**AL-FARABI KAZAKH NATIONAL UNIVERSITY**

**Biology and Biotechnology Faculty**

**Department of Biotechnology**

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|  | APPROVED byDean of Faculty \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **B.K. Zayadan**  **"\_09\_"\_\_07\_\_ 2021** |

# EDUCATIONAL-METHODICAL COMPLEX OF THE DISCIPLINE

### PCT 4310 « Pathology of cells »

1. “6В05102 – Biology // 6B051 Biological and related sciences

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| Course | 3 |
| Semester | 5 |
| Number of credits | 3 |
| Lecture | 15 hour |
| Seminar  Lab classes | 15 hour  15 hour |
| IWSP | 5 |

**Almaty 2021**

Educational-methodical complex of the discipline is made by the of the professor Department of Biodiversity and Bioresources Vsevolodov.E.B in accordance with the basic curriculum for the 6B05102 Biological and related sciences.

Based on the working curriculum on the Biological and related sciences «6В05102 – Biology »

Considered and presented at a meeting of the Department of Biodiversity and Bioresources

from « 19 » 06 2021 year, protocol № 32

Head of department Professor, D.B.S. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kurmanbayeva M.S.

(Signature)

Recommendeded by the methodological council of the faculty

« 15 » 06 2021 year, protocol №18

Chairman, C.B.S., Associate Professor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Nazarbekova S.T.

(Signature)

**SYLLABUS**

**Fall semester 2021-2022 academic years**

**on the educational program “Pathology of cells”**

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| **Discipline’s code** | **Discipline’s title** | **Independent work of students (IWS)** | **No. of hours per week** | | | | | **Number of credits** | **Independent work of student with teacher (IWST)** |
| **Lectures (L)** | **Practical training (PT)** | | **Laboratory (Lab)** | |
| PCT 4310 | Pathology of cells | 56 | 15 | 15 | | 15 | | 3 | 5 |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Number of IWS** | | **Form of final control** |
| mixed | Theoretical | Analytical,Padlet, Quizlet.Slido | | | Situation tasks,INSERT | | 5 | | oral / Microsoft teams |
| Lecturer | Vsevolodov Eduard Boricovich | | | | | |  | | |
| e-mail | eduardvsevolodov@mail.ru | | | | | |
| Telephone number | 8 (707) 251 9019 | | | | | |
| **Assistant** | Tileshova Moldir | | | | | |  | | |
| **e-mail** | tleshova\_moldir@mail.ru | | | | | |  | | |
| **Phone No.** | 8-7753911146 | | | | | |  | | |

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| **Academic presentation of the course** |

