**AL-FARABI KAZAKH NATIONAL UNIVERSITY**

**Medicine and Health Care Faculty**

**Higher School of Medicine**

**Department of Fundamental Medicine**

**AFFIRM**

**Dean of the Faculty**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Kalmatayeva Z. A.**

**"\_\_\_\_\_\_" \_\_\_\_\_\_\_\_ 2022**

**EDUCATIONAL AND METHODICAL COMPLEX OF DISCIPLINE**

**MBOH1202 Molecular Biology and Bioorganic Chemistry**

В086 «General medicine»

Educational program "6B10103 - General medicine"

Course – 1

Semester – 2

Number of credits – 5 (5 ECTS)

Almaty 2022

Educational and methodical complex of discipline was compiled by PhD Aimbetov R., PhD Pinskiy I., PhD Seitimova G., PhD Kudaibergenova B., master of natural sciences Tastanbekov D., master of natural sciences Zhanayeva A., master of natural sciences Tolenova K.

Based on the educational program B086 General medicine

Considered and recommended at a meeting of the fundamental medicine department from "\_\_\_" \_\_\_\_\_\_\_\_\_\_\_\_\_\_ 202\_, protocol No. ...

Head of the department \_\_\_\_\_\_\_\_\_\_\_ Sarsenova L. K.

Recommended by the Methodological Council of the Higher School of Medicine

"\_\_\_\_" \_\_\_\_\_\_\_\_\_\_\_ 202\_\_, protocol No.

Chairman of the Method Council of the Higher School of Medicine \_\_\_\_\_ Dzhumasheva R.T.

**AL-FARABI KAZAKH NATIONAL UNIVERSITY**

**Medicine and Health Care Faculty**

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**SYLLABUS**

Fall semester, academic year 2022 - 2023

**Academic course information**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Discipline’s code** | **Discipline’s title** | **Type** | **No. of hours per week** | | | | **Number of credits** | **ECTS** |
| Lect. | Pract. | | Lab. |
| **MBOH1202** | Molecular Biology and Bioorganic Chemistry | CD UC | 2 | 3 | | 0 | 5 | 5 |
| **Lecturers** | Aralbayeva Arailym Nugmanovna | | | | Office hours | | According to schedule | |
| **e-mail** | aralbaeva.arailym@med-kaznu.com | | | |
| **Phone number** | 87783792215 | | | | Auditorium | | According to schedule | |
|  | Kashaganova Kulyash Tugelbayevna | | | |
| **e-mail** | kashaganova.kulyash@med-kaznu.com | | | |
| **Phone number** | 87013498652 | | | |
| **Teacher of Molecular Biology** | | | | |
|  | Yeszhanova Gaukhar Askarovna | | | |
| **e-mail** | yeszhanova.gaukhar@med-kaznu.com | | | |
| **Phone number** | 87781318194 | | | |
|  | Aralbayeva Arailym Nugmanovna | | | |
| **e-mail** | aralbaeva.arailym@med-kaznu.com | | | |
| **Phone number** | 87783792215 | | | |
| **Teacher of Bioorganic Chemistry** | | | | |
|  | Kashaganova Kulyash Tugelbayevna | | | |
| **e-mail** | kashaganova.kulyash@med-kaznu.com | | | |
| **Phone number** | 87013498652 | | | |

