AL-FARABI KAZAKH NATIONAL UNIVERSITY

Faculty of biology and biotechnology

Department of Molecular biology and genetics

APPROVED by
Dean of Faculty

Kurmanbaeva M.S.

"23" 05 **2025,** protocol №10

EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE

«90445 Pharmacogenetics»

«7M05105 - Genetics»

Course	2
Semester	3
Number of credits	5 (1,70+3,30+0)

Almaty 2025

Educational-methodical complex of the discipline «90445 Pharmacogenetics» is made by Associated Professor, candidate of biological science Aigul Kuzembayevna Amirova based on the educational program «7M05105 - Genetics».

Considered and recommended at the meeting of the department of Molecular Biology and Genetics from «21» 05 2025, protocol №22

Head ofdepartment _____ Zh.K. Zhunusbayeva

SYLLABUS
Fall semester 2025 – 2026 academic year
Educational program "7M05105 - Genetics", 2 course

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
90445 Pharmacogenetics	5	1,70	3,30	-	5	6

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control
Offline	P, UC	problematic, analytical lecture	problem solving, situational tasks	Traditional written exam, Univer, offline of the exam
Lecturer - (s)	associate professor Aigul Amirova			
e-mail :	aigul_amir@mail.ru			
Phone :	+7(708)8047195			

ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) *	Indicators of LO achievement (ID)
Discipline aims to form professional competencies in pharmacogenetics and molecular diagnostics. It will consider the pharmacodynamic and pharmacokinetic mechanisms of the sensitivity of the individual organism to drugs, genetic variations of enzymes involved in drug metabolism, the interaction between genes and drugs that determine the therapeutic response, and the methods of personalised medicine using molecular diagnostics.	1.To evaluate achievements in the field of pharmacokinetics and their practical significance in various branches of science, production and industry.	1.1 Summarizes the achievements in the field of pharmacogenetics.
		1.2 Explains the practical significance of pharmacokinetics in various branches of science, production and industry
	2. Use pharmacogenetic methods and systematize the results of scientific research by processing literary data.	2.1 Applies pharmacogenetic methods.
		2.2 Summarizes the results of scientific research by processing literary data.
	3. To use the acquired knowledge in practice in the field of pharmaceuticals.	3.1 Analyzes the obtained data.
		3.2 Applies the acquired knowledge in practice in the field of pharmaceuticals.
	4. Explain the various techniques and methods of pharmacogenetics, identify the advantages and limitations of pharmacogenetics and pharmacogenomics.	4.1 Identifies various techniques and methods of pharmacogenetics.
		4.2. Analyzes the advantages and limitations of pharmacogenetics and pharmacogenomics.
	5. To identify key issues in the widespread implementation of pharmacogenetic principles in healthcare systems.	5.1 Identify key issues in pharmacogenetics.
		5.2 Develop recommendations for the widespread implementation of pharmacogenetic principles in the healthcare system.
Prerequisites	Molecular and Forensic-Medical Expertise, Population Genetics, Genopathology	
Postrequisites	Dissertation Writing	
Learning Resources	**Literature:** main, additional. 1. Prokofieva, D.S., Nurgalieva, A.Kh., Nadyrshina D.D., Khusnutdinova, E.K. Pharmacogenetics: textbook / D.S. Prokofiev – Ufa: RIC BashSU, 2017. – 97 p. 2. Grachev V.G., Sychev D.A., Ramenskaya G.V. Drug Metabolism. Scientific Foundations of Personalized Medicine (Guide for Physicians) GEOTAR-Media. 2018. 3. Krupitsky E.M., Akhmetova E.A., Asadullin A.R. Pharmacogenetics of chemical addictions. Scientific reviews // Review of psychiatry and medical psychology no. 4-1, 2019, 12 p. 4. Roseann S. Gammal, Pharm.D., BCPS; and Christy S. Harris, Pharm.D., FHOPA, BCOP Pharmacogenomics and Precision Medicine /PSAP 2020 BOOK. 22 p.	

