FACULTY OF PHARMACY

STUDY PROGRAM 0916.1 PHARMACY

CHAIR OF GENERAL CHEMISTRY

APPROVED
at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum faculty of Pharmacy
Minutes No. 4 of 06.06.2019

Chairman, PhD, associate professor

Uncu Livia _____

APPROVED
at the Council meeting of the Faculty of Pharmacy
Minutes No. 4 of 07.06.2019

Dean of Faculty, PhD, associate professor

Ciobanu Nicolae _____

APPROVED
approved at the meeting of the chair of
General chemistry
Minutes No 15 of 04 June 2019
Head of chair, PhD, associate professor

Cheptanaru Constantin _____

SYLLABUS

DISCIPLINE **THE CHEMISTRYOF VEGETAL AND ANIMAL PRODUCTS**

Integrated studies

Type of course: **Optional discipline**

Chisinau, 2019

I. INTRODUCTION

- **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of theprofessional / specialty training program**

  The curriculum *The Chemistry of vegetal and animal products* a pharmacist qualification is a normative pedagogical document and a didactic tool for the efficient organization of the educational process, elaborated on the basis of the Framework Program for Pharmaceutical Higher Education in the Republic of Moldova and based on the Charter of the State University of Medicine and Pharmacy "NicolaeTestemitanu", rules of higher education studies, based on the National Credit Studies System, no. 1/8 of 06.04.2017, rules for evaluation and academic performance in State University of Medicine and Pharmacy "NicolaeTestemitanu", no. 5/4 of 12.10.2016, coordinated with the curriculum of pharmaceutical subjects (pharmaceutical chemistry, pharmaceutical biochemistry, drug technology, pharmacology and clinical pharmacy).

- **Mission of the curriculum (aim) in professional training**

  To form concepts of classification, chemical structure, distribution in nature of natural organic compounds and their interconnection as metabolic activity of natural compounds of plant and animal nature. To develop the interest in knowledge and research of biological systems, drugs, for the scientific interpretation of the theoretical and real phenomena that accompany them.

- Languages of the course**:** Romanian, English

- Beneficiaries: students of the 2ndyear, faculty of Pharmacy

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		**S.04.A.047**	
Name of the discipline		**The chemistry of vegetal and animal products**	
Person(s) in charge of the discipline		Ph.D in chem., assistant prof. Constantin Cheptanaru, Lector Elena Globa	
Year	**II**	Semester/Semesters	**III**
Total number of hours, including:			**60**
Lectures	**10**	Practical/laboratory hours	**-**
Seminars	**20**	Self-training	**30**
Clinical internship			
Form of assessment	**DC**	Number of credits	**2**

III. TRAINING AIMS WITHIN THE DISCIPLINE

At the end of the discipline study the student will be able to:

- ***at the level of knowledge and understanding:***
  - to know, from chemical, structural and functional point of view the main classes of compounds in the body: water, hydroxy-, oxo- and α-aminoacids, peptides and proteins, vitamins, carbohydrates, lipids, nucleotides, terpenoids and steroids.
  - to know the structure, properties and importance of organic compounds of vegetal and animal origin - simple and complex lipids, terpenoids, steroids, alkaloids and their synthetic analogs.
  - to know the most important chemical transformations that take place in biological processes both in the vegetal and animal world.
  - to understand the structural and functional concept of the main classes of natural organic compounds and their interconnection with the metabolic activity of the natural compounds.
- ***at the application level:***
  - to determine the belonging of natural organic compounds to the classes of polyheterofunctional organic compounds and to represent graphically the structural, stereochemical and conformational formulas of organic compounds, types of stereoisomers.
  - toapply the characteristic reactions of monofunctional organic compounds to the identification and chemical transformation of polyheterofunctional organic compounds.
- ***at the integration level:***
  - to appreciate the importance of chemical transformations of natural polyheterofunctional organic compounds to explain metabolic processes
  - to explain the pharmacological properties of organic substances according to their structure.

