

## SYLLABUS OF THE EDUCATIONAL COMPONENT "CELL BIOLOGY"

for students of higher education 1 course **full-time** forms of education  
educational program "**Pharmacy**"  
specialty "**226 Pharmacy, industrial pharmacy**"  
specialization "226.01 Pharmacy"  
field of knowledge "22 Health care"  
**second (master's)** level of higher education

### TEACHER



**Seniuk Igor Valerievich**

**citochrom@gmail.com**

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, Kulikovska str., 12, ground floor, т. 057-706-30-99.

3. **Web site of the department:** <https://biochem.nuph.edu.ua/en/>

#### 4. **Information about teachers:**

##### **Seniuk Igor**

PhD, associated professor of 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.

5. **Consultations:** take place every Wednesday from 12.05 to 12.50.

6. **Abstract of the educational component:** the educational component "Cell Biology" is aimed at: obtaining holistic ideas about the matrix processes occurring in a living cell; replication, transcription and broadcasting; study at the modern level of knowledge of the structural organization of the most important biopolymers; proteins and nucleic acids; acquaintance with modern enzymology, the structure and functions of enzymes, enzyme systems and their regulation in the cell; study of the main metabolic pathways, bioenergetic mechanisms, the interrelationship of carbohydrate, lipid and protein exchanges in the non-regulatory systems of cell metabolism.

7. **The purpose of teaching the educational component.** The purpose of teaching the selective educational component "Cell Biology" is to form students in-depth basic theoretical knowledge and practical skills about the structure of cells, chemical processes occurring in living cells for use in biotechnology; obtaining basic ideas about the structure and properties of the most important organelles, membranes, the role of their spatial organization in ensuring the specificity of biochemical processes of cells; study of the main metabolic pathways related to energy supply processes and familiarity with the principles of regulation of metabolic processes of cells; to get acquainted with the features of the functioning of germ cells and the features of tumor cells.

## 8. Competencies according to the educational program:

### Soft-skills / General competences

GC 1. The ability to act socially responsibly and civically.

GC 2. Ability to apply knowledge in practical situations, make informed decisions.

ZK 3. Efforts to preserve the environment.

GC 4. Ability to think abstractly, analyze and synthesize, learn and be modernly trained.

GC 5. The ability to show initiative and entrepreneurship.

GC6. Knowledge and understanding of the subject area and understanding of professional activity.

GC 7. Ability to adapt and act in a new situation.

GC 8. The ability to communicate in the state language both orally and in writing, the ability to communicate in a foreign language (mainly English) at a level that ensures effective professional activity.

GC 9. Skills in using information and communication technologies.

GC 10. The ability to choose a communication strategy, the ability to work in a team and with experts from other fields of knowledge/types of economic activity.

GC 11. Ability to evaluate and ensure the quality of performed works.

GC12. Ability to conduct research at the appropriate level.

### Hard-skills

PC 1. The ability to carry out sanitary and educational work among the population for the purpose of prevention of common diseases, prevention of dangerous infectious, viral and parasitic diseases, as well as for the purpose of promoting timely detection and support of adherence to the treatment of these diseases in accordance with their medical and biological characteristics and microbiological features.

PC 3. The ability to provide pre-medical assistance to the sick and injured in extreme situations and emergencies.

PC 19. The ability to apply methods of identification of the condition of the skin and its appendages, to differentiate their features depending on the individual properties of the body, age, gender of the client, etc., to implement technologies for diagnosing the condition of the client's skin in a comprehensive scheme of care for the skin and its appendages and correction of cosmetic defects in conditions cosmetology institution, implement cosmetology care technologies taking into account their features.

## 9. Program learning outcomes:

PLO 1. To carry out professional activities in social interaction based on humanistic and ethical principles; to identify future professional activity as socially significant for human health.

PLO 2. Apply knowledge from general and specialized disciplines in professional activity.

PLO 3. To comply with the norms of the sanitary and hygienic regime and the requirements of safety equipment when carrying out professional activities.

PLO 4. Demonstrate the ability to independently search, analyze and synthesize information from various sources and use these results to solve typical and complex specialized tasks of professional activity.

PLO 7. Perform professional activities using creative methods and approaches.

