SYLLABUS OF THE EDUCATIONAL COMPONENT
BIOLOGICAL CHEMISTRY
for applicants for higher education of 2-3 year of study full-time form of education
of educational program "Pharmacy",
in specialty "226 Pharmacy, Industrial Pharmacy"**,**
field of knowledge "22 Public Health"

training for Master`s (second) level of higher education

TEACHER

Senyuk Igor Valerievich **citochrom@gmail.com**

Galyzinskaya Lubov Valerievna **ljubvgaluzinskaja@ukr.net**

1. **The name of higher education establishment and department:** National University of Pharmacy, Department of Biological chemistry and Veterinary medicine.

2. **Address of the department:** Kharkiv, Kulikivska str., 12, ground floor, т. 057-706-30-99.

3. **Web site of the department:** https://biochem.nuph.edu.ua/?lang=en

4. **Information about teachers:**

Senyuk Igor

PhD, associated professor of the Department of Biological chemistry and Veterinary medicine of National University of Pharmacy. Experience of scientific and pedagogical work – 30 years. He teaches courses “Biological Chemistry”, “Functional Biochemistry”. Research interests: study of mechanisms of pathogenesis and ways of correction of hepatobiliary system.

Galyzinskaya Lubov

PhD, Associate Professor of the Department of Biological Chemistry and Veterinary Medicine of the National University of Pharmacy. Experience of scientific and pedagogical work – 23 years. She teaches courses: "Biological Chemistry", "General Biochemistry and Molecular Biology", "Biochemistry", "Functional Biochemistry", "Environmental Biochemistry". Research interests: biochemistry, pharmacology, clinical biochemistry.

5. **Consultations:** every Wednesday 13:00-14:00 (Senyuk Igor), every Thursday 13:00-14:00 (Galyzinskaya Lubov).

6. **Brief summary of the educational component:** the educational component “Biological Chemistry” Module 2 include in compulsory subjects for specialty 226 "Pharmacy, Industrial Pharmacy", educational program "Pharmacy" for applicants for higher education at the 3rd year of study in 5th semester. Final control – semester credit, semester exam (Note! Educational component “Biological Chemistry” Module 1 supposed to be at the 2nd

year of study in the 4th semesters. Final control – semester credit).

7. The purpose statement of studying the educational component: the formation of concepts of: structure biochemical functions about the of compounds that make up living organisms and the relationship with their; the formation of a modern understanding of the principles of the structural organization of the main classes of biomacromolecules – proteins, nucleic acids, etc.; formation of knowledge of the patterns of release, accumulation and energy consumption in biological systems; the formation of knowledge about the main metabolic pathways in the body, their interrelation and molecular mechanisms of regulation; formation of knowledge of the molecular basis of the transfer of genetic information, protein biosynthesis and mechanisms oftheir regulation; acquaintance with modern methods of biochemical diagnostics of the state of body metabolism;the formation of the skills of scientific analysis and synthesis of phenomena and facts observed; providing a theoretical basis for the study of other biomedical disciplines: pharmacology, pharmacotherapy with pharmacokinetics, clinical pharmacology, and individual pharmaceutical disciplines.

8. Competences in accordance with the educational program: conducting lectures and practical classes for a better understanding of topics.

Hard-skills / Professional (special) competences (PC):

PC 4 The ability to ensure the rational use of prescription and nonprescription medications and other products of the pharmacy assortment in accordance with physico-chemical, pharmacologic characteristics, biochemical, pathophysiological characteristics of a particular disease and pharmacotherapeutic schemes of its treatment.

9. The program learning outcomes: (PLO):

PLO 14 Determine advantages and disadvantages of medicinal products of various pharmacologicalgroups, taking into account their chemical, biopharmaceutical, pharmacokinetics and pharmacodynamic properties.

PLO 16 Determine the influence of factors affecting the processes of absorption, distribution, deposition, metabolism, and excretion of the medicinal product and are determined by the condition, features of the human body, and the physicochemical properties of medicinal products.

PLO 18 Choose biological objects of analysis, determine xenobiotics and their metabolites in biological environments and evaluate the results obtained taking into account their distribution in the body.

10. Status of the educational component: *compulsory*.

11. Prerequisites of the educational component: "Biological Chemistry" as educational component is based on students′ knowledge of inorganic, analytic, physical and colloid, organic chemistry, botany, physiology and microbiology, and is integrated with such disciplines; supplies students with basic information on clinical biochemistry, laboratory diagnostics, biotechnology, pharmacology that supposes certain integration of teaching with these disciplines and formation of skills to apply knowledge on biochemistry in the process of further education and in professional activity.

12. The volume of the educational component: The study of the educational component (Module 2) is given 90 hours, 3 ECTS credits. Of these, 8 lecture hours, 36 hours of practical classes, 23.5 hours for independent work and 22.5 hours for the semester exam.

