

**NON-PROFIT JOINT-STOCK COMPANY
«AL-FARABI KAZAKH NATIONAL UNIVERSITY»**

MODULE HANDBOOK

EDUCATION PROGRAMME

7M05101-Biology

CLUSTER A

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Purpose of education programme

The programme is aimed at training highly qualified biologists with professional and personal competencies, research and analytical skills, fundamental knowledge in the field of general biology, ecology, biomedicine, biotechnology, which will allow them to effectively implement and apply their knowledge and skills in research, environmental protection, medical, sanitary and epidemiological, agricultural, educational institutions and manufacturing enterprises.

Learning outcomes

- ON1.** demonstrate systemic fundamental knowledge in the field of general biology, cellular and molecular biology, genetics, microbiology, biochemistry, biophysics, and biotechnology during research, development of innovative technologies, including educational practice of higher education using information technologies;
- ON2.** improve the level of scientific biological research through the widespread use of modern methods of processing, biometrics and interpretation of scientific data in the field of botany, zoology, cell biology, embryology, molecular biology, bioengineering; *ext*
- ON3.** Critically evaluate scientific research and theory in the field of biology, biotechnology, ecology, medicine, education and solve problems at a professional level;
- ON4.** systematize scientific theories and concepts of modern areas of biology for use in the selection of initial theoretical positions in the creative solution of problem situations in educational, methodical, scientific, industrial activity;
- ON5.** implement scientific and scientific-technical programs and projects in the field of biology and related fields of activity for solving practical problems of medicine, agriculture, ecology, biotechnology;
- ON6.** carry out interdisciplinary research in the field of biology, chemistry, physics, ICT, medicine, agriculture to create new drugs, strains of microorganisms, varieties of agricultural plants and animals, GMOs;
- ON7.** design and carry out comprehensive research based on the scientific worldview, mastered research technologies in the field of biology and biotechnology, using modern computer technology, software products for implementation of independent biological research;
- ON8.** build research activities based on the principles of bioethics, guaranteeing the scientific reliability of the results, conservation and protection of biodiversity, human rights and health;
- ON9.** develop a scheme of the experimental stages of semi-production and carry out the technological processes used in the fields of biotechnology and biology on their basis;
- ON10.** review and evaluate scientific products in the field of biology and related fields, such as ecology, medicine, agriculture, biotechnology.

Learning Objectives-Module Matrix

Module	Learning outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
M-1 Module on history and philosophy of science	+		+				+			+		
M-2 Psychology and Pedagogy Module	+		+	+								
M-3 Hormones, genes and aging		+	+		+		+		+	+		
M-3 Body regulation factors		+	+		+		+		+	+		
M-4 Fundamental principles and phenomenal of life	+	+	+		+	+	+					
M-5 Cellular technologies in biology and medicine			+		+					+		
M-6 Experimental embryology	+	+	+		+	+						
M-6 Biophysical aspects of physiology	+	+	+		+	+				+		
M-6 Actual problems of zoology		+	+		+		+	+				+
M-6 Bioindicative botany			+	+	+	+		+				
M-6 New technologies in human and plant genetics	+	+		+		+	+					
M-6 Research methods in biology, phylogenetics and evolutionary biology		+	+		+		+	+	+			

Programme structure

RESEARCH	
24	

CORE DISCIPLINES	
UNIVERSITY COMPONENT	ELECTIVE COMPONENT
20	15
35	

MAJOR DISCIPLINES	
UNIVERSITY COMPONENT	ELECTIVE COMPONENT
31	18
49	

TERM

1	Module on history and philosophy of science / Psychology and Pedagogy Module 6 ECTS	Hormones, genes and aging / Body regulation factors 6 ECTS	Fundamental principles and phenomenal of life / Cellular technologies in biology and medicine / Fundamental principles and phenomenal of life 12 ECTS	RES. Master's Student Research (MSR), Including Scientific Internship And Dissertation Writing 3 ECTS	27
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2	Module on history and philosophy of science / Psychology and Pedagogy Module 9 ECTS	Hormones, genes and aging / Body regulation factors 9 ECTS	Fundamental principles and phenomenal of life / Cellular technologies in biology and medicine / Fundamental principles and phenomenal of life 6 ECTS	RES. Master's Student Research (MSR), Including Scientific Internship And Dissertation Writing 6 ECTS	30
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3	Cellular technologies in biology and medicine	<ul style="list-style-type: none"> • Experimental embryology • Biophysical aspects of physiology • Actual problems of zoology • Bioindicative botany • New technologies in human and plant 	27
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9 ECTS	<p>genetics</p> <ul style="list-style-type: none"> • Research methods in biology, phylogenetics and evolutionary biology 	18 ECTS
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4	<p>RESEARCH Master's Student Research (MSR), Including Scientific Internship And Dissertation Writing</p> <p>15 ECTS</p>	<p>FINAL ATTESTATION</p> <p>12 ECTS</p>	27
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List of modules

Workload HPW (Hours per week) according – Teaching methods as lecture, seminar, lab works and others (lesson, project, etc.)

Module/Disciplines	ECTS	Workload HPW				Term
		lec.	sem.	lab.	other	
Module on history and philosophy of science						
History and philosophy of science	3	1,5	1,5			1
Foreign Language (professional)	6		6			2
Psychology and Pedagogy Module						
Pedagogy of higher education	3	1,5	1,5			1
Psychology	3	1,5	1,5			2
Teaching Internship						2
Hormones, genes and aging						
Cell aging and anti-aging	6	3	3			1
Regulation of gene expression and mechanisms of action of hormones	9	3	6			2
Body regulation factors						
Mechanisms of the tumor process	6	3	3			1
Epigenetics and factors of humoral regulation		3	6			2
Fundamental principles and phenomenal of life						
Organization and Planning of Scientific Research (in English)	6	1,5	4,5			1
Functional phytocenology	6	3	3			1
Theoretical Biology	6	3	3			2
Cellular technologies in biology and medicine						
Cell biology and cell technologies	9	3	6			3
RESEARCH PRACTICE (abroad travel to one of series contract Universities for 2 weeks)	4			4		3
Experimental embryology						
Embryology of human and animal	9	3	6			3
Modern problems of tissue biology	9	3	6			3
Biophysical aspects of physiology						
Biophysical monitoring of ecosystems and chronobiology	9	3	6			3
Molecular mechanisms of regulation of body function and cardiovascular system	9	3	6			3
Actual problems of zoology						
Laboratory Animal Science and Animal Science	9	3	6			3
Comparative morphology and embryology of animals	9	3	6			3
Bioindicative botany						
Urban floristry and green architecture	9	3	6			3
Phytoindication	9	3	6			3
New technologies in human and plant genetics						
Molecular diagnostics	9	3	6			3
Technologies in genetics	9	3	6			3
Research methods in biology, phylogenetics and evolutionary biology						
Modern botanical and biophysical research methods	9	3	6			3

Problems of taxonomy, phylogeny of vertebrates and evolutionary biology	9	3	6			3
Master's student research (msr), including scientifying internship and dissertation writing	24					
Research seminar	3	1	1	1	-	1-4
Dissertation writing	14	2	3	2	7	1-4
Scientific internship	3	-	-	-	3	4
Publication in the proceedings of international conferences	4	-	-	-	4	4
FINAL ATTESTATION	12					4
TOTAL	120					

CORE DISCIPLINES

University component

M-1 Module on history and philosophy of science

Module Objectives. Students will be able to:

1. to determine the features of science as a special kind of knowledge, activity and social institution;
2. to systematize the main problems and discussions on methods and strategies for conducting scientific research and the laws governing the development of science;
3. choose the methods and strategies of research most relevant to the subject under study and follow them in professional activity;
4. Critically evaluate current scientific achievements and orientate in choosing the most effective strategies for interdisciplinary search;
5. formulate and correctly argue their own ethical position in relation to the current problems of the current stage of development of science.

Module designation	<i>History and philosophy of science</i>
Credit points	5
Semester(s) in which the module is taught	1-2
Relation to curriculum	UNIVERSITY COMPONENT M-1 Module on history and philosophy of science
Teaching methods	Lecture, seminar, practice, project Lectures will a selection from the orientation readings and material for classroom discussion based on their own judgment. It is recommended that students used those texts not selected for classroom discussion as background readings which will help them contextualize the texts which will be subject of discussion (lecture-discussions, lectures with case studies, lecture-study, fluent brainstorming, lecture with the use of feedback techniques, lecture-consultation). The seminars are interactive and allow students to practice their new skills and explore different topics.
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 15 Contact hours. 2 hours per week for Seminar, total 30 Contact hours. 105 self-study hours

Person responsible for the module	Amrebayeva Zhyldyz PhD, senior-lecturer, Department of Philosophy Faculty of philosophy and political science
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	<i>Prerequisites:</i> Philosophy, the complex of natural-science and socio-humanistic studies of bachelor course
Module objectives/intended learning outcomes	<u>Knowledge base:</u> The purpose of the discipline is to study the complex of problems of science in philosophical knowledge and philosophical research through the presentation of the main directions, approaches, methodology, methods associated with the phenomenon of science, modern science, epistemology, research of science in culture, etc.
	<p><u>Analysis:</u> critically analyze and evaluate the philosophical concepts of science and the "main" approaches to the "problems" of science in philosophy and philosophy of science.</p> <p><u>Synthesis:</u> can synthesize and transform the philosophical and interdisciplinary knowledge to solve educational and research applications, can use conceptual and methodological apparatus of philosophy and social sciences to solve creative issues of various difficulty levels, using modern computer technologies and interactive teaching methods;</p> <p><u>Evaluation:</u> substantiate and reveal the essence of the philosophy of science in the context of the development of philosophical knowledge and the methodology of philosophical cognition and researches;</p> <p><u>Application:</u> argue their own position and point of view regarding the importance of the diversity of scientific research, as well as approaches to the problems of science;</p> <p><u>Application of skills:</u> can work on educational and research projects to determine the context of the problem, formulate research goals and objectives, substantiate the methodology and methods of the project (using modern computer technology, resources, etc.)</p> <p><u>Autonomy in skill use:</u> can plan and implement basic and applied research projects, perform science projects using methods of analysis of social and individual reality and methods of research process of its transformation, present ability of design and carrying out professional, scientific and scientific pedagogical activity, based on the philosophical understanding of modern educational processes.</p>