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| **Academic presentation of the course** | **Course type:** core discipline of university component from the module “Biomedicine essentials”.  **Aim of discipline:** to form an understanding of the molecular basis of the functioning of the cell and the organism as a whole, regulation of gene expression, the chemical structure, properties and functions of biologically active compounds in living organisms, which are necessary for further understanding of both normal processes of life activity and their disruption. Diseases, including hereditary.  **Learning outcomes of discipline**:   1. Explain the structure, isomerism and nomenclature of biologically active compounds 2. Describe the physico-chemical properties, the biological role of compounds involved in the processes of vital activity 3. Demonstrate knowledge of gene biology and mechanisms for implementing genetic information, protein biosynthesis; 4. Apply knowledge of the causes and mechanisms of development of certain changes in the structure and functioning of nucleic acids, especially the expression of genes 5. Understand the mechanisms of hereditary and variability and their role in the formation of human hereditary pathology and congenital malformations 6. Understand the molecular-genetic and cellular mechanisms of the body's response to drugs and biologically active compounds. 7. Demonstrate the ability to apply the language and knowledge of each discipline to discuss and solve fundamental scientific and clinical problems. 8. Integrate knowledge of the structural and functional characteristics of the genome to solve clinical problems. 9. Demonstrate the ability to identify learning gaps and create strategies to enhance one’s own knowledge and skills.   10. Effectively communicate with other students and teachers regarding medical and scientific information, articulate their opinions clearly when discussing and work effectively as a member of the team. |
| **Prerequisites** | “From molecule to cell” |
| **Post requisites** | “Mechanisms of Defense and Health” |
| **Information resources** | **Basic literature**:  1. Alberts B. et al. Molecular biology of the cell. 6th ed. 2015. Garland Science.  2. Lodish H. et al. Molecular cell biology. 8th ed. 2016. WH Freeman.  3. John McMurry, et al. Fundamentals of General, Organic, and Biological Chemistry, 8th Edition. 2018. Pearson Education Limited.  4. Soderberg T. Organic Chemistry with a Biological Emphasis. 2016. Chemistry Publications.  **Additional literature:**  1. Jenis, J. Study Guide and Practice Tests for Organic Chemistry (Organic Compounds of Aliphatic Series) / Al-Farabi KazNU. Almaty: Qazaq university, 2017.  2. Russell P.J. iGenetics. A molecular approach. 3rd ed. 2009. Pearson.  3. Karp G. Cell and molecular biology. Concepts and experiments. 7th ed. 2013. Wiley.  4. Hartwell L. et al. Genetics. From genes to genomes. 4th ed. 2011. McGraw Hill.  5. Zhussupova A.I. Molecular Biology (Interdisciplinary Approaches in Teaching and Research) / Al-Farabi KazNU. Almaty: Qazaq university, 2016.  6. Zhussupova A.I. Modern issues in molecular diagnostics / Al-Farabi. Kazakh National University – Almaty: Qazaq university, 2015.  **Internet resources:**  1.Lecturio.com [https://www.lecturio.com](https://www.lecturio.com/)  2. “Human Genome” Project <https://web.ornl.gov/sci/techresources/Human_Genome/project/info.shtml>   1. NCBI - The National Center for Biotechnology Information, USA <https://www.ncbi.nlm.nih.gov/> 2. NDB - a portal for three-dimensional structural information about nucleic acids <http://ndbserver.rutgers.edu/> 3. OMIM - compendium of human genes and genetic phenotypes <https://www.ncbi.nlm.nih.gov/omim?db=OMIM> 4. Ensembl - Genome browser for vertebrate genomes <http://asia.ensembl.org/index.html> 5. EMBL-EBI - European Bioinformatics Institute <https://www.ebi.ac.uk/>   Video lectures by Molecular Biology: <https://www.khanacademy.org/> |
| **Academic course policy in the context of university moral and ethical values** | CLASSES ATTENDANCE  Students of Al-Farabi Kazakh National University must attend all types of academic sessions in accordance with the approved schedule. It is not allowed to miss classes without an acceptable reason, proved by suitable documents. Students of Al-Farabi Kazakh National University must attend all types of academic sessions in accordance with the approved schedule. It is not allowed to miss classes without an acceptable reason, proved by suitable documents. Students who have missed classes without a valid reason for more than 5 weeks are subject to expulsion from the university for violating the rules of the university's academic policy. Students who do not attend training sessions for more than 5 weeks due to illness must inform their advisor and instruct a trusted person to issue an academic leave for health reasons. If a student misses more than 50% of study sessions on a discipline, he/she is automatically graded "F" ("unsatisfactory") and is not allowed to the final assessment on the discipline.  ASSESSMENT OF EDUCATIONAL ACHIEVEMENTS OF STUDENTS  To assess educational achievements of students (achievement of expected learning outcomes), there are following types of control of students' academic performance: – ongoing assessment; – interim examinations (IE1, IE2); –final assessment (final exam). Grade points of the interim examination reflect cumulative total assessment of current academic performance of the student (according to the grades indicated in the attendance list) and results of performance of special tasks of interim examination. The maximum level of academic performance for interim examinations on the discipline is 100 grade points for each interim examination, including the results of ongoing assessment. Students who have scored at least 50 grade points (IE1 + IE2 / 2) are admitted to the final assessment of their academic performance. The maximum grade for the final exam is 100 grade points. Admission to the examination session is issued by order of the dean of the faculty. It is not allowed to change the results of interim examinations to increase them. To the final examination are not admitted: – students who scored less than 50 points based on the results of interim examinations (IE1 + IE2 / 2); – students who missed more than 50% of classes on the discipline, regardless of documentary evidence;  – students who have not submitted term papers (projects) on the relevant discipline; – students studying on contractual basis for provision of educational services, who have debts in payment of tuition fees.  