IV. PROVISIONAL TERMS AND CONDITIONS

Curriculum - organic chemistry.
Skills - for the good grasp of the course, students must have the ability to understand, learn and apply theoretical notions. Students should have the ability to make correlations between taught notions, between course and both practical and interdisciplinary. Thorough knowledge of the organic chemistry of natural compounds: hydroxy-, oxo- and α-amino acids, peptides and proteins, vitamins, carbohydrates, nucleotide lipids, terpenoids and steroids.
Student of the second year should possess:
• knowledge of the language of instruction;
• digital competences (use of the Internet, document processing, electronic tables and presentations, use of graphic programs);
• ability to communicate and work in team;
• qualities - tolerance, compassion, autonomy.

V. THEMES AND ESTIMATE ALLOCATION OF HOURS

Lectures, practical hours/ laboratory hours/seminars and self-training

No. d/o	THEME	Number of hours		
		Lectures	Practical hours	Self-training
1.	Classification and nomenclature of natural polyheterofunctional organic compounds, hydroxy-, oxo- and α-aminoacids, peptides and proteins, vitamins, carbohydrates, lipids, nucleotides, terpenoids and steroids and their spreading in nature.	1	3	5
2.	Natural hydroxy- and oxo-acids participating in biological processes in nature. Main chemical reactions of the tricarboxylic acid cycle (Crebs Cycle).	1	3	5
3.	Carbohydrates chemistry. Classification and spreading in nature. Monosaccharides, di- and polysaccharides, aminomonosaccharides and heteropolysaccharides. Main chemical reactions of glycolysis and energy balance of glycolysis.	2	4	5
4.	Proteinogenic amino acids, structure and classification. Physical and chemical properties of proteinogenicaminoacids, biological transformations. Peptides and proteins. Primary structure; establishment of the primary structure and chemical synthesis of the peptides.	2	3	5
5.	Lipids, structure and classification. Simple (neutral) lipids, properties and biological function. Complex lipids, phosphatides, sphingolipids, glycolipids. Biological structure and function.	2	4	5
6.	Terpenoids (classification, structure, biological functions, synthesis); Steroids (classification, structure, biological functions, synthesis);	2	3	5
Total		**10**	**20**	**30**

VI. REFERENCE OBJECTIVES OF CONTENT UNITS

Objectives	Content units
Chapter 1. Natural polyheterofunctional organic hydroxy-, oxo- and α-amino acids, peptides and proteins, carbohydrates.	
• to define the notions of hydroxyacid, oxo acid, proteinogenic amino acid, monosaccharides, di- and polysaccharides. • to know the particularities of the chemical reactivity of the hydroxy-, oxo- and amino acid hetero-functional compounds, polyhydroxyaldehydes and polyhydroxy-ketones (monosaccharides, di- and polysaccharides). • to demonstrate the chemical reactions of -hydroxy, oxo- and amino acids, monosaccharides, di- and polysaccharides), explaining their metabolic transformations • to apply the knowledge about the reactivity of the heterofunctional compounds to explain the peculiarities of the chemical behavior of these compounds in their metabolic transformations. • to integrate the knowledge gained in the field with the needs of other disciplines in the field of biochemistry and drug chemistry.	Hydroxyacids and natural oxoacids, the spread in nature and their transformations in metabolic reactions. Reactions of the Crebs Cycle. α-Aminoacid proteins, the main reactions used in peptide synthesis and biologically important reactions. The role of dioxyphosphate in the decarboxylation and transamination of α-amino acids. Monosaccharides, di- and polysaccharides as representatives of natural biopolymers and their biological role. Getting metabolic reactions. Reactions of glycolysis.
Chapter 2. Simple and complex lipids, nucleotides, terpenoids, steroids.	
• to define the notions of nucleosides, nucleotides, nucleic acids, hydrolyzable and non-hydrolyzable lipids, terpenoids, steroids. • to know the chemical reactions that explain the metabolic properties and metabolic transformations of lipids, nucleotides, terpenoids and steroids. • to demonstrate the principle of the chemical structure of polynucleotide chains, complementary bases, triacylglycerols, phospholipids, terpenoids and steroids. • to apply the accumulated knowledge to describe the biosynthesis of fatty acids, lipids, terpenoids and steroids. • to integrate the knowledge gained in the field with the needs of other disciplines in the field of biochemistry and drug chemistry.	Nucleoside mono- and nucleoside polyphosphates. Nucleotide coenzymes: ATP, NAD^+, $NADP^+$, FAD. Their structure and importance. The role of ATP in the biosynthesis of peptides and proteins. Hydrolysable lipids - simple and complex Biosynthesis concepts of fatty acids, triacylglycerides and phospholipids. Non-hydrolysable lipids - terpenoids and steroids. Particularities of the terpene and carotenoid structure as isoprenic derivatives. Structure and classification of steroids. Biosynthesis of some steroids.