13. Organization of training:

Content of the educational component:

MODULE 1. GENERAL METABOLIC PATHWAYS IN THE CELLS
Content Module 1. Structure and functions of biomolecules
Topic 1. Amino Acids, Peptides, and Proteins. Tree-dimensional Structure of Proteins. Physical-chemical Properties of Proteins.
Topic 2. Conjugated Proteins: Hemoproteins, Glycoproteins, Proteoglycans, Lipoproteins, Metalloproteins, Phosphoproteins. Nucleoproteins and Nucleic Acids. Structure, Functions, Biological Role.
Topic 3. Enzymes. Structure. Classification and Functions. Vitamins as Coenzymes. Kinetics of Enzymatic Reactions. Mechanism of action. Specificity and Regulation of Enzyme Activity.
Content module control CM1.
Content Module 2. The major metabolic pathways
Topic 4. Introduction into Metabolism. High-energy Bond Compounds and ATP Synthesis. Citric Acid Cycle. Biological Oxidation. Regulation of Energetic Processes in the Cell. Other Types of Oxidations.

Topic 5. Carbohydrate Metabolism: Carbohydrate Structure, Digestion and Absorption. The Major Pathways of Carbohydrate Metabolism and its Regulation. Carbohydrate Metabolism Disorders.
Topic 6. Lipid Metabolism: Lipid Structure, Digestion and Absorption. The Major Pathways of Lipid Metabolism and its Regulation. Lipid Metabolism Disorders.
Topic 7. Protein Digestion and Amino Acid Absorption. Amino acid Putrefaction in Intestine and Detoxication its Products. General Amino Acid Pathways and their Regulation. Ammonium Detoxication. Specific Pathways of Amino Acid Metabolism and its Disorders.
Content module control CM2.
Semester Supervision of Module 1
MODULE 2. METABOLISM AND ITS REGULATION
Content Module 3. Fundamentals of molecular biology
Topic 8. Conjugated proteins metabolism. Metabolism of nucleotides and nucleic acids. Metabolism of Hemoproteins.
Topic 9. Transfer of Genetic Information. Protein Bio-synthesis in the Cell. Mechanisms of ProteinBiosynthesis Regulation. Antibiotics.
Content module control CM3.
Content Module 4. Some metabolic processes
Topic 10. Vitamins. Nomenclature and Classification of Vitamins, Chemical Structure and Vitamin`sAction Molecular Basis. Vitamin Deficiency.
Topic 11. Biochemical bases of reception. Mechanisms of signal transmission inside the cell. General characteristics and classification of hormones and neuro-transmitters. Mechanisms of action of hormones. Endocrine dysfunction and their pharmacocorrection.
Topic 12. Liver biochemistry. Biochemical transformation of drugs in the body. Pharmaceutical Biochemistry.
Content module control CM4.
Semester Supervision of Module 2
Semester Exam

14. Forms and types of academic achievements supervision:

Progress supervision: the types of control are listed (oral survey, writing test tasks, solving situational (problems, etc.)
Supervision of content modules: the types of tests are listed (oral survey, preparation of test tasks, solution of situational problems, etc.)
Semester exam: types of tests are listed (answers to theoretical questions, writing test tasks, solving situational problems, etc.)
Semester control form: semester credit, semester exam.
Conditions for admission to the supervision of content modules: for admission to the supervision of content module 2, it is necessary to have a minimum number of points for the topics of content module 1, for the supervision of content module 1.
Conditions for admission to semester supervision: a current rating of more than 60 points, absence of missed laboratory, practical and seminar classes, fulfillment of all requirements stipulated in the work program of the educational component.

15. Evaluation system of the educational component:

The results of semester supervision in the form of a semester exam are evaluated according to the ECTS scale, a 100-point scale and a four-point scale ("excellent", "good", "satisfactory", "unsatisfactory").

Points from the educational component are calculated according to this ratio:

Types of evaluation	**Maximum number of points (% of the number of points per module – for content modules)**
Module 1	
Content module 1: ***Structure and functions of biomolecules*** - *evaluation of topics (1-3) (work in classes 1-10): work in classes (oral survey, writing test tasks, solving situational problems);* - *supervision of content module 1 (writing test tasks, solving situational tasks)*	*50 (50 %)*
Content module 2: ***The major metabolic pathways*** - *evaluation of topics (4-7) (work in classes 11-20): work in classes (oral survey, writing test tasks, solving situational problems);* - *supervision of content module 2 (writing test tasks, solving situational tasks)*	*50 (50 %)*

