	5.10 2,3,4,6,7
Aldehydes and Ketones. Definition. Electronic structure of the carbonyl group. Methods of preparation. Physical properties. Chemical properties: addition reactions of hydrogen, hydrogen cyanide, sodium hydrogen sulfide, with phosphorus halides, oxidation, aldol and croton condensations. Individual representatives. Their applications. Laboratory work No. 7. Preparation and study of the properties of aldehydes and ketones.			2	4	5.10 2,3,4,6,6,7,11
Carboxylic acids and their functional derivatives. Classification of acids. Monobasic saturated carboxylic acids, structure of the carboxyl group. Nomenclature. Production. Physical properties. Chemical properties: reactions involving hydrogen of the carboxyl group, reactions involving the OH- group. Functional derivatives of carboxylic acids, esters, halogen anhydrides, anhydrides, acid amides. Their preparation and the most important properties. Higher carboxylic acids. Individual representatives: palmitic, oleic, stearic, acids, their structure. Fats. Composition. Structure. Difference between solid fats and liquid and oily fats. Chemical properties: saponification, hydrogenation, rancidity of fats, soap. Hydroxy acids. Nomenclature. Methods of preparation. Chemical properties. The most important oxyacids, glycolic, lactic, malic, tartaric, citric acid. Phenoloxo acids: salicylic acid and its esters.			2	4	5.10 2,3,4,6,7,11

Laboratory work No. 8. Monobasic and polybasic carboxylic acids and their derivatives.			2		5.10
Topic 4. Carbohydrates Monosaccharides. Classification of monosaccharides by the number of carbon atoms, by the main functional group. Optical isomerism (D- and L-isomers); α - β - forms. Structure of monosaccharides of the Fisher and Hayworth formula. Extraction, physical and chemical properties. Distribution in nature. The importance of monosaccharides for living organisms. Disaccharides. The structure of disaccharides according to Fisher and Hayworth. Reducing disaccharides (maltose, lactose), non-reducing (sucrose, trehalose). The meaning of disaccharides. Laboratory work No. 9. Chemical properties of mono- and disaccharides Polysaccharides. The structure of the most important polysaccharides (starch, cellulose). Methods of production. Physical and chemical properties of polysaccharides. Starch is an important food polysaccharide. Laboratory work No. 10. Chemical properties of polysaccharides.	2		2	2	2,3,4,6,7,8,11
			2	4	5.10
				4	
			2		5.10
Topic 5. Nitrogen-containing organic compounds Amins. Classification of amines by radical structure (aliphatic, aromatic, heterocyclic). Acyclic amines. Classification (primary, secondary, tertiary), nomenclature. Preparation by the Hoffmann reaction, reduction of nitro compounds. Chemical properties: salt formation, alkylation reaction, acylation. Reaction with nitrous acid. Aromatic amines. Nomenclature. Preparation of amine (Zinin reaction). Chemical properties of aniline: reaction of the amino group (alkylation, diazotization). Azo dyes. Laboratory work No. 11. Amines. Amino acids Amino acids. Nomenclature and isomerism of amino acids. Methods of preparation. Classification: monoaminocarboxylic acids,	2			4	2,3,4,6,7,11
			2		5.10
			2	4	2,3,4,6,7

[illegible]

Topic 8. Carbohydrate and lipid metabolism, their disorders in pathologies of internal organs	2			4	1,8,9,12
Disturbances in the digestion and absorption of carbohydrates in pathologies of internal organs. Features of carbohydrate digestion in ruminants and its disorders in rumen acidosis. Intermediate carbohydrate metabolism and its changes in pathologies of the liver and pancreas. Diagnosis of carbohydrate metabolism disorders. Determination of glucose in blood plasma (serum) by glucose oxidase enzymatic method) and express method (glucometer)			2		
Disturbances in lipid digestion and absorption in pathologies of internal organs in monogastric and ruminant animals. Ketogenesis and lipid peroxidation and its disorders. Diagnosis of lipid metabolism disorders. Determination of total lipids and cholesterol in animal blood serum			2		
Topic 9. Clinical biochemistry in disorders of macro-, microelements and vitamin metabolism	2			12	1,8,9,12
Macroelement metabolism in pathologies of internal organs. Biochemical methods for diagnosing macroelementosis (deficiency or excess of Ca, P, Mg, K, Na). Diagnosis of macroelement metabolism disorders. Determination of calcium and inorganic phosphorus content in blood serum and clinical interpretation of the results obtained			2		
Microelement metabolism in pathologies of internal organs. Biochemical methods for diagnosing microelementosis. Diagnosis of microelement metabolism disorders. Determination of copper, zinc, iron, manganese, cobalt and selenium in animal blood serum and clinical interpretation of the results obtained			2		
Clinical biochemistry for fat-soluble vitamin metabolism disorders. Diagnosis of vitamin metabolism disorders. Determination of vitamin A content in blood serum and interpretation of the obtained results. Determination of vitamin E content in blood serum and interpretation of the			2		