VII. PROFESSIONAL (SPECIFIC (SC)) AND TRANSVERSAL (TC) COMPETENCES AND STUDY OUTCOMES

✓ Professional (specific) (SC) competences

PC1.The knowledge of the disciplines theoretical bases included in the faculty curriculum, general principles in the design, formulation, preparation and conditioning of pharmaceutical and para-pharmaceutical products.

PC2.Basic theoretical knowledge in the field of natural organic compounds - structures and functions of the main classes of biochemical compounds (carbohydrates, lipids, proteins, vitamins, hormones, minerals, etc.), metabolism (energetic, carbohydrates, lipids)

PC3.The ability to apply in the professional activity the acquired theoretical knowledge.

PC4.Adoption of messages in various socio-cultural environments, including through multi-language communication, use of problem solving capabilities through interdisciplinary correlation with other fundamental and specialized subjects: analytical chemistry, pharmaceutical chemistry, pharmacognosis, biochemistry, etc., the development of the bibliographic documentation and the synthesis of the obtained information.

✓ Transversal competences (TC)

TC1.Obtaining moral markers, forming professional and civic attitudes, allowing students to be honest, non-conflictive, cooperative, available to help people interested in community development;

TC2.to know and apply ethical principles related to medical-pharmaceutical practice; recognize a problem when it comes out and provide solutions that are responsible for solvingit.

TC3.Using knowledge and skills in new contexts. Openness for continuous education, autonomy and responsibility, observance of professional ethics.

- **.Study outcomes**

• chemical, structural and functional knowledge of the main constituent classes of plant and animal products: peptides and proteins, carbohydrates, lipids, nucleotides, terpenoids and steroids.

• knowing the specificities of the chemical reactivity of the heterofunctionalhydroxy-, oxo- and amino acid compounds, polyhydroxyaldehydes and polyhydroxy-ketones (monosaccharides, di- and polysaccharides)

• applying the knowledge regarding the reactivity of the heterofunctional compounds to explain the peculiarities of the chemical behavior of these compounds in their metabolic transformations.

• applying accumulated knowledge to describe the biosynthesis of fatty acids, lipids, terpenoids and steroids.

VIII. STUDENT'S SELF-TRAINING

No.	Expected product	Implementation strategies	Assessment criteria	Implementation terms
1.	Working with information sources	Read lecture or course material in the subject carefully. Read questions on the subject, which require a reflection on the subject. To get acquainted with the list of additional information sources on the topic. Select the source of additional information for that theme. Reading the text entirely, carefully and writing the essential content. Wording of generalizations and conclusions regarding the importance of the theme / subject	Ability to extract the essentials; interpretative skills; the volume of work	During the semester
2.	Working with the problem book	Problem solving in the subject of laboratory work.	Volume and accuracy of solved problems.	During the semester
3.	Report	Analysis of relevant sources on the topic of the paper. Analysis, systematization and synthesis of information on the proposed theme. Compilation of the report in accordance with the requirements in force and presentation to the chair.	The quality of systematization and analysis of the informational material obtained through its own activity. Concordance of the information with the proposed theme.	During the semester