PLO 8. Carry out professional communication in the state language, use oral communication skills in a foreign language, analyzing specialized texts and translating foreign language information sources.

PLO 9. To carry out professional activities using information technologies, "Information databases", navigation systems, Internet resources, software and other information and communication technologies.

PLO 10. Adhere to the norms of communication in professional interaction with colleagues, management, consumers, work effectively in a team.

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

**11. Prerequisites of the educational component:** having a complete general secondary education with the study of biology and chemistry.

**12. Summary of the educational component:** 90 hours of 3 ECTS credits of the educational component.

**13. Organization of training:**

**The format of teaching the educational component:** giving lectures and holding seminars.

## Content of the educational component

*Content module 1.*

**General ideas about the cell as an elementary unit of life.**

**Cell membranes.**

**Topic 1. Subject and methods of cytological research. Optical systems in biological research.**

Viruses. Prions. The subject and tasks of pharmaceutical biology. Forms of life. Levels of organization of living matter. Methods of biological research. Microscopy.

**Topic 2. Structure and functions of cell membranes. The cell membrane of plants, its chemical composition, structure and functions.**

The main structural components of the cell. Biomembranes: chemical composition, structure and functions. Types of membrane transport and their characteristics. General characteristics of receptors. Intercellular contacts, their classification. Cytoplasm: chemical composition, structure and properties. Structure and functions of double-membrane organelles: mitochondria, plastids.

**Topic 3. Mechanisms of transport of substances through the cell membrane.**

Types of membrane transport. Transport of small particles. Transport of large particles. Active transport. Ion pumps. Passive transport. Simple diffusion. Facilitated diffusion. Osmosis. Osmotic pressure. Water potential of cells. Fick's law. Turgor Endocytosis. Phagocytosis. Pinocytosis.

*Content module 2.*

**Structure, chemical composition and functions of the most important structures  
protoplast**

**Topic 4. General plan of cell structure. Vacuolar system of the cytoplasm.**

Cytoplasm. Chemical composition of cytoplasm. Compartmentalization of cells. Cytosol, its composition and functions. The cytoskeleton is the musculoskeletal system of the cell. Microtubules. Microfilaments. Non-membrane organelles. Membrane organelles. Inclusion. Vacuolar system of the cytoplasm. Cellular center. Ribosomes. Endoplasmic reticulum. Centrioles - their structure and functions. Anabolic cell organoids. Catabolic cell organoids.

**Topic 5. Plastids, their types, structure, chemical composition and functions of chloroplasts.**

**Photosynthesis.**

Plastids and proplastids. Etioplasts. Chloroplasts - structure and functions. Chlorophyll. Endosymbiotic hypothesis of the origin of chloroplasts. Chromoplasts - their structure, functions and difference from chloroplasts.

**Topic 6. Cytoskeleton, its structure and functions. Locomotor structures of the cell: microfilaments, intermediate filaments, microtubules.**

Cytoskeleton, its structure and functions. Three types of locomotory cell structures: intermediate filaments, microfilaments, and microtubules. Intermediate filament proteins: keratins, vimentin, desmin, glial fibrillar protein, peripherin, neurofilament proteins, nuclear lamina proteins.

**Topic 7. Cell nucleus, its structure and functions.**

The main functions of the kernel. The structure of chromatin and chromosomes in prokaryotes and eukaryotes. Structure of nuclear pores. Nuclear lamina. Broadcast device. Two ways of information flow in the kernel. The structure and functions of the outer and inner shell of the nucleus. Nuclear matrix and protein skeleton of the nucleus. General characteristics of the genetic apparatus of cells. Morphology of metaphase chromosomes: acrocentric, metacentric, bodycentric, submetacentric.

*Content module 3.*

**Cell reproduction.**

**Life expectancy and cell pathology.**

**Topic 8. Life cycle of a cell. Mitosis is a way of dividing somatic cells.**

General characteristics of the life cycle of cells. General characteristics of the cell cycle. Periodization of the cell cycle. Differences in the mitotic cycle of the cell. The duration of the cell cycle of different cells. Cell cycle control system. Violation of mitosis.