Content

1. Introduction to the discipline. The subject of history and philosophy of science.
2. Science as a subject of philosophy, and a variety of "scientific" and "theoretical" research in philosophy, as well as research of science itself in philosophy.
3. Classical and modern philosophy of science in the context of studying the problems of science and its evolution: comparisons and evaluations.
4. Features of science as a social institution. Classical philosophy and philosophy of science: essence, criteria and names.
5. Historical dynamics of science and its features.
6. Foundations and possibilities of internalist and externalist approaches and models of the development of scientific knowledge.
7. Scientific picture of the world and actual problems of science in modern philosophy of science.
8. The problem of scientific rationality in modern philosophy of science.
9. Science and methodological knowledge. Science and methodological culture.
10. The nature and specificity of the scientific revolution.
11. Theoretical knowledge.
12. Disciplinary structure of science: philosophical analysis.
13. Social and humanitarian knowledge and science: evolution,

	<p>structure, tasks, problems, etc.</p> <p>14. Scientific discovery.</p> <p>15. Science as the basis for the development and modernization of modern society.</p>
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<p>Main:</p> <ol style="list-style-type: none"> 1. Mitroshenkov, OA History and Philosophy of Science: textbook for universities / OA Mitroshenkov. - Moscow: Yurayt Publishing House, 2022. - 267 p. (Russian) 2. Franz-Peter Griesmaier, Jeffrey A. Lockwood. This is Philosophy of Science: An Introduction, 2022; 3. Nikiforov, A.L. Philosophy and history of science: Textbook. - Moscow.: Infra-M, 2018. - 384 p. (Russian) 4. Christopher Donohue and Charles T. Wolfe. Vitalism and Its Legacy in Twentieth Century Life Sciences and Philosophy (History, Philosophy and Theory of the Life Sciences, 29): 2022 <p>Recommended:</p> <ol style="list-style-type: none"> 1. Nikiforov, A.L. Philosophy and history of science: Textbook. -Moscow.: Infra-M, 2018. - 384 p. (Russian) 2. Kuzmenko, G.N. Philosophy and Methodology of Science: Textbook for Masters / - Moscow: Yurayt, 2016. - 450 p. (Russian) 3. Myrzaly S.K. History and philosophy of science. - Almaty:Bastau, 2014. (Kazakh) 4. Stepin V.S. History and philosophy of science. – Moscow: Academic Project, 2011. - 423 p. (Russian). 5. Khasanov M.Sh., Petrova V.F. History and philosophy of science. - Almaty: Kazakh University, 2013. - 150 p. (Russian) 6. Ostrovsky E.V. (2012) History and Philosophy of Science. UNITY-DANA, 160 p 7. Cover J.A., Curd M. and Pincock, C. (2012) Philosophy of Science: The Central Issues, 2nd edition. Norton. (English) 8. Mamchur E.A. The future of fundamental science. Conceptual, philosophical and social aspects (2011) URSS, Moscow (Russian)

Module designation	Foreign Language (Professional)
Credit points	6
Semester(s) in which the module is taught	Semester 1
Relation to curriculum	UNIVERSITY COMPONENT M-1 Module on history and philosophy of science
Teaching methods	Practical lessons (individual, group, project work, discussion, test)
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 15 Contact hours. 2 hours per week for Seminar, total 30 Contact hours. 120 self-study hours
Person responsible for the module	Valeriya Tsyganova

Language	English
Required and recommended prerequisites for joining the module	Prerequisites: intermediate level of English (B1)
Module objectives/intended learning outcomes	<p>Speaking:</p> <ul style="list-style-type: none"> • apply professional vocabulary and terminology necessary for effective communication in a professional environment within the framework of specialty; • think creatively; • be creative in solving new problems and situations; • independently prepare and deliver oral messages on professional topics, including the use of multimedia technologies. <p>Reading:</p> <ul style="list-style-type: none"> • read and translate authentic texts in the specialty from English into native language using a dictionary; • extract the necessary information from English-language sources created in various sign systems (text, table, graph, diagram, audiovisual series, etc.) in typical situations of professional and business communication; • recognize significant information in oral and written utterances, as well as use the basic grammatical units characteristic of technical speech. <p>Writing:</p> <ul style="list-style-type: none"> • to compose written texts of an informative nature (message, report, review, scientific and technical documentation); • abstract of texts on the profile of the specialty, reports of master's students on research topics; • correctly and logically formulate own thoughts in writing. <p>Listening:</p> <ul style="list-style-type: none"> • listen and understand an authentic speech of a general, professional and scientific nature. <p>Prepare presentation material and a project on the topics studied.</p>
Content	<p>UNIT 1 Getting started in research Planning a career in science Applying for research funding Writing up a résumé or CV Preparing for an interview</p> <p>UNIT 2 The scientific community Communicating with scientific communities Writing a critical review Completing a Material Transfer Agreement</p> <p>UNIT 3 Finding a direction for your research Doing a literature review Using evidence in arguing a point Taking part in a meeting</p> <p>UNIT 4 Designing an experiment Describing approaches to data collection Designing an experimental set-up Describing material phenomena and forces Making predictions of experimental results</p>

	<p>UNIT 5 Describing an experiment Describing a process Evaluating the results of an experiment Describing problems with an experiment Keeping a lab notebook UNIT 6 Writing up research 1: materials and methods Describing states and processes Describing data: numbers / numerical values Writing up from lab notes UNIT 7 Writing up research 2: presenting data Analysing data (statistical analysis) Summarising data in visual form Writing captions for figures Describing visual data</p>
Examination forms	<p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p>
Reading list	<ol style="list-style-type: none"> 1. Tamzen Armer. <i>Professional English. Cambridge English for Scientists.</i> Cambridge University Press, 2011 2. Michael McCarthy, Felicity O'Dell. <i>Academic Vocabulary in Use. Vocabulary reference and practice.</i> Cambridge University Press, 2012 3. Cathy Cox and David Hill <i>English for academic purposes. Student's book.</i> Pearson Longman. 2004

M-2 Psychology and Pedagogy Module

Module Objectives. Students will be able to:

1. understand the current state of the theory and practice of management psychology in an amount that is optimal for use in the subsequent professional activity;
2. to analyze the methodological problems of the psychological analysis of management processes and phenomena;
3. apply and describe psychological methods of studying individuals and social groups (communities) in order to improve management efficiency;
4. explain the basic psychological characteristics of the activities of individuals and groups that are the objects of management;
5. systematize the basic psychological characteristics of the activities of the subjects of management; establish the nature and content of the psychological preparation of subjects of management;
6. to characterize the socio-psychological phenomena arising in the management process in the interests of increasing its effectiveness;
7. demonstrate methods and techniques for the development and improvement of the professionally important psychological qualities of the subjects of management;
8. develop business and interpersonal skills in the context of the contact of different managerial cultures;

Module designation	Pedagogy of higher education
Credit points	3
Semester(s) in which the module is taught	2
Relation to curriculum	UNIVERSITY COMPONENT M-2 Psychology and Pedagogy Module
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 15 Contact hours. 2 hours per week for Seminar, total 30 Contact hours. 45 self-study hours
Person responsible for the module	Kasymova Roza, PhD
Language	Kazakh / Russian
Required and recommended prerequisites for joining the module	Pedagogy Teaching Internship
Module objectives/intended learning outcomes	Students have abilities to analyze of theoretical issues of modern higher school pedagogy; can examine of methodology pedagogy can assess the significance of methodology's approaches, just how people understand and/or learn about pedagogy, given the vast array of ideas, practices, institutions, and communities that lay claim to the category can to apply outcomes of psychological studies in professional and teaching activity
Content	1. The main directions and trends in higher education in the

	<p>world. Higher Education in the Republic of Kazakhstan.</p> <ol style="list-style-type: none"> 2. Teaching science and its place in the human sciences. 3. Higher School of Pedagogy Methodology 4. The nature and structure of educational activities 5. Personality of a high school teacher and current requirements for the competence of its 6. Communicative competence of a high school teacher 7. Traditional methods and forms of training 8. The theory of the pedagogical process 9. Methodological foundations of the learning process in higher education. Managing the learning process 10. Active teaching methods to train future specialists 11. Active teaching methods to train future specialists 12. New educational technologies in higher education 13. Organization of the educational process of higher education on the basis of the credit system 14. Technology pedagogical planning, organization and control in higher education 15. High school as a social institution.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<ol style="list-style-type: none"> 1. Geoff Petty. Teaching today. A practical Guide. Fourth Edition. United Kingdom, Nelson Thornes Ltd, 2019. -614p. 2. Mynbaeva A.K., Fundamentals of the Higher School of Pedagogy: Learning PSAR. - Almaty, 2021. - 156p. 3. Peonov, P. Pedagogy of higher education. - Minsk University, 2020. <p>Pedagogy and psychology of higher education. - Rostov n/D: Phoenix, 2019. - 544p.</p>

Module designation	Psychology of Management
Credit points	3
Semester(s) in which the module is taught	1
Relation to curriculum	UNIVERSITY COMPONENT M-2 Psychology and Pedagogy Module
Teaching methods	communication technology; problem learning, critical thinking. Active and interactive forms of training, individual creative and analytical tasks, brainstorming, brainstorming, competition, quiz, decision tasks case; SWOT analysis.
Workload (incl. contact hours, self-study hours)	Total workload: 3 - 190 contact hours 15 weeks, 1 hour per week for Lecture, total 15 Contact hours. 1 hours per week for Seminar, total 15 Contact hours. Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lectures in the form of a mini-conference, video presentations, a traditional lecture and a

	<p>heuristic conversation, the lecture is an INSERT. Seminars in the form of practical, discussion form, debates and other interactive types.</p> <p>Private study including examination preparation, specified in hours: independent work of a student and independent work under the guidance of a teacher - 60</p>
Person responsible for the module	Sveta Berdibayeva (Doctor of Psychology, prof. in Kazakh)/ Maira Kabakova (kand.psyc.n, ,Russian), Candidate of Psychological Science)/ Aidana Rizulla (PhD, in eng),
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	Prerequisite - Psychology at the Bachelor's degree Postrequisite – Foreign Language (professional)
Module objectives/intended learning outcomes	<p><u>Analysis:</u> carry out psychological analysis of management processes and phenomena; analyze and evaluate communication processes and processes of interpersonal perception in the organization through the application of system analysis and cross-cultural management techniques; Critically analyze the management performance of a manager based on a survey of management styles; analyze the professional activities of the manager in terms of ensuring his psychological effectiveness;</p> <p><u>Synthesis:</u> factors affecting the effectiveness of the group, psychological methods of resolving conflict situations, psychological support for innovations;</p> <p><u>Evaluation:</u> assess life and professional situations from the point of view of management psychology; Assess occupational risks in various management activities;</p> <p><u>Application:</u></p> <ul style="list-style-type: none"> - interpret the processes of interpersonal perception, interpersonal and intercultural communication in the organization to maintain the corporate culture and psychological climate; - apply psychological technologies to regulation of emotional state, stress tolerance, personal growth, reduction of management conflicts, improvement of psychological climate and corporate culture; - apply skills of psychological selection of personnel, management decisions, methods of motivation of work; managing the organization's emotional environment
Content	<p>Lecture 1. Introduction to management psychology</p> <p>Lecture 2. History of management psychology development</p> <p>Lecture 3. Theoretical and methodological foundations of management psychology.</p> <p>Lecture 4. Research methods in management psychology</p> <p>Lecture 5. Personality in management interaction</p> <p>Lecture 6. The identity of the leader as a subject of organization management.</p> <p>Lecture 7. Psychology of management decisions.</p> <p>Lecture 8. Motivational aspects of management.</p> <p>Lecture 9. Personality and building a business career in the</p>