Semester Supervision of Module 1	*100*
Types of evaluation	**Maximum number of points (% of the number of points per module -for content modules)**
Module 2	
Content module 3: *- evaluation of topics (8-9) (work in classes 1-3): workin classes (oral survey, writing test tasks, solving situational problems);* *- supervision of content module 3 (writing test tasks)*	*40 (40 %)*
Content module 4: *- evaluation of topics (10-12) (work in classes 4-9): work in classes (oral survey, writing test tasks, solving situational problems);* *- supervision of content module 2 (writing test tasks, solving situational tasks)*	*60 (60 %)*
Semester Supervision of Module 2	*100*
Semester Exam	*100*

The individual work of applicants for higher education is evaluated during the progresssupervision and during the content module supervision

16. Academic policies of the educational component:

Academic Integrity Policy. It is based on the principles of academic integrity stated in the POL "On measures to prevent cases of academic plagiarism at the National University of Pharmacy". Cheating during the evaluation of an applicant for higher education during supervision activities in practical (seminar, laboratory) classes, supervision of content modules and the semester exam is prohibited (including the use of mobile devices). Abstracts must have correct text references to the used literature. The detection of signs of academic dishonesty in the student's written work is a reason for the teacher notto credit it.

Class attendance policy. An applicant for higher education is obliged to attend classes (POL "On the organization of the educational process of the National University of Pharmacy") according to the schedule (https://nuph.edu.ua/rozklad-zanyat/), to observe ethical norms of behavior.

Policy regarding deadlines, working out, rating increase, liquidation of academic debts. The completionof missed classes by an applicant for higher education is carried out in accordance with the POL "Regulations on the completion of missed classes by applicants and the procedure for eliminating academic differences in the curricula of the National University of Pharmacy" in accordance with the schedule for working out missed classes established by the department. Increasing the rating and liquidating academic debts from the educational component is carried out by the applicants in accordancewith the procedure specified in the POL "On the procedure for evaluating the results of training of applicants for higher education at the National University of Pharmacy ". Applicants of higher education are obliged to comply with all deadlines set by the department for the completion of written works from the educational component. Works that are submitted late without valid reasons are assessed at a lower grade - up to 20% of the maximum number of points for this type of work.

Policy on appeals of evaluation of the educational component (appeals). Applicants for higher education have the right to contest (appeal) the evaluation of the educational component obtained during control measures. The appeal is carried out in accordance with the POL "Regulations on appealing the results of the final supervision of knowledge by applicants of higher education at the National University of Pharmacy".

17. Information and educational and methodical support of the educational component:

The main reading suggestions	Biological chemistry : textbook for the self-training of higher education student / V. M. Kravchenko, G. B. Kravchenko, O. A. Krasilnikova, I. V Seniuk. – Independent electronic edition. – Kharkiv : National University of Pharmacy, 2023. – 392 p.
Supplementary reading suggestions for in-depth study of theeducational component	1. Lieberman M., Marks A. Marks' basic medical biochemistry: a clinical approach. – Lippincott Williams & Wilkins, a Wolters Kluwer business., 2009. – 1011p. 2. Bhagavan N.V., Chung-Eun H. Essentials of medical biochemistry: withclinical cases. – ELSEVIER Inc., 2011. – 581p. 3. David M. Nelson and Michael M. Cox Leininger Principles ofBiochemistry, 7th edition, 2017. – 572 p. 4. Biological chemistry: methodical recommendations for organizing self-training work of a higher education student / V. M. Kravchenko, I. V. Seniuk, G. B.

	Kravchenko [et al.] – Kharkiv : NUPh; 2023. – 47 p.
Current electronic information resources (magazines, websites) for in- depth study of theeducational component	1. Department of Biological chemistry and Veterinary medicine Site: http://biochem.nuph.edu.ua/ . 2. NPhU Library: e-mail library@nuph.edu.ua 3. The Medical Biochemistry Page by Michael W. King: https://themedicalbiochemistrypage.org/ 4. Biochemistry Online: An Approach Based on Chemical Logic by Henry Jakubowsky: https://employees.csbsju.edu/hjakubowski/classes/ch331/bcintro/default.html
Moodle distance learning system	for the 2*nd year: https://pharmel.kharkiv.edu/moodle/course/view.php?id=4002 for the 3rd year: https://pharmel.kharkiv.edu/moodle/course/view.php?id=3982

18. Material, technical and software support of the educational component: LabAnalyt SP-V1000 spectrophotometer, aqua distiller Dl-10, LabAnalyt DM 0412 clinical centrifuge, pH meter pH-305, R-Line personal computer with Intel Core i3-8100 processor, Philips 223V5LSB, R-Line workstation with IntelCore i5-7400 processor, EPSON EB-X05 projector, TC-80 thermostats, Application software and online services: a set of services for organising online and distance learning - Google Workspace for Education Standard, licence type – free licence for education, unlimited; software for organising video conferences ZOOM, licence type - free license for education for 1 year with the possibility of extension; modular object-oriented dynamic learning environment MOODLE 3.9.8, licence type - Open Source.