IX. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

- ***Teaching and learning methods used***

The discipline of C*hemistry of vegetal and animal products* is taught in classical ways: lectures, practical works. At the lectures, the theoretical course will be read by the course holders. Students acquire chemical, structural and functional knowledge of the main classes of constituents of plant and animal products: peptides and proteins, carbohydrates, lipids, nucleotides, terpenoids and steroids.

- ***Applied teaching strategies / technologies*** *(specific to the discipline)*

To succeed in the discipline of *Chemistry of vegetal and animal products*, the student should actively work both in courses and seminars, as well as in his own right, and the teacher should use the didactic technologies specific to the discipline. The most important methods in teaching organic chemistry are *problematization and brainstorming.*

Brainstorming is a technique of group creativity designed to generate a large number of ideas to solve a problem.

Problematization called and teaching through problem solving or, more specifically, teaching through productive problem solving. A didactic method consisting in putting in the minds of the students some deliberately created difficulties in overcoming which, by their own effort, the student learns something new.

- ***Methods of assessment*** *(including the method of final mark calculation)*

Current: front and / or individual control via

1. solving problems / exercises,
2. analysis of case studies
3. current quiz.

Final*:*

Differentiated colloquium (semester III).

The final grade at the differentiated colloquium in the third semester will be made up of the average grade from one current quiz, the grid test and the oral test.

The topics for the differential colloquium are approved at the department meeting and are brought to the attention of the students with at least one month until the session.

Method of mark rounding at different assessment stages

Intermediate marks scale (annual average, marks from the examination stages)	National Assessment System	ECTSEquivalent
1,00-3,00	**2**	**F**
3,01-4,99	**4**	**FX**
5,00	**5**	**E**
5,01-5,50	**5,5**	
5,51-6,0	**6**	
6,01-6,50	**6,5**	**D**
6,51-7,00	**7**	
7,01-7,50	**7,5**	**C**
7,51-8,00	**8**	
8,01-8,50	**8,5**	**B**
8,51-8,00	**9**	
9,01-9,50	**9,5**	**A**
9,51-10,0	**10**	

The average annual mark and the marks of all stages of final examination (computer assisted, test, oral) - are expressed in numbers according to the mark scale (according to the table), and the final mark obtained is expressed in number with two decimals, which is transferred to student's record-book.

Absence on examination without good reason is recorded as "absent" and is equivalent to 0 (zero). The student has the right to have two re-examinations.

X. RECOMMENDED LITERATURE:

A. Compulsory:

1. ZURABYAN S.E. *Fundamentals of bioorganic chemistry*. GEOTAR-Media publishing group, 2017.
2. STEVEN S. ZUMDAHL. *Chemistry.*Lexington, Massachusetts, Toronto, 1986.
3. FRANCIS MARION MILLER. *Chemistry, Structureanddynamics.*McGraw-Hill book company, USA., 1984.
4. ТЮКАВКИНА Н.; БАУКОВ Ю. *Биоорганическаяхимия.* М.: “Медицина”, 2011.
5. NENIŢESCU C. D. *Chimie organică.* B.: “Regia Autonomă Monitorul Oficial”, 2015.

B. Additional

1. NENIŢESCU C. D. *Chimie organică.* B.: “Regia Autonomă Monitorul Oficial”, 2015.
2. БЕЛОБОРОДОВ В. Л.; ЗАРУБЯН С. Э.; ЛУЗИН А. П.; ТЮКАВКИНА Н. А. *Органическая химия.* М.: „Дрофа”, 2008.
3. VERONICA DINU, Eugen Truția, Elena Popa, Aurora Popescu. Biochimie medicală, mic tratat. Editura medicală, București, 1998.