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| **Aim of course** | | **Expected Learning Outcomes (LO)**  As a result of studying the discipline the undergraduate will be able to: | **Indicators of LO achievement (ID)**  (for each LO at least 2 indicators) |
| To form a system of competencies in the context of the qualification requirements of the specialty in the field studying pathological processes in cells and cell organelles | 1 Analyze achievements and problems in the field of pathological physiology and cytology; | 1.1 Demonstrates knowledge about cell homeostasis, specific and nonspecific reactions of cells in response to the action of physical, chemical and biotic etiological factors, acute, subchronic and chronic types of damage (alteration);  1.2 Competently, logically, reasonably forms its own judgments and assessments on the achievements and problems in the field of pathological cytology; |
| 2 Apply and systematize knowledge about pathological processes in the body at the molecular, subcellular and cellular levels in various diseases; | 2.1 Critically analyzes information about structural and functional changes in cells in organs and tissues of vertebrates and humans under the influence of pathological factors;  2.2 Applies knowledge about structural and functional disorders of the organization of cells and cell organelles to solve complex research problems in the field of pathological cytology; |
| 3 To consider and describe the observed changes in the structure of cell organelles (cell nucleus, biomembranes, endoplasmic reticulum, Golgi apparatus, lysosomes, perxisomes, etc.) during the development of pathology; | 3.1 Applies the principles of light-optical and electron microscopic description of structural changes in cellular organelles, cells, tissues and tissue systems in various pathologies in order to accurately diagnose a particular disease;  3.2 Knows how to use various methods of microscopic analysis when describing cytological and histological preparations;  3.3. On the basis of visual observation, explains the pathogenetic and pathophysiological mechanisms of the development of various diseases; |
| 4 Use research methods to study pathologically altered cells and cell structures; | 4.1 Applies knowledge of classical methods of microscopic analysis of cell organelles, cells and tissues (methods of fixation of objects, preparation of histological sections, cytological preparations, their cyto- and histochemical staining) in research work  4.2 Uses modern methods of microscopic analysis (microscopy in transmitted and reflected light, phase contrast, interference, luminescence microscopy, transmission and scanning electron microscopy) in research work  4.3 Interprets and explains the principles and significance of using various research methods in the diagnosis of various pathologies at the subcellular and cellular levels |
| 5 Implement a systematic approach in the search, critical analysis and synthesis of information on the methodology of cellular pathology | 5.1 Finds and critically analyzes information on the methodology of cellular pathology, pathomophology and pathophysiology  5.2 Competently, logically, reasonably forms its own judgments and assessments according to the methodology of cellular pathology in the interpretation of the pathogenesis of certain diseases. |
| **Prerequisites** | | Training course: "Cell and tissue biology", "Microbiology and Virology", "Genetics" , etc. | |
| **Post requisites** | | Histology | |
| **Information resources** | | Sakharov A.V., Makeyev A. A. Pathology of the cell. Textbook. -Novosibirsk: publishing house OF fgbou VPO "ngpu", 2013. -104 p. | |
| **References and Resources** | | 1. Gilbert S.F. Developmental biology. 9th edition. 2016. USA. Sinauer Associates, Inc. page 1-96   2. Белоусов Л.В. Основы общей эмбриологии. М.,МГУ, 2012.стр224-235  3. Газарян К.Г., Белоусов Л.В. Биология индивидуального развития животных. Учебник. М., Высшая школа, 2015. Стр 95-112  4. Карлссон. Эмбриология по Петтэну. М., 2015.стр 30-63  5. Голиченков В.А. и др. Эмбриология. Учебник. М., изд-во «Академия», 2014 стр 63-96.  6. Кнорре А.Г. Краткий очерк эмбриологии человека. Ленинград, «Медицина», 2017 стр 96-112  7. Нуртазин С.Т. Эмбриология животных. Алматы, изд-во «Қазақ университеті», 2013.  Available online: Additional educational materials on univer.kaznu.kz. in EMCD.  Internet sources:  <http://elibrary.kaznu.kz/ru>  <https://hi-news.ru/>  <https://cyberleninka.ru/>  <http://mosmetod.ru>  <http://works.doclad.ru> | |

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| **Academic policy of the course in the context of university moral and ethical values** | **Academic Behavior Rules:**  All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule.  ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC.  **Academic values:**  - Practical trainings/laboratories, IWS should be independent, creative.  - Plagiarism, forgery, cheating at all stages of control are unacceptable.  - Students with disabilities can receive counseling at e-mail eduardvsevolodov@mail.ru |
| **Evaluation and attestation policy** | **Criteria-based evaluation:**  assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams).  **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task. |

**CALENDAR (SCHEDULE) THE IMPLEMENTATION OF THE COURSE CONTENT:**

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| **Weeks** | **Topic name** | **LO** | **ID** | **Number of hours** | **Max. score** | **Form of knowledge assessment** | **Lesson type / platform** |
| **Module 1** | | | | | | | |