	<p>organization.</p> <p>Lecture 10. Psychology of business communication and professional communication.</p> <p>Lecture 11. Psychology of interpersonal perception in the organization.</p> <p>Lecture 12. Psychology of intercultural communication.</p> <p>Lecture 13. Emotional management.</p> <p>Lecture 14. Psychology of management conflicts.</p> <p>Lecture 15. Corporate culture of the organization</p>
Examination forms	<p>The form of the exam is written - the solution of cases - grouped by the topic of situational and problematic problems. Case topics:</p> <ol style="list-style-type: none"> 1. The identity of the manager. 2. Personality and business career 3. Interpersonal and intercultural communication in the organization. 4. Stereotypes of perception in the organization. 5. Employee motivation problems. 6. Management decision-making. 7. Communicative barriers to business communication. 8. Management conflicts.
Reading list	<ol style="list-style-type: none"> 1. Akhtaeva N.S., Abdizhapparova A.I., Bekbaeva Z.N. Baskaru pshihologiya. - Almaty: Kazakh University, 2018. - 452 p. 2. Irgebayeva N.M. Baskaru pshihologiya. [Electronic resource]: textbook/Irgebayeva N.M. - Electronic text data. - Almaty: Nur-Print, 2015.- 356 p. - Access mode: http://www.iprbookshop.ru/67021.html. - EBS "IPRbooks" 3. Korolev L.M. Pshihologiya upravleniya. 5th ed. - M.Dashkov and K., 2016. - 188 p. 4. Umbitaliyev A.D. Baskaru pshihologiya: textbook/A.D. Umbitaliyev, K.B. Satymbekova, G.E. Kerimbek/Almaty: Economics, 2017. - 464 p. 5. Gilbreth L.M. The Psychology of Management. Palala Press, 2015 - 360 p. 6. Voskoboynikov F. The Psychology of Effective Management. Strategies for Relationship Building, Taylor & Francis eBooks, 2016 – 174 p. 7. Shane Linder. Project Management & Business Psychology: A Guide to Construction Management, 2020. 8. James P Armatas. Management Practices of Successful CEOs: Memoir of a Psychological Consultant to Management, 2020.

Module designation	Teaching Internship
Credit points	5
Semester(s) in which the module is taught	1
Relation to curriculum	UNIVERSITY COMPONENT M-2 Psychology and Pedagogy Module
Teaching methods	-
Workload (incl. contact	-

hours, self-study hours)	
Person responsible for the module	Egyzbaeva M.K. docent
Language	Kazakh / Russian
Required and recommended prerequisites for joining the module	Before teaching practice, undergraduates study the following disciplines: «Pedagogy of higher education», «Psychology of Management»
Module objectives/intended learning outcomes	<p>The purpose of the pedagogical practice of magistracy studies is to prepare for scientific and pedagogical activities in a higher educational institution, to acquire and consolidate the skills of practical exercises for the implementation of the educational process in higher education, including the teaching of particular disciplines, the organization of educational activities of students, scientific and methodological work on the subject. In addition in the course of teaching practice, a master's student should expand and deepen theoretical knowledge:</p> <ul style="list-style-type: none"> - basic principles, methods and forms of organization of the pedagogical process; - methods of control and evaluation of professionally significant qualities students; - requirements for a university teacher in modern conditions. - implementation of methodological work on the design and organization of the educational process; - speaking in front of an audience and creating a creative atmosphere in the course of classes; - analysis of difficulties arising in pedagogical activity and the adoption of an action plan to resolve them; - independent conduct of psychological and pedagogical research; - self-control and self-assessment of the process and result of pedagogical activity. - correct diagnosis of the pedagogical phenomenon; - skills are associated not only with the direct presentation of educational information but also with the methods of obtaining and processing it. - independently conduct classes according to the plan of the academic discipline (at least two lessons); - develop lecture notes for individual academic disciplines (at least one abstract); - form a methodological package for the chosen academic discipline; - accessible, taking into account the specifics of the subject, the level of preparedness of students, their life experience and age to present educational material; - using various teaching methods and their combinations, it is logically correct to build the process of teaching and learning information by students; - to formulate questions in an accessible, concise and expressive way; - effectively use technical training aids, visual aids, computer

	<p>programs;</p> <p>- promptly diagnose the nature and level of learning by students of educational material;</p>
Content	<p>The content of pedagogical practice is focused on the following types of pedagogical activity: 1. Training work: preparation and conduct of training sessions in the discipline, participation in the examination of the exam in the discipline, checking the tests of students. 2. Educational work: development of plans for training sessions, educational and methodological support, funds of evaluative means of discipline. 3. Organization of NIRS and extracurricular work of students: counseling students in the preparation of independent work, preparing students to participate in competitions / olympiads / conferences, conducting polls and survey of students. The specific content of practice is planned by the scientific director and is reflected in the individual schedule of the task of pedagogical practice.</p>
Examination forms	<p>The student-trainee draws up the practice results in a written report, which he defends in the commission at the graduating department during the corresponding period of intermediate certification according to the academic calendar. The assessment of the student's internship results is equated to the theoretical training marks, is taken into account when considering the issue of awarding a scholarship, and when calculating the overall GPA and transferring it to the next year of study and entered in the statement of practice. The general results of the practice summarise at the Academic Councils of the faculties with the participation of representatives of the practice bases. The final grade for pedagogical practice gets rated by a commission, which includes teachers in pedagogy and psychology and the head of training from the graduating department.</p>
Reading list	<ol style="list-style-type: none"> 1. Afonin, I.D. Psychology and Pedagogy of Higher School / I.D.Afonin, A.I. Afonin. - M.: Rusayns, 2018. - 256 p. 2. Gromkova, M.T. Pedagogy of Higher School: Textbook / M.T.Gromkov. - M.: Unity, 2017. - 80 p. 3. Mukasheva A.B., Kasen G.A. Pedagogical practice in magistracy: guidelines. - Almaty: Kazakh University, 2011. - 84 p. 4. Okolelov, O.P. Pedagogy of Higher School: Textbook / O.P.Okolelov. - M.: Infra-M, 2016. - 219 p. 5. Stolyarenko, L.D. Psychology and Pedagogy of Higher School:Textbook / L.D. Stolyarenko. - Rn / D: Phoenix, 2014. - 336 p.

Elective component

M-3 Hormones, genes and aging

Module Objectives. Students will be able to:

1. demonstrate knowledge and understanding of the general laws of the endocrine system and the specific features of individual structural elements of the endocrine system;
2. describe and substantiate the mechanisms of neuro-hormonal regulation of vegetative functions of the body; mechanisms that ensure the interaction of individual systems of the body and the body as a whole with the external environment;
3. apply the basic methodological principles of the analysis of the functional activity of the endocrine glands; apply research methods for assessing the functional state of the endocrine glands and the body as a whole;
4. to evaluate and argue the importance of genetic and endocrinological analyses for solving practical problems in the field of biomedicine;
5. synthesize information on genetics and endocrinology based on theoretical and methodological principles and techniques for assessing and describing the physiological state of the body;
6. analyze the dynamics of solving scientific problems in the field of genetics, endocrinology and geriatrics; analyze the results of research, summarize them in the form of a scientific essay, presentation, review, scientific review, etc.;
7. demonstrate the knowledge gained about the physiological functions, genes and patterns of development of organisms in phylogeny, ontogenesis of animals and humans;
8. demonstrate an understanding of the structure and relationships between its hormones, cells, mediators, nerve signals and mechanisms of aging of the body, including new knowledge in the context of basic knowledge in the aspect of gerontology, interpret their

Name of Discipline Cell aging and anti-aging

Discipline designation	Cell aging and anti-aging
Credit points	6
Semester(s) in which the module is taught	1
Relation to curriculum	Elective component Cell aging and anti-aging
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Lab, total 30 Contact hours. 120 self-study hours
Person responsible for the module	Shalakhmetova Tamara Minajevna Professor, Department of Biodiversity and Bioresources Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity and Bioresources
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	-

Module objectives/intended learning outcomes	<p>Discipline objectives: To know the about molecular, cellular, tissue mechanisms of aging for the purpose of professional research of the problems of gerontology and anti-aging.</p> <p>Learning outcomes: analyze achievements and problems in the field of gerontology; substantiate and argue their own ideas about existing problems in the study of the mechanisms of aging of cells, tissues, organs, and the body;</p> <p>Own: technologies for collecting, analyzing, summarizing and interpreting scientific information in the field of gerontology and anti-aging.</p> <p>Students acquire practical skills: Search, critical reading and evaluation of the evidence level of scientific publications in the field of gerontology.</p>
Content	<p>Aging as a physiological process. Increase in average life expectancy. Free radical theory of aging. Genetic Theory of aging. The Inflammatory Hypothesis of aging. Neuroendocrine theory of aging. Molecular mechanisms of aging. Biomarkers related to specific diseases of the aging organism. The effect of reducing the caloric content of food - Caloric restriction and reduced calorie mimetics. Geroprotectors. The role of growth hormone and other hormones in aging. Adaptogens. Coenzyme Q (ubiquinone Q10). Enterosorbents. Age-related disorders of nervous activity. Programmed "aging". Priorities of anti-aging medicine.</p>
Examination forms	<p>Written examination</p> <p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p> <p>Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.</p>
Reading list	<p>1 Almaz Sharman, Zhaksybai Zhumadilov. Scientific Foundations of Quality Longevity and Anti-Aging. Textbook. New York, Mary Ann Liebert, Inc. -2014.-184 p.</p> <p>2. The aging process and potential interventions to extend life expectancy//Clin Interv Aging. 2008 Sep; 2(3): 401–412.</p> <p>3. Mitochondrial determinants of mammalian longevity//Open Biol. 2017 Oct; 7(10): 170083.</p> <p>4. Geraldine Aubert, and Peter M. Lansdorp. Telomeres and Aging. 2008. 1 Apr 2008 https://doi.org/10.1152/physrev.00026.2007</p> <p>5. S.A. Filatova, L.P. Bezdenezhnaya, L.S. Andreeva. Gerontology. Rostov n / a.: Phoenix. 2004. S. 5-65.</p> <p>6. G.A. Ryzhak, S.S. Konovalov. Gerontology in the prevention of age-related pathologies. SPb.: Prime Eurosign. 2004, p. 146.</p> <p>7. V.N. Anisimov. Molecular and physiological mechanisms of aging. St. Petersburg: Nauka, 2008. 468 p.</p> <p>Internet resources:</p> <p>1. elibrjry.kaznu.kz</p> <p>2. Cell Biology – Hipertextbook</p> <p>3. http://esg-www.mit.edu:8001/esgbio/cb/cbdir.html</p>