obtained results			2		
Determination of vitamin E content in blood serum and interpretation of the results obtained			2		
Biochemical aspects of water-soluble vitamin metabolism disorders and methods of their diagnosis. Disorders of water-electrolyte metabolism in the animal body.					
Total				150	

4. TEACHING AND LEARNING METHODS

DRN	Teaching methods(work that will be carried out by the teacher during classroom lessons, consultations)	Number of hours	Teaching methods(what types of learning activities should the student perform independently)	Number of hours
DRN 1. Understand the chemical nature of physiological processes in the animal body involving organic substances, which determines their subordination to basic chemical laws	<i>Explanatory and reproductivemethods:</i> lecture, story-explanation, conversation, aimed at identifying the value-oriented content of the educational material (in the context of professional tasks) Using the platformMOODLE, PADLET, ZOOM during blended learning.	20	working with textbooks, manuals, Internet materials; illustration, demonstration, performing experiments, exercises, didactic tasks, independent work, etc.	20
DRN 2. Establish the relationships between the chemical and biological processes that occur in the animal body normally and pathologically.	<i>Partial search methods:</i> problem-dialogical, modeling, case method, etc. <i>Inductive methods</i> -related to predicting observations and experiments based on experience data Using the platformMOODLE, Google Meet, ZOOM during blended learning.	20	independent search for educational information, performance of laboratory work of partial search content, complex didactic tasks and tasks.	20
DRN 3. Be able to use laboratory equipment and chemical reagents in compliance with the rules for their safe storage and use when conducting specialized research	<i>Visual methods</i> —demonstration of experiments <i>Practical methods</i> —work with reagents, laboratory glassware and instruments in compliance with safety regulations.	18	Preparation for laboratory work, execution and preparation of a report on the results of laboratory work	18
DRN 4. Formulate conclusions,	<i>Deductive methods</i> – related to the	18	Reading literature on the topic, preparing for a	16

recommendations, advice on the maintenance, feeding and treatment of animals or establish a diagnosis based on the results of laboratory tests	formulationgeneral provisions, formulas, laws and their application to specific tasks. <i>Inductive methods</i> -related to predicting observations and experiments based on experience data		laboratory session, performing and writing a report on the results of laboratory work	
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5. EVALUATION BY EDUCATIONAL COMPONENT

5.1.Diagnostic assessment (indicated as needed)

5.2.Summative assessment

5.2.1. To assess the expected learning outcomes, there are

No.	Summative assessment methods	Points / Weight in the overall score	Date of compilation
1.	Preparation of a comprehensive written control	(3x15) points /45%	7, 10, 14 weeks
2.	Laboratory work report	25 points / 25%	until 14-15 weeks
3.	Final control: exam	30 points / 30%	Exam week

5.2.2. Evaluation criteria

Component ²	Unsatisfactorily	Satisfactorily	Good	Perfectly ³
Preparation of a comprehensive written thematic control (3 papers)	<5 points A shortened condition of the problem has been drawn up, reaction equations and formulas are missing	5-8 points A shortened problem statement was drawn up, calculations were performed only using the ready-made formula	9-12 points The necessary formulas of substances and reaction equations are given, the solutions to the problems contain errors.	13-15 points The tasks are completed in full, the presentation is logical and rational, the conclusions and generalizations are well-reasoned.
Laboratory work report	<5 points the main content of the material is not presented, conclusions and generalizations are lacking	6-15 points There are gaps in the presentation of the material, the presentation is not systematized, the conclusions and generalizations are poorly argued, and there are errors in them.	16-22 points There are minor shortcomings in the presentation of the material, the presentation is not sufficiently systematized, and there are some inaccuracies in the conclusions and generalizations.	23-25 points the material is presented in full, the presentation is logical, the conclusions and generalizations are well-reasoned
Final control: exam	<14 points Ticket issues not resolved	15-20 No more than two tasks are revealed	21-26 No more than three tasks revealed	27-30 Three tasks are revealed and a practical solution is proposed.