**Topic 9. Alternative ways of cell division. Direct cell division (amitosis). Endoreproduction, polyteny, polyploidy.**

Characteristics of alternative ways of cell division. Amitosis - direct cell division, its characteristics, causes and biological significance. Characteristics of endomitosis and its stages, causes and biological significance. Characteristics of polytenia and its biological significance. Mechanisms of genomic and chromosomal mutations.

**Topic 10. Meiosis, types of meiosis and their characteristics.**

General characteristics of meiosis and its types. Two main stages of meiosis: meiosis 1 and meiosis 2. Characteristics and chromosomal formula of prophase 1 stages: leptotene, zygotene, pachytene, diplotene and diakinesis. Features and biological significance of metaphase 1 and its chromosomal formula. Features Levels of organization of living matter. Cell research methods. Cellular and non-cellular life forms.

**14. Types and forms of control:**

*Current control:* oral survey, writing test tasks, solving situational (calculation) problems.

*Control of content modules:* oral survey, writing test tasks, solving situational (calculation) problems.

*Semester control form:* semester credit/semester differentiated credit.

*Conditions for admission to control of content modules:* a minimum number of points for the topics and biological significance of anaphase 1 and its chromosomal formula. Features and biological significance of telophase 1 and its chromosomal formula.

**Topic 11. Cell growth and development, cell differentiation. Stem cells.**

Characterization and biological difference between cell growth and development. Peculiarities of cell differentiation and the biological significance of this phenomenon. The concept of cell phenotype. The concept of cell morphogenesis. Differentiation of blood cells and gametes. The concept of cell dedifferentiation. Characteristics of stem cells. The concept of cell potency: pluripotency, totipotency, monopotency. Concept of callus. Modern application of stem cells in medicine, biology, biotechnology.

**Topic 12. Life span of cells in various tissues and organs. Theories of aging.**

General characteristics of the lifespan of cells. Comparison of the lifespan of cells in different tissues and organs of animals and humans. Life span of blood cells, hair, skin, liver, bones, stomach. Cells in the human body that are not renewed. The period of complete renewal of cells in the human body.

**Topic 13. Pathology of cells. Tumor growth. Theories of oncogenesis. Reproductive biotechnology.**

General characteristics of pathology and physiological norm. Concept of pathological process and pathological reaction. Alteration is the trigger of pathology. Characteristics of the types of alteration. Cell pathology in general: dystrophy, necrosis, hypertrophy, atrophy. Pathology of subcellular structures and organelles: lysosomal, peroxisomal and chromosomal diseases. Classification of etiological factors of alteration. Characteristics of tumor growth. Theories of oncogenesis. Characteristics of assisted reproductive biotechnologies: IVF, ICSI, cryopreservation of gametes and embryos.

**Semester control**

(lessons) of the previous content module is required for admission to the control of content modules.

*Conditions for admission to semester control:* the current rating is more than 60 points, the absence of unworked seminar class absences, the fulfillment of all requirements stipulated by the work program of the educational component.

**15. The educational component evaluation system:** The results of semester control in the form of a semester credit are evaluated on a 100-point, undifferentiated scale ("passed", "failed") and on the ECTS scale.

*Points from the educational component are calculated according to the following ratio:*

Types of assessment	Maximum number of points (% of the number of points per module - for content modules)
Content module 1: ... - evaluation of topics (1-3) - (work in classes: oral survey, writing test tasks, solving situational problems; - control of content module 1 (writing test tasks, solving situational problems)	30%

Content module 2: ... - evaluation of topics (4-7) - (work in classes: oral survey, writing test tasks, solving situational problems; control of content module 2 (writing test tasks, solving situational problems)	30%
Content module 3: ... - evaluation of topics (8-13) - (work in classes: oral survey, writing test tasks, solving situational problems; control of content module 3 (writing test tasks, solving situational problems)	40%
Semester control	100%

**The independent work of students of higher education is evaluated during the current control and during the control of the content module.**

**16. Politics of the educational discipline:** The policy of the educational component ("rules of the game") is determined by the requirements of the department to the student of higher education when studying the educational component regarding academic integrity, regarding attending classes, regarding deadlines, working out, increasing the rating, liquidating academic debt, regarding contesting the assessment from the educational component (appeals), etc. .