Discipline designation	Regulation of gene expression and mechanisms of action of hormones
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Credit points	9
Semester(s) in which the module is taught	2
Relation to curriculum	Elective component Hormones, genes and aging
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Lab, total 60 Contact hours. 180 self-study hours
Person responsible for the discipline	<i>Taipakova Sabira Myktybekkyzy, PhD, Senior Lecturer of the Department of Molecular Biology and Genetics</i> <i>Srailova Gulziya Turapovna Associate Professor of Department of Biophysics, Biomedicine and Neuroscience</i> <i>Candidate of Biological Sciences</i>
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	-
Discipline objectives/intended learning outcomes	<p>Discipline objectives: to form a holistic system of knowledge in the field of gene expression regulation and hormone biochemistry for undergraduates, to form an understanding of the regulatory role of hormones at the molecular, subcellular levels in the implementation of the mechanisms of biochemical, physiological, genetic and immunological processes.</p> <p>Learning outcomes:</p> <ul style="list-style-type: none"> - substantiate the molecular-genetic nature of the regulatory processes that ensure the vital activity of various organisms; - use the methodology and experimental approaches used to study the regulatory mechanisms of the cell; - analyze the features of the functioning of regulatory mechanisms in pro- and eukaryotic organisms; - explain the biochemistry of hormones and hormone-like compounds, the molecular mechanism of their action.

Content	Regulation of gene expression by physical and chemical modifications of the DNA structure. Mechanisms of regulation of gene expression at the level of transcription, protranscriptional modification, translation, post-translational modification; mechanisms of regulation of enzyme activity. Intercellular communications. Mechanisms of hormone regulation based on negative feedback and positive feedback. Molecular mechanisms of action of hormones and transmission of regulatory signals. Biochemistry of second messengers. Structural features, gene expression, properties, molecular mechanisms of action of protein-peptide hormones. Biosynthesis, structure, reception, molecular mechanisms of action of hormones, amino acid derivatives; mechanisms of biosynthesis, metabolism, biological action of steroid hormones; Regulation of cellular response by tissue hormones and growth factors; interaction of regulatory mechanisms.
Examination forms	Written or oral examination Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	<ol style="list-style-type: none"> 1. Ya. Kolman, K.G-Rem Visual biochemistry. Knowledge Lab, 2021 2. Wilson K., Walker D. Principles and methods of biochemistry and molecular biology, Binom, 2015. 3. McLaughlin MB, Jialal I. Biochemistry, Hormones. 2022 Jul 18. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022. PMID: 31082156. 4. Gerald Litwack. Hormones. 4th ed. 2022. ISBN: 9780323902625. 474 p. 5. Nalini Raghavachari, Natàlia Garcia-Reyero. Gene Expression Analysis. Methods and Protocols. Springer New York, 2018. 387 p. <p> http://elibrary.kaznu.kz/ru https://meduniver.com/Medical/Physiology/; https://www.twirpx.com/file/961051/; https://yandex.kz/video/search?text; http://www.bio.bsu.by/physioha/files/sandakov-kurslekcyy.pdf </p>

M-3 Body regulation factors

Module Objectives. Students will be able to:

1. identify and distinguish tumor cells from normally functioning ones to explain the causes and mechanisms of their transformation into tumor cells and to solve problems of carcinogenesis;
2. explain the mechanisms of cytodifferentiation leading to the formation of tumors;
3. explain the key provisions of the theory of carcinogenesis to understand the nature of the occurrence of tumors and tissue malignancy;
4. interpret the processes of development of various types of tumor cells;
5. substantiate the epigenetic mechanisms of cell differentiation;
6. analyze the basic laws and mechanisms of the endocrine system and the principles of humoral regulation of physiological functions;
7. apply molecular genetic and physiological methods of analysis and assessment of the state of living systems.
8. use the methodology and experimental approaches used to study the regulatory mechanisms of the cell

Discipline designation	Epigenetics and factors of humoral regulation
Credit points	9
Semester(s) in which the module is taught	2
Relation to curriculum	Elective component Body regulation factors
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Lab, total 60 Contact hours. 180 self-study hours
Person responsible for the discipline	<i>Omirbekova Nargul Zhapparovna, Doctor of Biological Sciences, Professor of the Department of Molecular Biology and Genetics.</i> <i>Srailova Gulziya Turapovna Associate Professor of Department of Biophysics, Biomedicine and Neuroscience</i> <i>Candidate of Biological Sciences</i>
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	-

<p>Discipline objectives/intended learning outcomes</p>	<p>Discipline objectives: the formation of ideas about epigenetics, which studies the inherited changes in gene activity during the development of an organism or cell division and the processes of humoral regulation, consisting in the coordination of physiological and biochemical processes, carried out through the body fluids (blood, lymph, tissue fluid) with the help of hormones, organs and tissues during their life. Learning outcomes:</p> <ul style="list-style-type: none"> - substantiate the epigenetic mechanisms of cell differentiation; - reveal the mechanisms and ways of realization of implementing epigenetic signals in the cell; - to analyze the main patterns and mechanisms of the endocrine system and the principles of humoral regulation of physiological functions; - apply molecular-genetic and physiological methods of analysis and assessment of the state of living systems; - use the methodology and experimental approaches used to study the regulatory mechanisms of the cell.
<p>Content</p>	<p>Objects and methods of epigenetics. Mechanisms and ways of realization of epigenetic signals in the cell of organisms of different levels of organization. The value of RNA interference, small RNA and chromatin. Genomic imprinting. The role of epigenetics in various diseases in humans. Hormonal regulation of physiological functions. General properties and functions of hormones. Telecrine, paracrine and autocrine effects of action of biologically active substances. The mechanism of action of hormones. Chemical classification of hormones. Interaction of hormones with receptors. Biological action of secondary mediators. Reception of steroid hormones. Dynamics of formation and action of hormones. Morphological and functional features and physiological features of the endocrine glands. Regulation of hormone production.</p>
<p>Examination forms</p>	<p>Written or oral examination</p> <p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p> <p>Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes</p>

Reading list	<p>1. Ed. Ellis S.D., Jenuwein T., Reinberg D. Epigenetics. – M.: Technosfera, 2013.- 436 p.</p> <p>2. Ed. Lewin B. Genes. – M.: Binom. Knowledge Lab. 2012. - 896 p.</p> <p>3. Ed. Gavrillov M., Maltseva I. Epigenetics. Manage your genes - AST, 2021. - 320 p.</p> <p>4. Carey Nessa. Epigenetics. – Phoenix, 2012. – 349 p.</p> <p>5. Wilson K., Walker D. Principles and methods of biochemistry and molecular biology, Binom, 2015.</p> <p>http://elibrary.kaznu.kz/ru https://meduniver.com/Medical/Physiology/; https://www.twirpx.com/file/961051/; https://yandex.kz/video/search?text; http://www.bio.bsu.by/physioha/files/sandakov-kurslekey.pdf</p>
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Discipline designation	Mechanisms of the tumor process
Credit points	6
Semester(s) in which the module is taught	1
Relation to curriculum	Elective component Mechanisms of the tumor process
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for seminar total 30 Contact hours. <i>120 self-study hours</i>
Person responsible for the discipline	Shalakhmetova Tamara Minajevna Professor, Department of Biodiversity and Bioresources Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity and Bioresources
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	
Discipline objectives/intended learning outcomes	Discipline objectives: To know the about molecular, cellular, tissue mechanisms of tumor growth for the purpose of professional research of the problems of carcinogenesis; Be able to: identify and distinguish tumor cells from normally functioning ones, to explain the causes and mechanisms of their transformation into tumor cells and to solve the problems of carcinogenesis; to explain the mechanisms of cytodifferentiation leading to the formation of tumors;to explain the key provisions of the theory of carcinogenesis to understand the nature of the occurrence of tumors and tissue malignancy; Own: technologies for collecting, analyzing, summarizing and interpreting scientific information in the field of oncology. Students acquire practical skills: Search, critical reading and evaluation of the evidence level of

	scientific publications in the field of oncology.
Content	<p>Characteristics of tumor cells, dedifferentiation, division and growth. Proliferation of tumor cells, receptor proteins, signaling systems of tumor cells. Genome instability and gene expression of tumor cells. Tumor suppressor genes that limit their growth and proliferation. Tumor cells and apoptosis. The role of pro-apoptotic and anti-apoptotic regulatory proteins. Unlimited DNA replication potential of tumor cells, the role of telomerase. Induction of neoangiogenesis, endothelial vascular growth factors. Activation of invasion and metastasis. Implementation of an invasive growth program. Processes of metastatic colonization. The role of inflammation in the intensification of tumor formation and progression. Energy metabolism of cancer cells. Immunity and malignant transformation of cells. Achievements of molecular oncology in recent years.</p>
Examination forms	<p>Written examination Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.</p>
Readinglist	<ol style="list-style-type: none"> 1. Adams, J.M., Cory, S. (2007). The Bcl-2 apoptotic switch in cancer development and therapy. <i>Oncogene</i>. 26, 1324-1337. 2. Aguirre-Ghiso, J.A. (2007). Models, mechanisms and clinical evidence for cancer dormancy. <i>Nat. Rev. Cancer</i>. 7, 834-846. 3. Baeriswyl, V, Christofori, G. (2009). The angiogenic switch in carcinogenesis. <i>Semin. Cancer Biol.</i> 19, 329-337. 4. Barnes, D.E, Lindahl, T. (2004). Repair and genetic consequences of endogenous DNA base damage in mammalian cells. <i>Annu. Rev. Genet.</i> 38, 445-476. 5. Berdasco, M., Esteller, M. (2010). Aberrant epigenetic landscape in cancer: How cellular identity goes awry. <i>Dev. Cell.</i> 19, 698-711. 6. Berx, G., van Roy, F (2009). Involvement of members of the cadherin superfamily in cancer. <i>Cold Spring Harb. Perspect. Biol.</i> 1, a003129. 7. Bindea, G., Mlecnik, B., Fridman et al. (2010). Natural immunity to cancer in humans. <i>Curr. Opin. Immunol.</i> 22, 215-222. 8. Blasco, M.A. (2005). Telomeres and human disease: ageing, cancer and beyond. <i>Nat. Rev. Genet.</i> 6, 611-622. 9. Urkhart, D.L., Sage, J. (2008). Cellular mechanisms of tumour suppression by the retinoblastoma gene. <i>Nat. Rev. Cancer</i>. 8, 671-682 <p>Internet resources: 1. elibrjry.kaznu.kz 2. Cell Biology – Hipertextbook 3. http://esg-www.mit.edu:8001/esgbio/cb/cbdir.html</p>