	5. Ku-Lang Chang, MD, Kristin Weitzel, Siegfried Schmidt. Pharmacogenetics: Using Genetic Information to Guide Drug Therapy // American Family Physician October 1, 2015. V. 92, 7 www.aafp.org/afp (https://www.aafp.org/pubs/afp/issues/2015/1001/p588.pdf) **Research infrastructure** 1. https://www.researchgate.net/publication/293876140_Farmakogenomika_s_osnovami_farmakogenetiki **Internet resources** 1 . http://elibrary.kaznu.kz/ru 2. MOOC / video lectures, etc. 3. https://www.coursera.org/ 4. https://www.edx.org/

Academic course policy	The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University . Documents are available on the main page of IS Univer. **Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. **Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. **Academic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings". Documents are available on the main page of IS Univer . **Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail aigul_amir@mail.ru or via video link in ZOOM: https://us05web.zoom.us/j/88254829221?pwd=mIjuOjokfnvcjeA41Z1O0kDDQ3EG3N.1 to the meeting. **Integration MOOC (massive open online course).** In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule. **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements

Grade	Digital equivalent points	points, % content	Assessment according to the traditional system
A	4.0 _	95-100	Great
A-	3.67	90-94	
B+	3.33	85-89	Fine

Assessment Methods

Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.

Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.

Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.

B	3.0	80-84		**Formative and summative assessment**	**Points % content**
B-	2.67	75-79		Activity at lectures	5
C+	2.33	70-74		Work in practical classes	20
C	2.0	65-69	Satisfactorily	Independent work	25
C-	1.67	60-64		Design and creative activity	10
D+	1.33	55-59		Final control (exam)	40
D	1.0	50-54		TOTAL	100
FX	0,5	25-49	Unsatisfactory		
F	0	0-24			

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	Number of hours	Max. ball
	MODULE 1 Pharmacogenetics. Pharmacogenetic methods.		
1	**L 1.** Subject and tasks of pharmacogenetics. History of developments and significance of pharmacogenetics.	1	
	PC 1. The importance of pharmacogenetics. Pharmacogenetic methods. Solving problem (task, test).	2	
2	**L 2.** Phases of biotransformation of drugs…	1	
	PC 2. Methods of drug absorption and distribution throughout the body.	2	
	IWST P 1. Consultations on the implementation of **IWS 1**	1	
3	**L 3.** The role of genetic factors in the formation of pharmacological response.	1	
	PC 3. Genetic basis of individual sensitivity to drugs, Pharmacodynamics of drugs. Main reactions of phases I and II of Biotransformation. Pharmacological response.	2	
4	**L 4.** Pharmacokinetics of lipophilic and hydrophilic drugs in the body.	1	
	PC 4. The relationship between pharmacokinetics and pharmacodynamics.	2	10
	IWS 1. Pharmacogenetics of antibiotics. Pharmacogenetic methods.	2	20
5	**L 5.** The role of polymorphic variants of genes encoding drug transporters in pharmacological response.	1	
	PC 5. Therapeutic drug monitoring.	2	10
	IWST P 2. Consultations on the implementation of IWS 2	1	
6	**L 6.** The role of polymorphic variants of genes encoding enzymes of phase I biotransformation of drugs in the pharmacological response.	1	
	PC 6. General characteristics of drug transporters. Glycoprotein-P. Transporters of organic anions and cations.	2	10
	IWS 2 Solving problem (task, test).	1	10
7	**L 7.** The role of polymorphic variants of genes encoding enzymes of phase II biotransformation of drugs in the pharmacological response.	1	
	PC 7. Polymorphism of genes encoding enzymes of phase I of drug biotransformation. Cytochrome P450 family.	2	10
	IWST 3. Consultations on the implementation of IWS 3	1	
8	**L 8.** Genetic factors influencing the pharmacodynamics of drugs.	1	
	PC 8. Polymorphism of genes encoding enzymes of phase II biotransformation of drugs.	2	10
	IWS 3 Pharmacogenetic tests. Personalized medicine: problems and prospects.	2	20
Midterm control 1			**100**
9	**L 9.** Genetic polymorphism of angiotensin-converting enzyme and β2-bradykinin receptors.	1	
	PC 9. Genetic polymorphism of β2- and β1-adrenergic receptors.	2	7
	IWST 4. Consultation on the implementation of IWS 4	1	
10	**L 10.** Genetic polymorphism of glucose-6-phosphate dehydrogenase (G-6-PD) and ryanodine receptor type 1.	1	
	PC 10. Genetic polymorphism of β2-bradykinin receptors.	2	7
	IWS 4. Pharmacogenetics of antiplatelet agents.	1	25
11	**L 11.** Altered pharmacological response in hereditary diseases.	1	
	PC 11. Clinical significance of pharmacodynamic gene polymorphisms.	2	7
	IWST 5. Consultation on the implementation of IWS 5	2	
12	**L12.** Pharmacogenetic test.	1	
	PC 12. Pharmacogenomic tests used in practice.	2	7
	IWS 5. Pharmacogenetics of drugs used in obstetrics and gynecology.	1	25
13	**L 13.** Pharmacogenetic testing in statin use.	1	
	PC 13. Medicines and clinically available pharmacogenomic tests.	2	7
	IWS 5 Solving problem (task, test).	1	