²Specify the summative assessment component

³Indicate the distribution of points and the criteria that determine the level of assessment

5.3. Formative assessment:

To assess current progress in learning and understand areas for further improvement,

No.	Elements of formative assessment	Date
1	Interactive testing to check the mastery of lecture material	10 minutes at the beginning of the lab session
2	Checking individual homework, discussion with the teacher and self-correction of the work done by students	Within a week after execution
3	Survey and oral comments from the teacher on its results	weekly
4	Verification of the results of experiments for laboratory work with feedback	Within a week after execution

6. LEARNING RESOURCES (LITERATURE)

6.1 Main sources

5.3.1. Textbooks and manuals

1. Veterinary clinical biochemistry: textbook / V.I. Levchenko et al. ed. V.I. Levchenko and V.V. Vlizla. 2nd ed., revised and supplemented. Bila Tserkva, 2019. 416
2. Organic Chemistry / Snitynskyi V.V., Fedevich E.V., Solovodzinska I.E., Shkumbatyuk R.S., Vishchur O.I. — Lviv: SPOLOM, 2016. — 300 p.
3. Organic chemistry. Practical course: a teaching aid for agricultural students of III-IV levels of accreditation in the specialties "Veterinary medicine", "Zooengineering", "Agronomy" / O. I. Kononsky. - K.: Higher school, 2002. - 248 p.
4. Biochemistry. Workshop/ L.I. Ostapchenko, I.V. Kompanets, O.V. Skopenko and others. – Kyiv: Publishing and Printing Center *Kyiv University*, 2018.- p.296
5. Biochemistry short course. Part 1. / Z.M. Skorobagatova, M.A. Stashkevych, A.G. Matvienko. – Biokompozit, 2021. – 148 p.
6. **Analytical Chemistry: A Toolkit for Scientists and Laboratory Technicians**, 2nd Edition (2024) Authors: Bryan M. Ham, Aihui MaHam, Wiley Focus: a comprehensive guide for laboratories - methods, techniques, safety, instrumental approaches.
7. **Basics of Analytical Chemistry and Chemical Equilibria: A Quantitative Approach**, 2nd Edition (2023) Author: Brian M. Tissue, Wiley Focus: fundamental principles, calculations, chemical equilibrium for analysts.
8. **Bioinorganic Chemistry: A Short Course, 3rd Edition** Author: Rosette M. Roat-Malone, Wiley Publishing, January 2020Description: A compact, modern introduction to bioinorganic chemistry - metal-ligand interactions in biology, enzymatic mechanisms, physicochemical approach

5.3.2. Methodological support

9. **Morozov B.S.**Bioinorganic and analytical chemistry. Methodological guidelines for conducting laboratory and practical classes. Methodological guidelines for students of the Faculty of Veterinary Medicine of the full-time form of Sumy. 2023. – 33 p.
10. **Morozov B.S.**Bioorganic and analytical chemistry "Methodological instructions for conducting laboratory work". Methodological instructions for students of the Faculty of Veterinary Medicine of the full-time form of Sumy. 2023. – 25 p.
11. **Morozov B.S.**Biological Chemistry. Part 1. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2024.39 p.
12. **Morozov B.S.**Biological Chemistry. Part 2. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2024.35 p.
13. **Morozov B.S.**Biological Chemistry. Part 3. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2025.36 p.
14. **Morozov B.S.**Biological Chemistry. Part 4. Methodological guidelines for conducting practical classes for students of the Faculty of Veterinary Medicine of full-time study for the educational degree 'Master' of Sumy. 2025. 40with.

5.4. Additional sources

15. Kravchenko M.Y., Ivchenko V.D. Organic chemistry: methodological instructions for performing laboratory work for 1st year students of specialties 211 "Veterinary medicine", 212 "Veterinary hygiene, sanitation and expertise" of the educational degree "master". – Sumy, 2021. – 36 p.
16. Kravchenko M.Y., Ivchenko V.D. Organic Chemistry. Methodological instructions for independent study of the module "Theoretical foundations of organic chemistry" by 1st year students of specialties 211 "Veterinary medicine" and 212 "Veterinary hygiene, sanitation and expertise" of the educational degree "master" - Sumy: SNAU, 2021. - 37 p.
17. Kravchenko M.Y., Ivchenko V.D. Organic chemistry. Part 1. Hydrocarbons: lecture notes for 1st year students of specialties 211 "Veterinary medicine", 212 "Veterinary hygiene, sanitation and expertise" of the educational degree "master". – Sumy, 2021. – 51 p.

6.2. Software

Software(to support distance learning (Moodle), Zoom, Google Meet, etc.)