MAJOR DISCIPLINES
University component

M-4 Fundamental principles and phenomenal of life

Module Objectives. Students will be able to:	
1. interpret and explain modern problems of theoretical and practical biology, evaluate the concepts of biological time and biological space in the physical, biological and philosophical sense, and also use these concepts in practice in their research and teaching activities;	
2. apply scientific knowledge on the main achievements and problems of modern theoretical and practical biology;	
3. determine the principles of formation and functioning of adaptive biological systems over organisms;	
4. to determine and evaluate the mechanisms of the origin of life, its variability and evolution, to have an idea of development and biodiversity;	
5. analyze, justify, and discuss the concepts and theories of modern biology, including the theory of the biological clock and the problems of aging;	
6. evaluate the fundamental principles and levels of biological organization and regulatory mechanisms of life, based on the role of biological diversity as a leading factor in the sustainability of living systems and the biosphere as a whole;	
7. to interpret the concepts of time in the physical, biological and philosophical senses, applying the principle of stable non-equilibrium of living systems, as the main one for the analysis and characterization of all life phenomena;	
8 possess methods of research and analysis of living systems for the examination and modeling of biological processes and phenomena.	

Discipline designation	Organization and planning of scientific research
Credit points	6
Semester(s) in which the module is taught	1
Relation to curriculum	University component. Fundamental principles and phenomenal of life
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 3 hours per week for Seminar, total 30 Contact hours. 120 self-study hours
Person responsible for the discipline	Aitasheva Zaure Gainetdinovna Professor of the Department of Molecular biology and Genetics
Language	English
Required and recommended prerequisites for joining the module	Prerequisites: courses of B.Sc. studies. Postrequisites: Master’s Dissertation Preparation and Defense
Discipline objectives/intended learning outcomes	Discipline objectives: - Determine principles of literature search and types of citations; - Analyse appropriate type of citation while writing an abstract, paper or manuscript; - Analyse the quality of the abstract, poster, paper or report; - Elucidate proper methods of conducting correct experimental work, interviewing, forming research teams, designing research proceedings (abstracts, papers, reports, graduate theses, and grant

	proposals); - Summarize and make analysis on modern techniques of scientific reasoning while holding or taking part in symposia and workshops, streaming research videos, making experimental procedures in teams, setting up editorial boards
Content	Introduction. Philosophical backgrounds of scientific reasoning Tasks of scientific reasoning. Literature search (Part 1). Library and online search. Literature search (Part 2). Implementation of Snowball Principle. Abstract compilation. Art of designing an abstract. Overall types of research publications. Reviews, experimental papers, short communications, letters to the editor, abstracts, synopses, highlights. Scientific paper as one of the main grounds for the development of scientific reasoning skills. Poster presentations. Advantages and the risk of failure. Art of oral presentations. Issues of Interviewing. Ten Rules principles in scientific reasoning. Online learning and commercialization of scientific research. Life-long learning. Perspectives and constraints of scientific development
Examination forms	Project, creative task. 5-10 pages project by the subject to be chosen by the team (of 1-3 graduates) out of topics.
Reading list	1 Vaughn L. Concise Guide to Critical Thinking. 2-nd Edition, 2020, 368 pp. 2 Morrow D.R., Weston A. A Workbook for Arguments: A Complete Course in Critical Thinking 3-rd Edition, 2019, 563 pp. 3 Golard A. A field guide to thinking errors: Using neuroscience to classify, avoid, and exploit our biases. 2021, 260 pp. 4 Potochnik, A., Colombo M., Wright C. Recipes for Science, Taylor&Francis, 2019, 327 pp. 5 Meltzoff, J. and H. Cooper. Critical Thinking about Research (2-nd editon).APA (Amazon Kindle), 2018, 335 pp. 6 Rurherford, A. Critical thinkers:methods for clear thinking and analysis in everyday situations from the greatest thinkers in history. Amazon (Great of Kindle Edition), 2018, 173 pp.

Discipline designation	Functional phytocenology
Credit points	6
Semester in which the module is taught	1
Relationship with curriculum	Elective Specialization Module
Teaching methods	lectures, seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for seminar, total 30 Contact hours. 120 self-study hours
Person responsible for the module	Mamurova Asem Tleuzhanova, Associate Professor of the Department of Biodiversity and Bioresources
Language	Kazakh
Required and recommended prerequisites for learning the module	Botany, Plant and animal Biodiversity, Plant Ecology, Geobotany
Module	As a result of the training, students will know the place of phytocenology

objectives/intended learning outcomes	in the system of sciences, the main stages of the development of the science of the plant community, the main scientific schools, directions, systemic approaches to the analysis of phytocenoses; Know the formation of phytocenoses and the relationship of its components, ecological and phytocenological optimum of the species; Know the composition, structure, ecology of phytocenoses, ordination of plants, productivity, dynamics, succession, geobotanical indication, assessment of the environment using plant association indicators; Be able to argue the classification of phytocenoses in the field of biocology, physiological dynamics, flora, geobotany, modern problems in biology, follow the ways to solve them and study the morphological features of plants using population research methods.
Content	1. The main stages of the development of the science of phytocenology, the formation, structure of phytocenoses. The main stages of the development of the science of the plant community. The main scientific schools, traditions and trends. Systemic approaches to the analysis of phytocenosis. The formation of phytocenoses and the relationship of its components. Regularities of phytocenosis formation classification of plants in phytocenosis based on the result of exposure to each other. Ecological and phytocenotic optimum of the species. The composition of phytocenosis. Floral composition, floral richness of phytocenosis. The fullness of flora, the ecological composition of phytocenosis. Stages and vital states of individual plant development. The importance of the diversity of the composition of the cenopopulation. Phytocenotypes. Niche of cenopopulations. Quantitative ratio of cenopopulations, phytocenotic structure of cenopopulations. Age composition of cenopopulations, types of phytocenosis. Structure, ecology, ordination of phytocenoses. Morphological or chronological structure of phytocenosis (synmorphology). The tiering of phytocenoses and the horizontal structure of phytocenoses. Ecological and biological structure of phytocenoses. Elements of the functional structure of phytocenoses. Approaches to the study of the institutional structure of phytocenoses. Functional structure of phytocenoses. Price cell. Sinusia. Consort. Ecology of phytocenoses. The main problems of ecology of phytocenoses (Synecology). Habitats in biological equilibrium. The main methodological ways of studying the connections between plants and the environment.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<ol style="list-style-type: none"> 1. Study of biological diversity of Kazakhstan at the present stage / Materials of the International Scientific Conference posv. Anniversary dates of outstanding scientists – botanists of Kazakhstan. Almaty, June 6-7, 2013. 2. Olonova M.V., Zhang D., Beckett U. Bulletin of the Tomsk State . University Biology 2013 No. 1 (21) pp.59-73. 3. Glazunov V.A. Protection of the flora of the XIII Congress of the Russian Botany.Society (September 16-22, 2013, pp.12-13). 4. L.A.Dimeeva, G.M.Kudabaeva, P.V.Veselova Protection of Flora XIII Congress of the Russian Botanic Community (September 16-22, 2013, pp.17-18). 5. Mukhitdinov N.M. Geobotany. Almaty., 2011. 384 b.

Discipline designation	<i>Theoretical Biology</i>
Credit points	6
Semester(s) in which the module is taught	2
Relation to curriculum	<i>Fundamental principles and phenomenal of life Theoretical Biology</i>
Teaching methods	<i>lectures, seminars</i>
Workload (incl. contact hours, self-study hours)	15 weeks <i>1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for seminars, total 30 Contact hours. 120 self-study hours</i>
Person responsible for the module	<i>Tuleukhanov Sultan Tuleukhanovich Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences Kulbaeva Marzhan Susarovna Acting docent of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences Kulmurzayeva Lyailya Rukhullova Acting docent of Department of Biophysics, Biomedicine and Neuroscience</i>
Language	<i>Kazakh, Russian, English</i>
Required and recommended prerequisites for joining the module	Zoology, Botany, Human and animal physiology, Biochemistry
Discipline objectives/intended learning outcomes	<p>Discipline objectives: understanding of the features of the subject of theoretical biology and the main approaches to the analysis of biological phenomena and processes in order to determine the basic laws and axioms of biological science for their further use in their research and teaching practice</p> <p>Learning outcomes:</p> <ul style="list-style-type: none"> -interpret and explain modern problems of theoretical and practical biology, evaluate the concepts of biological time and biological space in the physical, biological and philosophical sense, and also use these concepts in practice in their research and teaching activities -apply scientific knowledge on the main achievements and problems of modern theoretical and practical biology -determine the principles of formation and functioning of adaptive nadorg-lower biological systems -identify and evaluate the mechanisms of the origin of life, its variability and evolution, have an understanding of development and biodiversity. -analyze, justify, and discuss the concepts and theories of modern biology, including the theory of the biological clock and the problems of aging

Content	During the study of the discipline students will learn following aspects: Discipline is a course that shapes the scientific and methodological views of students. This discipline provides a study of the laws of theoretical biology: the Drish law, the law and 2 of Engels' law, the law of Vernadsky and others.
Examination forms	Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	<ol style="list-style-type: none"> 1. Bauer E.S. Theoretical biology.- St. Petersburg: Rostock, 2017. - 352 p. 2. Gavra D.P. Fundamentals of the theory of communication. 1st ed. St. Petersburg: St. Petersburg, 2011-457s. 3. Nikitin M.A. The Origin of life. From the nebula to the cell.-M.: Alpina non-fiction, 2018.-5102 4. Titok M.A. Molecular aspects of evolution. Mn.: BSU, 2011.-356s. 5. Yastrebova S. From atoms to the tree: An Introduction to the modern science of life. -M.: Alpina non-fiction, 2017.-7100s. 6. Chronobiology and chronomedicine/ collective of authors; edited by S.M. Chibisov, S.I. Rapoport, M.L. Blagonravova, M.: RUDN, 2018 – 828 p. <p>Internet resources: Electronic library of KazNU - https://elib.kaznu.kz/ Electronic library - http://elibrary.ru/ Website of the Faculty of Biology of Moscow State University -http://www.bio.msu.ru</p>

M-5 Cellular technologies in biology and medicine

1. demonstrate modern ideas about the structural and molecular organization of prokaryotic and eukaryotic cells of animals and plants;
2. explain the fundamental issues of cell biology, programs for the development of cells on the path of embryogenesis and the cellular mechanism of induction;
3. demonstrate the main directions and prospects for the development of cell biology, solved with the help of practical problems in biology, biomedicine, biotechnology and ecology;
4. demonstrate knowledge of modern methods of cell biology, understand the processes occurring in cells and tissues in normal and pathological conditions, regulation of growth, cell division and death;
5. to analyze the cytophysiological patterns of morphogenesis and differentiation in vitro in the field of biomedicine, biotechnology to create a new generation of biological products; explain the mechanisms of action of living cells, their organelles, structure, functioning, processes of cell reproduction, aging and death.
6. explain the modern fundamental and applied provisions of the theory of stem cells;
7. demonstrate using information about cell markers, differentiate stem cells according to the level of potency, understand the relationship between stem and differentiated cells in normal and pathological conditions;
8. demonstrate the skills of microscopy of cytological and histological preparations, recognize the degree and direction of cell differentiation by ultrastructural features.