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| 1 | Lecture 1. Topic: "The subject of the pathology of the cells. The influence of damaging factors on the structure and function of cells» | LО 1 LО 2 LО 5 | ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 1 |  |  | Discussion /Video Lon MS Teams |
| Laboratory (practice) studies 1. Methods of research of fixed cells and tissues: the basics of fixing the material, its compaction, preparation of sections, their staining. Types of dyes. Device and principles of operation of microscopes: light, phase-contrast, polarization, electronic. | LО 4 LО 3 LО 5 | ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 1. Topic: "The subject of the pathology of the cells. The influence of damaging factors on the structure and function of cells» | LО 5 LО 2 LО 3 | ID 2  ID 3.2  ID 5.3 |  | 5 |  | INSERT/Video Lon MS Teams |
| 2 | Lecture 2  Topic: "Pathology of the cell nucleus» | LО 5 LО 2 LО 3 | ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 1 |  | TK | Quizlet/Offline |
| Laboratory (practice) studies 2. Study of ultrastructural pathology of cell nuclei (electronograms) in various diseases. Morphometry (planimetry) of nuclei of various cell types in normal and pathological conditions | LО 5 LО 3 LО 1 | ID 1  ID 3.2  ID 5.3 | 2 | 10 |  | Situation tasks /Video Lon MS Teams |
| Seminar 2. Topic: "Pathology of the cell nucleus» | LО 5 LО 3 | ID 3.2  ID 5.3 |  | 5 | TK | Quizlet/Offline |
| 3 | Lecture 3.  Topic: "Pathology of the cytoplasm and cell membranes» | LО 5 LО 2 LО 3 | ID 3  ID 2.1  ID 3.2  ID 5.3 | 1 |  |  | Situation tasks /Video Lon MS Teams |
| Seminar 3. Topic: "Pathology of the cytoplasm and cell membranes» | LО 5 LО 3 | ID 3  ID 3.2  ID 5.3 |  | 5 | IT | Quizlet/Offline |
| Laboratory (practice) studies 3. Study of ultrastructural pathology of the cytoplasm and cell membranes (electronograms) in various diseases | LО 5 LО 3 | ID 3  ID 3.2  ID 5.3 | 2 | 10 |  | INSERT/ Video Lon MS Teams |
| IWS 1.- Factors causing cell and tissue pathology.  - Pathology of the cell nucleus and nuclear structures. Pathology of mitosis.  - Pathology of cell membranes and cytoplasm. | LО 5 LО 3 | ID 3  ID 3.2  ID 5.3 |  | 12 | TK | Video Lon MS Teams |
| IWST 1.Preparation of test tasks for lecture materials 1-5. Pathology of the cell nucleus and nuclear structures. Pathology of mitosis. |  |  | 1 |  |  |  |
| 4 | Lecture 4.  Topic: "Cell reception and cell pathology» | LО 5 LО 2 LО 3 | ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 1 |  | TK | Situation tasks /Video Lon MS Teams |
| Seminar 4. Topic: "Cell reception and cell pathology» | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 |  | 5 |  | Quizlet/Offline |
| Laboratory (practice) studies 4. Study of plasmalemma permeability and pathology of cell contacts of various types. | LО 5 LО 2 LО 3 | ID 4  ID 5.3 | 2 | 10 | TK | Quizlet/Offline |
| 5 | Lecture 5.  Topic: "Pathology of the granular endoplasmic reticulum and ribosomes» | LО 5 LО 2 LО 3 | ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 1 |  |  | Situation tasks /Video Lon MS Teams |
| Laboratory (practice) studies 5. Study of ultrastructural pathology of the granular endoplasmic reticulum and ribosomes (electronograms) in various diseases. | LО 5 LО 2 LО 3 | ID 2.1  ID 3.2  ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 5 . Topic: "Pathology of the granular endoplasmic reticulum and ribosomes» | LО 5 LО 2 | ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 |  | 5 |  | Situation tasks /Video Lon MS Teams |