14	**L 14.** Modern molecular genetic methods used in pharmacogenomics.	1	
	PC 14. Organization of a laboratory for molecular genetic research.	2	7
15	**L 15.** Personalized medicine.	1	
	PC 15. Genotyping. The concept of individualization of pharmacotherapy.	2	8
	IWST 6. Consultation on the final exam	1	
Midterm control 2			**100**
Final control (exam)			**100**
TOTAL for course			**100**

Dean _____ **Kurmanbaeva M.S.**

Chair of the Academic Committee
on the Quality of Teaching and Learning _____ **Baktybaeva L.K.**

Head of Department _____ **Zhunusbayeva Zh.K.**

Lecturer _____ **Amirova A.K.**

RUBRICATOR OF THE SUMMATIVE ASSESSMENT

CRITERIA EVALUATION OF LEARNING OUTCOMES

Task name IWS1 Pharmacogenetics of antibiotics. Pharmacogenetic methods. (30% of 100% RK)

Criterion	"Excellent" 25-30%	"Good" 20-20%	"Satisfactory" 15-20%	"Unsatisfactory" 0 – 15%
Understanding theories and concepts of the professional identity of the teacher and the teaching profession	Deep understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Understanding theories, concepts of the professional identity of the teacher and the teaching profession.	Limited understanding of theories, concepts of the professional identity of the teacher and the teaching profession.	Superficial understanding / lack of understanding of theories, concepts of the professional identity of the teacher and the teaching profession.
Awareness of key issues of the professional identity of the teacher and the teaching profession in Kazakhstan	Competent correlation of the key concepts of the professional identity and the role of polymorphic variants of genes encoding drug transporters in pharmacological response. Excellent substantiation of arguments with evidence from empirical research (for example, based on interviews or statistical analysis).	There is a connection between the concepts of professional identity of a teacher and the teaching profession with the context of Kazakhstan. The arguments are backed by evidence from empirical research.	Limited correlation of the professional identity of the teacher and the concepts of the teaching profession with the context of Kazakhstan. Limited use of evidence from empirical research	Insignificant connection / lack of connection between the concepts of the teacher's professional identity and the context of Kazakhstan. Little or no empirical research is used.
Pilot Study	Excellent use of the results of pilot studies (interviews or surveys) in the presentation	Good use of the results of pilot studies (interviews or surveys) in the presentation.	Satisfactory use of the results of pilot studies (interviews or surveys) in the presentation.	Poor use of the results of pilot studies (interviews or surveys) in the presentation.
Suggestion of policy or practical recommendations/suggestions	Offers very good policy and/or practical advice or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Offers some policy and/or practical recommendations or suggestions for improving the professional identity and teaching profession in Kazakhstan.	Limited policy and practical recommendations. Recommendations are non-essential, not based on rigorous analysis, and are shallow.	Little or no policy and practice advice, or advice of very low quality.
Presentation, teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality visuals, slides or other materials, good teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low engagement, low quality content, poor teamwork.

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Chair of the Academic Committee on the Quality of Teaching and Learning _____ **Baktybaeva L.K.**

Head of Department _____ **Zhunusbayeva Zh.K.**

Lecturer _____ **Amirova A.K.**