Discipline designation	Cell biology and cell technologies
Credit points	5
Semester(s) in which the module is taught	3
Relation to curriculum	Elective component Cell Biology
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks 1 hour per week for Lecture, total 15 Contact hours. 2 hours per week for Lab, seminar total 45 Contact hours. 90 self-study hours
Person responsible for the module	Shalakhmetova Tamara Minajevna Professor, Department of Biodiversity and Bioresources Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity and Bioresources
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	Cell Biology, Histology, Embriology.
Discipline objectives/intended learning outcomes	As a result of studying the course, students should: To know the about the modern achievements and problems of cell biology, modern methods of molecular genetics, biotechnological research. Retrospectively and on the basis of the latest achievements of science is drawn to the discovery of cells and subcellular structures, identification of basic functions of cells and determination of their relation with intracellular structures and systems, discovery of proteins, nucleic acids, lipids, regulator molecules and their molecular organization. Be able to:applies knowledge of the structural and functional

	<p>organization of cells in vivo and in vitro. stemcells to solve complex research problems in the field of biomedicine and medicine.</p> <p>Own: technologies for collecting, analyzing, summarizing and interpreting scientific information.</p> <p>Students acquire practical skills: Search, critical reading and evaluation of the evidence level of scientific publications in the field of cell biology, regenerative medicine.</p>
Content	<p>The main stages of cell evolution. Molecular prebiological evolution. Methods of cell biology. Cell culture method. Conditions for culturing cells and tissues outside the body. Interaction of cells with the environment. Natural and anthropogenic environmental factors. Organization and evolution of the nuclear genome. Молекулярная и пространственная организация хромосом. Mechanisms and regulation of cell division. Reception and intercellular communication, intercellular interaction of cells in vivo and in vitro. Signaling systems of cells. Mechanisms of cellular communication. Endocrine, paracrine and synaptic chemical signaling systems. Cell bioenergetics. Mechanisms of energy conversion in cells in vivo and in vitro. Stem cells: basic definitions and concept. The main sources and methods for isolating embryonic, hematopoietic, mesenchymal, epithelial stem cells. Use of hematopoietic stem cells in oncohematology. Stem cells as the main resource of reparative medicine - cell therapy. Therapeutic cloning. Bioethical principles.</p>
Examination forms	<p>Written examination</p> <p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p> <p>Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.</p>
Reading list	<p>1. Alberts B., Bray D., Lewis D. Molecular biology of the cell: in 5 volumes. M.: Mir. 2012, 2005.</p> <p>2. B. Alberts, A. Johnson, J. Lewis et al. Molecular Biology of the Cell. Fifth Edition. Garland Science. 2011. -1268 p.</p> <p>3. Chentsov Yu. S. Introduction to cell biology. Textbook. Moscow, Moscow State University, 2014. 494 p.</p> <p>4. B. Glick, J. Pasternak. Molecular biotechnology. Principles and application. M.: Mir. 2012. -589 p.</p> <p>Additional.</p> <p>1. Journals: Cytology, Ontogeny, Molecular Biology, Genetics</p> <p>This literature can be obtained in the subscription or reading room of the National Library of KazNU named after al-Farabi (see map of the provision of educational literature)</p> <p>Internet resources:</p> <ol style="list-style-type: none"> 1. elibrjry.kaznu.kz 2. Cell Biology – Hipertextbook 3. http://esg-www.mit.edu:8001/esgbio/cb/cbdir.html 4. http://www.biology.arizona.edu/cell_bio/cell_bio.html 5. http://www.cellsalive.com 6. Guide to Microscopy and Microanalysis on the Internet 7. http://www.mwrn.com/guide.htm 8. http://www.ou.edu/research/electron/mirror

RESEARCH PRACTICE

Internal Code of KazNU IP 6305

1 -st type as Internship practice - abroad travel to one of series contract Universities for 2 weeks

Module Objectives. Students will be able to: 1. systematize scientific theories and concepts of modern areas of biology for use in the selection of initial theoretical positions in the creative solution of problem situations scientific, industrial activity; 2. build research activities based on the principles of bioethics, guaranteeing the scientific reliability of the results, conservation and protection of biodiversity, human rights and health; 3. develop a scheme of the experimental stages of semi-production and carry out the technological processes used in the fields of biotechnology and biology on their basis; 4. critically evaluate the main problems and strategies for conducting scientific research in biology; 5. choose research methods and strategies of research most relevant to the subject of a study and follow them in professional activity; 6. possess practical skills of processing research results in biology and biotechnology; 7. review and evaluate scientific products in the field of biology and related fields, such as ecology, medicine, agriculture, biotechnology.
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Discipline designation	RESEARCH PRACTICE
Credit points	24
Semester(s) in which the module is taught	1-4
Relation to curriculum	University Component
Teaching methods	1 scientific work, publications, conferences and more
Workload (incl. contact hours, self-study hours)	2 weeks, 4 hour per day in 4-5 days in week
Person responsible for the module	Kurmanbayeva M.S. Doctor of Biological Sciences, Professor of the Department of Biodiversity and Bioresources Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity and Bioresources, Candidate of Biological Sciences Zharkova Irina Maratovna Senior Lecturer of the Department of Biodiversity and bioresources, Candidate of Biological Sciences
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	Organization and Planning of Scientific Research
Discipline objectives/intended learning outcomes	Publications, conferences and more
Content	The aim of practice: to conduct research using advanced international experience and new technologies. Practice forms the ability to achieve new scientifically based theoretical / experimental research results, to determine the relevance, content, scientific novelty, practical relevance of the study, to correlate research / experimental research methodological, practical) sections with the main defense rules.
Examination forms	Oral examination and publications Practical/laboratory exercises, SIW should be independent, creative. Plagiarism, forgery, the use

	of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	<p>1 Vaughn L. Concise Guide to Critical Thinking. 2-nd Edition, 2020, 368 pp.</p> <p>2 Morrow D.R., Weston A. A Workbook for Arguments: A Complete Course in Critical Thinking 3-rd Edition, 2019, 563 pp.</p> <p>3 Golard A. A field guide to thinking errors: Using neuroscience to classify, avoid, and exploit our biases. 2021, 260 pp.</p> <p>4 Potochnik, A., Colombo M., Wright C. Recipes for Science, Taylor&Francis, 2019, 327 pp.</p> <p>5 Meltzoff, J. and H. Cooper. Critical Thinking about Research (2-nd editon).APA (Amazon Kindle), 2018, 335 pp.</p> <p>6 Rurherford, A. Critical thinkers:methods for clear thinking and analysis in everyday situations from the greatest thinkers in history. Amazon (Great of Kindle Edition), 2018, 173 pp</p>

Elective Component

M-6 Experimental embryology

Module Objectives. Students will be able to:

1. understand the general patterns of human and animal embryonic development;
2. demonstrate the features of embryogenesis in humans compared to other mammals;
3. understand the chronology of growth and differentiation of organs;
4. assess the impact of environmental factors on development;
5. demonstrate modern applied methods of developmental biology of artificial insemination in animal husbandry;
6. master the methods of in vitro fertilization, embryo transplantation, cryopreservation, cloning.
7. demonstrate the structure and functions of tissues and their constituent elements in representatives of the main types of multicellular animals from evolutionary positions;
8. use familiarity with the nature of the reactions of various tissue types to external influences.

Discipline designation	Embryology of Human and Animal
Credit points	5
Semester(s) in which the module is taught	3
Relation to curriculum	ELECTIVE COMPONENT
Teaching methods	Lecture, Seminar
Workload (incl. contact hours, self-study hours)	15 weeks Lectures – 15 hours Seminar – 30 hours 105 self-study hours
Person responsible for the module	Yessimsiitova Zura Berkutovna (kaz) Associate professor of Department of Biodiversity and Bioresources
Language	Kazakh
Required and recommended prerequisites for joining the module	Embryology, Developmental Biology

Discipline objectives/intended learning outcomes	As a result of studying the course, students should: understand and explain the essence of the basic concepts, theoretical and practical bases and principles of human and animal individual development laws and tissue origin and histogenesis in practice. To be able to demonstrate the history of individual developmental biology, its relationship with other biological sciences, embryological terminology, tissue origin and histogenesis. Form competent, logical opinions on achievements and problems in the field of personal developmental biology and embryology
Content	The history of the development of the biology of individual human and animal development. Germ cells and their development. Germ cells and their development. Fertilization. Fragmentation. Gastrulation. Neurulation. The relationship of the fetus with the mother's organism and the external environment. Fetal development of lower vertebrates. Development of birds. Determination. Development of mammals. Classical experimental embryology or "mechanics of development". Macroanatomical aspects. Examples of experimental analysis of some organogenesis using modern methods. Phylogeny connection with ontogeny. A. N. Severtsov's theory of phylembryogenesis. Theory of phylembryogenesis.
Examination forms	Written exam Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. R.K. Danilov, T.G. Borovaya. Histology. Embryology. Cytology. Moscow, Ed. "GEOTAR - Media", 2018. - 520 p. 2. V.V. Yaglov, Fundamentals of Cytology, Embryology and Histology. Moscow, Ed. INFRA-M, 2017 - 635 p. 3. S.M. Zimatkin. Basics of Histology, Cytology, Embryology / Basics of Histology, Cytology, Embryology. Minsk. Higher School, 2020 - 235 p. 4. A.V. Droblenkov, V. V. Rusanovsky. Fundamentals of medical cytology. Knorus, 2020. - 240 p. 5. S.M. Zimatkin, Ya.R. Matsyuk, L.A. Mozheiko, E.Ch. Mikhailchuk. Minsk. Higher School, 2018 - 481 p. 6. N.Yu. Polonskaya. Clinical cytology. Practical guide. M.: Practical medicine, 2018. - 144 p.