| IWS 2. - Cellular reception and cell pathology.  - Pathology of the granular endoplasmic reticulum and ribosomes |  |  |  | 13 | IT | Padlet /Offline |
| IWST 2.Preparation of test tasks for lecture materials 1-5. Cellular reception and cell pathology. |  |  |  |  |  | Video Lon MS Teams |
|  | **RK 1** |  |  |  | 100 |  |  |
| **Module 2** | | | | | | | |
| 6 | Lecture 6  Topic: "Pathology of the agranular endoplasmic network» | LО 5 LО 3 | ID 5 ID 2.1  ID 3.2  ID 5.3 | 1 |  | TK | Quizlet/Offline |
| Laboratory (practice) studies 6. Study of ultrastructural pathology of the agranular endoplasmic network (electronogram) in various diseases | LО 5 LО 2 | ID ID 2.1  ID 5.1  ID 5.35 | 2 | 10 |  | Quizlet/Offline |
| Seminar 6. Topic: "Pathology of the agranular endoplasmic network» | LО 5 LО 2 | ID 2 ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 2 | 5 | IT | Quizlet/Offline |
| 7 | Lecture 7  Topic: "Pathology of the lamellar complex (Golgi apparatus)» | LО 5 LО 4 LО 3 | ID 4 ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 1 |  |  | INSERT/Video Lon MS Teams |
| IWS 3 Ultrastructural pathology and changes in the function of the agranular endoplasmic reticulum.  - Ultrastructural pathology and changes in the function of the lamellar Golgi complex. |  |  |  | 13 | IT | Video Lon MS Teams |
| IWST 3.Preparation of test tasks for lecture materials 1-5. Study of ultrastructural pathology of lysosomes and lysosomal diseases (electronograms). |  |  |  |  |  | Video Lon MS Teams |
| Laboratory (practice) studies 6. Study of ultrastructural pathology of the Golgi apparatus (electronogram). | LО 5 LО 2 LО 3 | ID 5  ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 7. Topic: "Pathology of the lamellar complex (Golgi apparatus)» | LО 5 LО 2 LО 3 | ID 3.3  ID 5.1  ID 5.1  ID 3.2  ID 5.3 | 2 | 5 |  | Padlet /Offline |
| 8 | Lecture 8  Topic: "Pathology of lysosomes. Lysosomal storage diseases» | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 5.1  ID 4.2  ID 3.2  ID 5.3 | 1 |  | IT | INSERT/Video Lon MS Teams |
| Laboratory (practice) studies 8. Study of ultrastructural pathology of lysosomes and lysosomal diseases (electronograms). | LО 5 LО 2 LО 3 | ID 5  ID 5.3 | 2 | 10 |  | Padlet /Offline |
| Seminar 8. Topic: "Pathology of lysosomes. Lysosomal storage diseases» | LО 5 LО 2 LО 3 | ID 5 ID  ID 3.2  ID 5.3 | 2 | 5 | TK | INSERT/offline |
| 9 | Lecture 9.  Topic: "Peroxisome pathology and peroxisomal diseases» | LО 5 LО 2 LО 3 | ID 5 ID 2.1  ID 5.1  ID 5.2 | 1 |  |  | Situation tasks /Video Lon MS Teams |
| Laboratory (practice) studies 9. Study of ultrastructural pathology of peroxisomes and peroxisomal diseases (electronograms). | LО 5 LО 2 LО 3 | ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 9. Topic: "Peroxisome pathology and peroxisomal diseases» | LО 5 LО 2 LО 3 | ID 2 | 2 | 5 |  | Quizlet/Offline |
| 10 | Lecture 10  Topic: "Mitochondrial pathology» | LО 5 LО 2 LО 3 | ID 3.2  ID 5.3 | 1 |  | TK | INSERT/Video Lon MS Teams |
| Laboratory (practice) studies 10. Study of ultrastructural pathology of mitochondria and changes in cell bioenergetics (electronograms). | LО 5 LО 2 LО 3 | ID 3.2  ID 5.3 | 1 | 10 | TK | Padlet /Offline |
| Seminar 10. Lecture 10  Topic: "Mitochondrial pathology» | LО 5 LО 2 LО 3 | ID 4 ID 2.1  ID 5.3 | 1 | 5 | TK | Padlet /Offline |
| IWS 4 - Ultrastructural pathology of mitochondria and changes in cell bioenergetics. |  |  |  | 12 | IT | Video Lon MS Teams |
| IWST 4.  Pathology of the cytoskeleton |  |  |  |  |  | Padlet /Offline |