The policy on academic integrity 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 Ukraine". Writing off when evaluating the success of a student of higher education during control activities in practical classes, control of content modules and semester exams is prohibited (including using 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 not to enroll it.

Class attendance policy. A student of higher education is obliged to attend classes (POL "On the organization of the educational process of the National Academy of Sciences of Ukraine") 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 debt. The completion of missed classes by a student of higher education is carried out in accordance with the POL "Regulations on the completion of missed classes by students and the procedure for eliminating academic differences in the curricula of the National Academy of Sciences" in accordance with the timetable for making up missed classes established by the department.

Increasing the rating and liquidating academic debt from the educational component is carried out by the students in accordance with the procedure specified in the POL "On the procedure for evaluating the results of training of students of higher education at the National Academy of Sciences". 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 assessment from the educational component (appeals). Applicants of 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 semester control of the knowledge of students of higher education at the National Academy of Sciences".

### **17. Informational and educational and methodological support of the educational component:**

<b>The main reading suggestions</b>	1. Medical biology / Ed. V.P. Pishaka, Y.I. Bajors Textbook. Vinnytsia: Nova kniga, 2017. – 608 p.; fig. Medical biology: a textbook (ZNZ I-III n. a.) / Art. Art. Bartsikhovskiy, P. Ya. Sherstyuk. - 4th ed., edition, 2017. – 312 p.; fig.
<b>Supplementary reading suggestions for in-depth study of the educational component</b>	1. Medical biology: a guide to practical classes / O.V. Romanenko, M.G. Kravchuk, V.M. Hrinkevich, O.V. Kostylov. - 2nd edition, 2020, 472 p.

	<p>2. Practicum in medical biology: study guide (university I-III year) / N.O.Salyak - 3rd ed., revised. and added 2017, 296 p.</p> <p>3. Histology: textbook and atlas. With Fundamentals of Cell and Molecular Biology: 8th Edition: in 2 volumes. Volume 1 / Wojciech Pavlina, Michael G. Ross, 2021, 462 p.</p> <p>4. Medical genetics: a textbook (university I-III year) / G.Y.Putintseva. - 2nd ed., revised. and added 2008, 392 p.</p> <p>5. Infectious diseases: textbook / O.A.Golubovska, M.A. Andreychyn, A.V. Shkurba and others. - 4th edition, 2022, 464 p.</p> <p>6. Infectious diseases: textbook / V.M.Kozko, G.O. Solomennyk, K.V. Yurko et al., 2019, 319 p.</p> <p>7. Medical parasitology with entomology: study guide / V.M.Kozko, V.V. Myasoyedov, G.O. Solomennyk et al., 2015, 336 p.</p>
<p><b>Current electronic information resources (magazines, websites) for in-depth study of the educational component</b></p>	<ol style="list-style-type: none"> <li>1. The website of the Ministry of Health of Ukraine- <a href="https://moz.gov.ua/">https://moz.gov.ua/</a></li> <li>2. The website of the World Health Organization - <a href="https://www.who.int/en/">https://www.who.int/en/</a></li> <li>3. The website of the National Scientific Medical Library of Ukraine - <a href="https://library.gov.ua/">https://library.gov.ua/</a></li> <li>4. Encyclopedia of modern Ukraine <a href="https://esu.com.ua/article-66062">https://esu.com.ua/article-66062</a></li> <li>5. State Expert Center of the Ministry of Health of Ukraine <a href="https://www.dec.gov.ua/cat_mtd/genetika/">https://www.dec.gov.ua/cat_mtd/genetika/</a></li> <li>6. Electronic database of medical and biological publications <a href="https://pubmed.ncbi.nlm.nih.gov/">https://pubmed.ncbi.nlm.nih.gov/</a> National Library of Medicine <a href="https://www.nlm.nih.gov/medline/medline_overview.html">https://www.nlm.nih.gov/medline/medline_overview.html</a></li> </ol>
<p><b>Moodle distance learning system</b></p>	<p><a href="https://pharmel.kharkiv.edu/moodle/course/view.php?id=5147">https://pharmel.kharkiv.edu/moodle/course/view.php?id=5147</a></p>

**18. Technical and software support of the educational component:** multimedia equipment, lecture notes, methodical recommendations, microscopic preparations of animals and plants, microscopic technique and equipment.