Discipline designation	Modern Problems of Tissue Biology
Credit points	5
Semester(s) in which the module is taught	3
Relation to curriculum	Elective Component
Teaching methods	Lecture, Seminar
Workload (incl. contact hours, self-study hours)	15 weeks Lectures – 15 hours Seminar – 30 hours 105 self-study hours
Person responsible for the module	Yessimsiitova Zura Berkutovna Associate professor of Department of Biodiversity and Bioresources
Language	Kazakh
Required and recommended prerequisites for joining the module	Cytology, Histology

Discipline objectives/intended learning outcomes	As a result of studying the course, students should: analyze the methodology for studying the structure and functioning of cells and tissues in organs and the body as a whole. Demonstrate knowledge of the history of cytology and histology, the relationship of this science with other biological sciences, cytological and histological terminology, the main provisions of the cell theory, the origin and histogenesis of various tissues, methodological approaches to the analysis of the structure and function of cellular organelles, cells, tissue systems in normal and under pathology.
Content	Research methods in histology and cytology. The doctrine of the cell. Single-membrane cell organelles. Bioenergetics of the cell. Non-membrane cell organelles. The structure and function of the
	cell nucleus. The structure of the nuclear envelope. Morphology of nuclear structures. Cell cycle. regulation of the cell cycle. Epithelial tissues. Structure. Classification. Glandular epithelium. Secretion types. Blood. Lymph. Hematopoiesis (hematopoiesis).. Connective tissues, their classification, functions performed. Examples of experimental analysis of some organogenesis using modern methods. Dense fibrous connective tissues. Connective tissues with special properties. Bone tissues. Osteohistogenesis. Histological structure of the tubular bone. Muscle tissues, morphofunctional characteristics, classification.
Examination forms	Written exam Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	<ol style="list-style-type: none"> 1. Chentsov Yu.S. Introduction to cell biology. Textbook. Moscow, Moscow State University, 2004. 494 p. 2. Chentsov Yu.S. General cytology. Textbook. Moscow, Moscow State University, 1995. 384 p. 3. Zavarzin A.A., Kharazova A.D., Molitvin M.N. Cell Biology: General Cytology. St. Petersburg: Publishing House of St. Petersburg. Univ., 1992, 239 p. 4. Workshop on cytology / Under the editorship of Yu.S. Chentsov. M.: Publishing House of Moscow State University, 1988. 5. Alberts B., Bray D., Lewis D. Molecular biology of the cell: in 5 volumes. M.: Mir. 2012. 6. Afanasiev Yu.I. etc. Histology. M., 2000, 678s. 7. Histology / ed. V. G. Eliseeva and others, M., "Medicine", 1989. 8. Shubnikova E.A. Functional morphology of tissues. Uch. allowance Moscow, Moscow State University, 1981, 328 p. 9. Additional: 10. Alberts B., Bray D., Lewis D. Molecular biology of the cell: in 5 volumes. M.: Mir. 1986.

M-6 Biophysical aspects of physiology

Module Objectives. Students will be able to:

1. carry out analyzes using DNA profiling methods: polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), short tandem repeats (SRT);
2. apply the methods of DNA diagnostics in forensics and determining the relationship of a person;
3. to practice the skills of molecular diagnostics of hereditary diseases at any stage of the development of the organism, including before birth (prenatal diagnosis);
4. determine the appropriate method of molecular diagnostic tests for specific samples of biomaterials.
5. analyze the features of the methods used to obtain new vector systems and superproducers of target proteins;
6. use theoretical knowledge and methodological skills of genetic engineering in professional activities;
7. use plasmids and vectors used in genetic engineering for specific purposes; use the methods of genetic engineering and selection in obtaining vaccines, transgenic and environmentally resistant plants, gene therapy and regenerative medicine.
8. choose biophysical and physiological research methods in accordance with the goals and objectives of research in the field of biology and medicine.

Discipline designation	Biophysical monitoring of ecosystems and chronobiology
Credit points	9
Semester(s) in which the module is taught	3
Relation to curriculum	elective component Biophysical monitoring of ecosystems and chronobiology
Teaching methods	lectures, seminars
Workload (incl. contact hours, self-study hours)	15 weeks 1 hour per week for Lecture, total 30 Contact hours 2 hours per week for Lab, total 60 Contact hours. 180 self-study hours
Person responsible for the module	<i>Ablaikhanova Nurzhanyat Tatukhanovna</i> Associate Professor of Department of Biomedicine, Biophysics and Neuroscience <i>Atanbaeva Gulshat Kapalbayevna</i> Professor of Department of Biophysics, Biomedicine and Neuroscience Candidate of Biological Sciences <i>Gumarova L.Zh.</i> Candidate of biological sciences, professor Department of Biophysics, Biomedicine and Neuroscience
Language	<i>Kazakh, Russian, English</i>
Required and recommended prerequisites for learning the module	<i>Human and animal physiology, Biochemistry, Biophysics</i>
Discipline objectives/intended learning outcomes	Discipline objectives: to form students' ability to conduct research on biological processes and phenomena in ecosystems from the standpoint of biophysics based on theoretical and applied thinking, knowledge and skills of working on modern biomedical, biophysical equipment, based on the basic theoretical provisions of

	<p>chronophysiology.</p> <p>Learning outcomes:</p> <ol style="list-style-type: none"> 1. know and understand the basic principles of cell biophysics and complex systems; basic physical laws underlying biological processes and phenomena; 2. be able to explain the essence of the first and second principles of thermodynamics; Hess' law, principles of Prigogine and E. Bauer; 3. analyze the mechanisms of bioelectrical and photobiological processes; 4. explain the mechanisms of generation of biological rhythms; principles of electrical conductivity of biosystems 5. interpret the basics of radiobiology and the mechanisms of radiation injury; 6. apply the acquired theoretical knowledge and practical skills in the practice of their own research.
Content	<p>Such subjects are studied by biological rhythms, biological clocks, molecular mechanisms for generating biorhythms. Melatonin. Biosynthesis of melatonin. The main functions of the epiphysis in the body. Biological role in melatonin, application in the clinic. Temporary organization of functions in the norm and in pathology. The concept of desynchronosis. Advantages of chronotherapy. Problematic issues of chronomedicine and chronotherapy.</p>
Exam form	<p><i>Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes</i></p>
Reading list	<ol style="list-style-type: none"> 1. Antonov V.F., Chernysh A.M., Kozlova E.K., Korzhuev A.V. <i>Physics and Biophysics. Workshop: textbook. Manual.</i> – M.: GEOTAR-Media, 2012. - 336 p. 2. Dzhakson M. <i>Molecular and cellular biophysics.</i> -M.: Mir.-2012.- 552s. 3. Inyushin V.M., Tuleukhanov S.T., Gumarova L.Zh., Kulbaeva M.S., Shvetsova E.V. <i>Ecological biophysics. Study guide.</i> – Almaty: Kazakh University, 2016. – 100 p. 4. Inyushin V.M., Toleukhanov S.T., Kulbaeva M.S., . Gumarova L.Zh., Shvetsova E.V., Kayrat B.K. <i>Tests in biophysics. Educational and methodical manual.</i> – Almaty: Kazakh University, 2019. – 116 b. 5. Kovaleva L. V. <i>Medical biophysics : textbook. manual / L. V. Kovaleva ; State med. un-t G. Semey.</i> - 2nd ed. - Almaty : Aknur, 2019. - 324 p. 6. Orynbayeva Z.S., Tuleukhanov S.T., Gumarova L.Zh., Kulbaeva M.S., Shvetsova E.V. <i>Introduction to the kinetics of biological processes: textbook</i> - Almaty: Kazakh University, 2020. – 89 p. 7. Samoilov V.O. <i>Medical biophysics: Textbook for universities.</i> – St. Petersburg: SpetsLit, 2013. – 591 s 8. Tuleukhanov S.T., Inyushin V.M., Gumarova L.Zh., Kulbaeva M.S., Shvetsova E.V. <i>Methodological guide to laboratory classes in biological physics.</i> – Almaty: Kazakh University, 2015. – 122 p. <p><i>Internet resources:</i></p> <p>Electronic library of KazNU - https://elib.kaznu.kz/</p> <p>Electronic library - http://elibrary.ru/</p> <p>Website of the Faculty of Biology of Moscow State University - http://www.bio.msu.ru</p>

Discipline designation	Molecular mechanisms of regulation of body function and cardiovascular system
Credit points	9
Semester(s) in which the module is taught	3
Relation to curriculum	Elective component. <i>Biophysics</i> <i>Medical Biophysics</i>
Teaching methods	lectures, seminars
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for seminars, total 60 Contact hours. 180 self-study hours
Person responsible for the module	<i>Murzakhmetova Maira Murzakhmetovna</i> <i>Doctor of Biological Science, Professor of Department of Department of Biophysics, Biomedicine and Neuroscience.</i> <i>Srailova Gulziya Turapovna</i> <i>Associate Professor of Department of Biophysics, Biomedicine and Neuroscience Candidate of Biological Sciences</i> <i>Bahtybaeva Layla Kirgizbaevna</i> <i>Associate Professor of Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences</i>
Language	<i>Kazakh, Russian, English</i>
Required and recommended prerequisites for learning the module	<i>Human and animal physiology, Biochemistry, Biophysics</i>
Discipline objectives/intended learning outcomes	Discipline objectives: to form the ability to analyze the functional state of the cardiovascular system and the molecular mechanisms of regulation of body functions. Learning outcomes: - apply the acquired knowledge in research work, in teaching practice and in other branches of science of applied importance - the ability to analyze the physiological mechanisms of the activity of the cardiovascular system, the influence of environmental factors - based on the acquired knowledge, the ability to solve theoretical and practical problems in the field of physiology of blood circulation and other applied sciences - the ability to generalize, interpret and evaluate the received learning outcomes; analyze the dynamics of solving scientific problems; the ability to analyze the results of the study, the ability to summarize them in the form of a scientific essay, presentation, review, scientific review, etc.; - to assess the state of the cardiovascular system of the body, to substantiate the features of the mechanisms of regulation of the activity of the heart and blood vessels, the functional state of the body as a whole and its reserve capabilities.
Content	When studying the course, the following aspects will be considered: it studies the activity of the cardiovascular system, the movement of blood through the system of cavities of the heart and blood vessels. The course provides for the study of the physiology of the heart, the properties of the heart muscle, the physiology of blood vessels, as well as methods for studying the cardiovascular system.