|  | **МТ (Midterm Exam)** |  |  |  | 100 |  |  |
| **Module 3** | | | | | | | |
| 11 | Lecture 11  Topic: "Pathology of the cytoskeleton» | LО 5 LО 2 LО 3 | ID 1  ID 2.1  ID 5.1 | 1 |  |  | Situation tasks /Video Lon MS Teams |
| Laboratory (practice) studies 11. Study of ultrastructural pathology of microtubules and microfilaments in various cell types (electronograms). | LО 5 LО 2 LО 3 | ID 1 ID 2.1  ID 5.2  ID 3.2  ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 11. Topic: "Pathology of the cytoskeleton» | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 5.1  ID 5.3 | 1 | 5 |  | Padlet /Offline |
| 12 | Lecture 12  Topic: "Cell death: apoptosis and necrosis» | LО 5 LО 2 LО 3 | ID2.1  ID 5.3 | 1 |  |  | Discussion /Video Lon MS Teams |
| Laboratory (practice) studies 12. Morphological and biochemical features of apoptic and necrotic cells. | LО 5 LО 2 LО 3 | ID 3 ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 2 | 10 | TK | Padlet /Offline |
| Seminar 12 . Topic: "Cell death: apoptosis and necrosis» | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 3.2  ID 5.3 | 2 | 10 |  | INSERT/Video Lon MS Teams |
| 13 | Lecture 13  Topic: "Adaptation and repair of cell damage» | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 5.1  ID 5.3 | 1 |  | TK | Discussion /Video Lon MS Teams |
| Laboratory (practice) studies 13 Study of cellular processes (proliferation, polyploidy, hypertrophy) during reparative regeneration of various organs. | LО 5 LО 2 LО 3 | ID 2 ID 2.1  ID 5.1  ID 5.2  ID 3.2  ID 5.3 | 2 | 10 |  | Quizlet/Offline |
| Seminar 13 . Topic: "Adaptation and repair of cell damage» | LО 5 LО 2 LО 3 | ID 3 | 2 | 10 | TK | Quizlet/Offline |
| IWS 5.  - Mechanisms of tumor cell formation.  - Morphological features in the structure of benign and malignant cells.- |  |  | 2 | 25 | IT | Webinar on MS Teams |
| IWST 5.  Pathology of the cytoskeleton |  |  | 2 |  |  | Webinar on MS Teams |
| 14 | Lecture 14.  Topic: "Carcinogenesis and formation of tumor cells» | LО 2 LО 4 | ID 2  ID 2.1  ID 4.3 | 1 |  |  | INSERT/Video Lon MS Teams |
| Laboratory (practice) studies 13 Study of the ultrastructure of benign tumor cells (electronograms) | LО 5 LО 2 | ID 2  ID 5.2  ID 3.2  ID 5.3 | 1 | 10 | TK | Slido /Offline |
| Seminar 14 . Topic: "Carcinogenesis and formation of tumor cells» | LО 5 LО 2 | ID 2  ID 2.1  ID 5.3 | 1 | 5 |  | INSERT/Video Lon MS Teams |
| 15 | Lecture 15.  Topic: "Carcinogenesis and formation of tumor cells" (continued) | LО 5 LО 2 | ID 2  ID 5.3 | 2 |  | TK | Webinar on MS Teams |
| Laboratory (practice) studies 15 Study of the ultrastructure of malignant tumor cells (electronograms) | LО 5 LО 2 | ID 2  ID 2.1  ID 5.3 | 1 | 10 |  | Quizlet/Offline |
| Seminar 15 . Topic: "Carcinogenesis and formation of tumor cells" (continued) | LО 5 LО 2 LО 3 | ID 3  ID 3.2  ID 5.3 | 1 | 5 | IT | Quizlet/Offline |
|  | **RK 2** |  |  |  | 100 |  |  |
|  | **Exam** |  |  |  | 100 |  |  |

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.

Comments:

- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)

- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.

- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).

- Tasks for the next week open after each deadline.

- The teacher at the beginning of the webinar gives CW assignments.]

Dean Zayadan B.K.

Chairman of the Faculty Methodical couincil Nazarbekova S.T

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| Head of the Department |  | Kurmanbayeva M.S. |
| Lecturer |  | Vsevolodov.E.B |