ASSESSMENT OF LEARNING OUTCOMES, APPEAL, RETAKING OF EXAMS  Academic achievements of students (knowledge, abilities, skills and competencies) are assessed using the 100-point scale in grade points, corresponding to the internationally accepted alphabetic system with digital equivalents (positive grades, in decreasing order, from "A" to "D" (100-50), and “unsatisfactory” - “FX” (25-49), “F” (0-24), and to the grades of the traditional system. “FX” grade is used only for final examinations. The student, who does not agree with the result of the final assessment on the discipline (grade for the exam), has the right to submit a reasoned written application within three working days after the exam results are published in the electronic records sheet in the Univer system. Application for appeal is accepted, if the grade for the exam does not correspond to the objective level of learning outcomes demonstrated by this student: – due to the incorrect wording of the examination question; – due to the fact that the examination question’s content does not correspond to the study program of the discipline; – due to the fact that the student’s response was assessed incorrectly because of the lack of qualification of the members of examination committee. Appealed grade and reason for the appeal should be stated in the student’s application. In the case of receiving the “unsatisfactory” grade corresponding to the “FX” mark (25-49), the student has the opportunity to retake the final assessment on a paid basis without repeated study of the whole program of the discipline / module. This should be done within the special period of time right after the examination session during which this grade was obtained. If the student gets the "F" grade as a result of re-taking the final exam, he/she should re-register for study of this discipline / module on a paid basis. He/she attends all study sessions, performs all types of academic activities according to the program of the discipline and retakes the final exam. If the student does not appear for a re-taking exam on the discipline for which he/she has been graded “FX”, this grade will be transferred to the "F" (“unsatisfactory”) and considered an academic debt. Then the student should attend in the next semester on a paid basis all types of study sessions, perform all types of academic work on this discipline according to the program, and take the final exam. Retaking the exam with an “FX” grade is allowed only once. . A student, who violates requirements of the Rules for conducting final assessment (that is using permitted supporting aids, mobile phones, being late for the exam without an acceptable reason, etc.), will get the "F" grade automatically, based on the record of violation, which is not subject to complain and appeal. In this case, the student should re-study this discipline on a paid basis. In the case of getting the "F" grade, the student has the right to repeat studying the discipline (Retake), but no more than two times. Repeated study of disciplines is carried out only on a paid basis.  THE CODE OF PROFESSIONAL CONDUCT OF STUDENTS OF THE HIGHER SCHOOL OF MEDICINE OF THE FACULTY OF MEDICINE AND HEALTHCARE OF KAZNU, THE CODE OF HONOR OF KAZNU, THE REGULATIONS ON THE STUDENT OF KAZNU  A student of KazNU strictly fulfills his academic duties, does not allow ethical, academic and legal violations, including: plagiarism; forgery; use of cheat sheets, cheating and hints at all stages of various forms of knowledge control; use of family or official ties to obtain a higher grades; bribery; cheating of a teacher and disrespectful attitude towards him; absenteeism and tardiness without a valid reason. A student of KazNU takes care of the safety of the property of KazNU and suppresses vandalism on its territory. In case of illegal actions, appropriate disciplinary penalties will be applied. |
| **Evaluation and attestation policy** | Criteria assessment: assessment of learning outcomes in relation to descriptors, verification of the formation of competencies (learning outcomes specified in the goal) is carried out by the following methods:   1. solution of situational problems, analysis of cases - within the framework of the current / final control - final results No. 1, 3, 4, 6, 8; 2. interview / oral interview - within the framework of the current / final control - final results No. 1, 4, 7, 8, 10; 3. assessment by direct observation within the framework of current control and IWS - final results No. 2, 5, 9, 10;   Summary assessment:  In the course, 2 controls (2 interims) are planned, within the framework of which the development of the material is evaluated.  For the semester, admission rating points are set: AR= (IE1 + IE2) / 2, where IE1 / IE2 = the sum of all points for classes + points for interim examination control and IWS of the corresponding period\*\*. IE1 - 1-7 weeks, IE2 - 8-15 weeks. The final control (exam) is conducted in the form of a written exam on tickets. The final grade for the discipline = AR\* 0.6 + Exam \* 0.4  \*\*AR-admission rating, IE - interim examination, IWS - independent work of student. |

**Calendar (schedule) of the implementation of the course content**

***Coursework calendar***

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Topic** | **Hours** | **Max. point** |
| 1 | Lecture 1. Introduction to Molecular Biology. Part 1. | 1 |  |
| Practical lesson 1. Introduction to Molecular Biology. Part 1. | 2 | 3 |
| Lecture 2. Introduction to Bioorganic Chemistry. | 1 |  |
| Practical lesson 2. Introduction to Bioorganic Chemistry. | 1 | 2 |
| 2 | Lecture 3. Introduction to Molecular Biology. Part 2. | 1 |  |
| Practical lesson 3. Introduction to Molecular Biology. Part 2. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 4. Safety rules in the chemical laboratory. | 1 |  |
| Practical lesson 4. Safety rules in the chemical laboratory. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| 3 | Lecture 5. Transcription of genetic information and mRNA processing. | 1 | 3 |
| Practical lesson 5. Transcription of genetic information and mRNA processing. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 6. Hydrocarbons. Alkane. Cycloalkane. Alkene | 1 |  |
| Practical lesson 6. Hydrocarbons. Alkane. Cycloalkane. Alkene | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |

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| 4 | Lecture 7. Translation of genetic information. | 1 |  |
| Practical lesson 7. Translation of genetic information. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 8. Hydrocarbons. Alkadiene. Alkyne. | 1 |  |
| Practical lesson 8. Hydrocarbons. Alkadiene. Alkyne. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| 5 | Lecture 9. Post-translational modification and folding of proteins. | 1 |  |
| Practical lesson 9. Post-translational modification and folding of proteins. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 10. Halogenated hydrocarbons | 1 |  |
| Practical lesson 10. Halogenated hydrocarbons. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| IWS: Case study 1. Recombinant DNA Technology | 3 | **7** |
| 6 | Lecture 11. Regulation of gene expression in prokaryotes and eukaryotes. | 1 |  |
| Practical lesson 11. Regulation of gene expression in prokaryotes and eukaryotes. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 12. Aromatic compounds. | 1 |  |
| Practical lesson 12. Aromatic compounds. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| 7 | Lecture 13. Mutations. | 1 |  |
| Practical lesson 13. Mutations. Colloquium 1 | 2 | 34 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 14. Alcohols, phenols and ethers. Properties of hydroxy compounds. | 1 |  |
| Practical lesson 14. Alcohols, phenols and ethers. Properties of hydroxy compounds. Colloquium 1 | 1 | 29 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. |  |  |
| **Interim Examination-1** |  | **100** |
| 8 | Lecture 15. DNA repair. | 1 |  |
| Practical lesson 15. DNA repair. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 16. Aldehydes and ketones. | 1 |  |
| Practical lesson 16. Aldehydes and ketones. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| 9 | Lecture 17. Epigenetics. | 1 |  |
| Practical lesson 17. Epigenetics. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 18. Carboxylic acids and their derivatives. Properties of carbonyl-containing compounds. | 1 |  |
| Practical lesson 18. Carboxylic acids and their derivatives. Properties of carbonyl-containing compounds. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| 10 | Lecture 19. Intracellular signaling. | 1 |  |
| Practical lesson 19. Intracellular signaling. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| Lecture 20. Heterocyclic compounds. | 1 |  |
| Practical lesson 20. Heterocyclic compounds. | 1 | 2 |
| IWST: Discuss the topic, conduct a discussion and check how students are working on their own work. | 1 |  |
| IWS: Case study 2. Gene therapy: myths and reality. | 3 | **7** |
| 11 | Lecture 21. Cell differentiation and the development of the multicellular organism. | 1 |  |
| Practical lesson 21. Cell differentiation and the development of the multicellular organism. | 2 | 3 |
| Lecture 22. Amines and amino acids. | 1 |  |
| Practical lesson 22. Amines and amino acids. | 1 | 2 |
| 12 | Lecture 23. Molecular and genetic basis of immunity. | 1 |  |
| Practical lesson 23. Molecular and genetic basis of immunity. | 2 | 3 |
| Lecture 24. Peptides and proteins. | 1 |  |
| Practical lesson 24. Peptides and proteins. | 1 | 2 |
| 13 | Lecture 25. The human genome. Part 1. | 1 |  |
| Practical lesson 25. The human genome. Part 1. | 2 | 3 |
| Lecture 26. Carbohydrates. | 1 |  |
| Practical lesson 26. Carbohydrates. | 1 | 2 |
| 14 | Lecture 27. The human genome. Part 2. | 1 |  |
| Practical lesson 27. The human genome. Part 2. | 2 | 3 |
| IWST: Discuss the topic, conduct a discussion and check how students | 1 |  |
| Lecture 28. Lipids. | 1 |  |
| Practical lesson 28. Lipids. | 1 | 2 |
| 15 | Lecture 29. Molecular biomedicine. | 1 |  |
| Practical lesson 29. Molecular biomedicine. Colloquium 2 | 2 | 31 |
| Lecture 30. Recap lesson by Bioorganic chemistry. | 1 |  |
| Practical lesson 30. Recap lesson by Bioorganic chemistry. Colloquium 2 | 1 | 27 |
| **Interim Examination-2** |  | **100** |
|  | **TOTAL** |  | **200** |