Examination forms	<i>Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes</i>
Reading list	<ol style="list-style-type: none"> 1. Nikitina, Olga Sergeevna Human anatomy and Physiology: workshop: in 2 hours / O. S. Nikitina, A. I. Kubarko, A. N. Kharlamova ; edited by V. A. Pereverzev ; Ministry of Health of the Republic of Belarus, BSMU, Department of Normal Physiology. - Minsk : BSMU, 2015 . . - ISBN 978-985-567-291-4. 2. Prishchepa, Inna Mikhailovna Human Anatomy: textbook. handbook for universities / [ed. E. P. Gorelik]; Ministry of Education of the Republic of Belarus. - Minsk ; M. : Nov. knowledge ; INFRA-M, 2013. - 457, [7] p. : ill. - (Higher education - Bachelor's degree : ser. founded in 1996). - Bibliogr.: pp. 458-459. - ISBN 978-985-475-579-3. 3. The Great Atlas of Human Anatomy: Atlas / BarCharts, Inc.; [trans. Y. V. Bukanova]. - M. : AST ; Kladez, 2015. - 189, [3] p. : tsv. il. - ISBN 978-5-17-082979-8 4. Aghajanyan N.A., Tel L.Z., Tsikin V.I. Human Physiology. - M., Novgorod: publishing house of NGMA, 2018. 5. Human and animal physiology: textbook for universities /author: Apchel V.Ya., Darinsky Yu.A., - M.: Academy, 2019 Internet resources:: https://meduniver.com/Medical/Physiology/; https://www.twirpx.com/file/961051/; https://yandex.kz/video/search?text; http://www.bio.bsu.by/physioha/files/sandakov-kurslekey.pdf https://www.youtube.com/watch?v=OqrXFbJIWE0

M-6 Actual problems of zoology

Module Objectives. Students will be able to:

1. systematize and present the latest achievements in the field of phylogenetics and evolutionary biology and the prospects for their use in various fields of practice and medicine;
2. use the methods and knowledge of phylogenetics and evolutionary biology in solving theoretical, practical issues and performing research work;
3. be able to use the transformation of information contained in all mantids (DNA) into an evolutionary tree to solve the problem of molecular phylogenetics, which consists in research in experimental biology to explain the most important biological processes;
4. To form a systematic understanding and understanding of the foundations of modern methods of phylogenetic research, which are the necessary basis for conducting research work, in subsequent scientific, industrial, pedagogical activities.
5. solve specific problems in choosing the most promising method of analysis and competently select the equipment necessary for conducting research.
6. correctly evaluate the reliability of the results obtained using metrological characteristics (interval of permissible errors, correctness, reproducibility, convergence), as well as analytical (sensitivity coefficient, selectivity, duration, performance).
7. to evaluate the significance of the results obtained in their own professional development and in the development of scientific ideas about the role of modern methods of biophysical research in medical and preventive and scientific institutions.
8. apply the scientific knowledge of modern biophysical research methods in practical professional activities in clinical diagnostic laboratories, medical and preventive and scientific institutions.

Discipline designation	Comparative morphology and embryology of animals
Credit points	9
Semester(s) in which the module is taught	3
Relation to curriculum	Elective Component Systematics of higher and lower plants
Teaching methods	lecture, seminar, laboratory work
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Lab, total 60 Contact hours. 180 self-study hours
Person responsible for the module	Kobegenova Saidina Serikbayevna Associate Professor, Candidate of Biological Sciences, Department of Biodiversity and Bioresources
Language	Russian
Required and recommended prerequisites for joining the module	systematics of higher and lower plants, plant ecology, phytocenology.
Discipline objectives/intended learning outcomes	Discipline objectives: "Comparative morphology and embryology of animals" is the formation of masters' knowledge about the laws of the structure of organs, their systems and the formation of the organism in the process of ontogenesis among various systematic groups of animals.

Content	The content of the discipline covers a range of issues related to the application of knowledge about the principles of homology and analogy of morphological structures of animals, understanding the patterns of evolutionary formation of morphological features of various taxonomic groups of vertebrates, biomechanical patterns of the structure of vertebrate organisms and the ability to compare the processes of embryonic development of organ systems of vertebrate embryos from different taxa.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<ol style="list-style-type: none"> 1. Gilbert S. Developmental biology. Publishing house "Mir", M., in 3 volumes, 1995, 823s. 2. Golichenkov V.A. Embryology / V.A. Golichenkov, E.A. Ivanov, E.N. Nikeryasova. –M.: Publishing House Center Academy, 2004. 3. Korochkin L.I. Biology of individual development (genetic aspect): Study. for students. biologist. spec./ L.I. Korochkin. -M.: Publishing House of Moscow State University, 2002. -263 p. 4. Kuznetsov S.L. Lectures on histology, cytology and embryology: Textbook. / S.L. Kuznetsov M.K. Pugachev / M. : Medical Information Agency, 2004. – 432 p. 5. Nurtazin S.T., Vsevolodov E.B. Biology of individual development. Publishing house "Kazakh University" Almaty, 2005, 297s., 2011, 330s. (2nd edition, supplemented). 6. Tokin B.P. General embryology. Publishing house "Higher School", 1987, 567s. 7. Muromtsev G.S. et al. Fundamentals of agricultural biotechnology. Moscow IN "Agropromizdat", 1990.

Discipline designation	Laboratory Animal Science and Animal Science
Credit points	9
Semester(s) in which the discipline is taught	3
Relation to curriculum	Elective Component
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	15 weeks 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Seminar, total 60 Contact hours. 180 self-study hours
Person responsible for the discipline	Kobegenova Saidina Serikbayevna Associate Professor, Candidate of Biological Sciences, Department of Biodiversity and Bioresources
Language	Russian
Required and recommended prerequisites for joining the discipline	plant ecology, phytocenology
Discipline objectives/intended learning outcomes	The purpose of the course "Science of Laboratory Animals and Animal Science" is to form the masters' knowledge about the main types of vertebrates used in scientific and experimental activities in order to study fundamental biological mechanisms, pharmacological preparations, as well as to improve and maintain breeds of farm animals and provide care for animals kept in captivity.

Content	The content of the discipline covers a range of issues related to the care, feeding and breeding of laboratory animals in vivarium conditions, stages of preclinical studies of pharmacological preparations on laboratory animals and production technologies of certain subsectors of animal husbandry.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<ol style="list-style-type: none"> 1. Islamov R. A. Methodology of the experiment using laboratory animals //Bulletin of the Kazakh National Medical University. - 2016. – No. 1. – pp. 489-492. Trubchaninova N. S. et al. General animal husbandry. – 2017. 2. Koptyaeva K. E. et al. Methods of opening and extracting organs of laboratory animals. Message 2: Mouse //Laboratory animals for scientific research. – 2018. – No. 4. – pp. 50-73. 3. Kiselev L. Yu. et al. Private animal husbandry. – 2000. 4. Gorelik O. V., Loretz O. G., Neverova O. P. Providing practical training in the preparation of masters in the direction of "Zootechny" //Agrarian education and science. - 2016. – No. 5. – pp. 22-22. 5. Notova S. V., Kazakova T. V., Marshinskaya O. V. Modern methods and equipment for assessing the behavior of laboratory animals (review) //Animal husbandry and feed production. – 2018. – Vol. 101. – No. 1. – pp. 106-115. 6. Korobeynikova E. P., Komarova E. F. Laboratory animals-biomodels and test systems in fundamental and preclinical experiments in accordance with the standards of good laboratory practice (NLP/GLP) //Journal of Fundamental Medicine and Biology. – 2016. – No. 1. – pp. 30-36. 7. Makarova M. N. et al. Principles of choosing animals for scientific research. Message 1. Selection of model organisms based on phylogenetic relationships //Laboratory animals for scientific research. – 2022. – No. 2. – pp. 58-70.

M-6 Bioindicative botany

Module Objectives. Students will be able to:

1. to systematize and present the latest achievements in the field of botany and the prospects for their use in various fields of practice and medicine;
2. use methods and knowledge of plant flora in solving theoretical, practical issues and performing research work;
3. demonstrate botanical research methods in experimental biology to explain the most important biological processes;
4. monitor the state, development, dynamics and degradation of individual natural components or processes, as well as environmental monitoring of all habitats;
5. demonstrate the scientific and methodological foundations for the development of landscape architecture objects of various levels, compositional techniques, planning, aesthetic tasks;
6. analyze and screen industrial contaminated areas with the help of plants;
7. to use the main methods of studying plant communities in different landscape zones, the diversity of species composition of ecobiotopes, methods of collecting, herbarization of plants.
8. determine the current state of the desertification process and the ecological state of individual regions.

Name of Discipline Phytoindication

Discipline designation	Phytoindication
Credit points	9
Semester in which the module is taught	3
Relation to curriculum	Elective Component plant ecology, phytocenology.
Teaching methods	lectures, seminar
Workload (incl. contact hours, self-study hours)	15 weeks 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Seminar, total 60 Contact hours. <i>180 self-study hours</i>
Person responsible for the discipline	Akhtayeva Nursulu Ziyakhanovna, Associate Professor of the Department of Biodiversity and Bioresources
Language	Kazakh, Russian
Required and recommended prerequisites for learning the module	The discipline "Phytoindication" is based on the knowledge gained in the study of university disciplines of taxonomy of higher and lower plants, plant ecology, phytocenology.
Discipline objectives/intended learning outcomes	The purpose of the course "Phytoindication" is the formation of theoretical knowledge and practical skills and professional competencies in the field of phytoindication, studying the influence of environmental factors on plants.
Content	The content of the discipline covers a range of issues related to methods for identifying indicator plants, considering phytoindicators of climate, soils, natural waters, rocks, relief, cultural landscape, studying indicator patterns in various types of vegetation.
Exam form	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless

	of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	<p>1. Opekunova M. G. Bioindication of pollution: textbook. allowance. - St. Petersburg: Publishing House of St. Petersburg University, 2016. - 300 pp. ISBN: ISBN: 978-5-288-05674-</p> <p>2. Bulokhov A.D. Phytoindication and its practical application. - Bryansk: BSU Publishing House, 2004. - 245 p.</p> <p>3. Bulokhov AD. Ecological assessment of the environment by phytoindication methods. - Bryansk: BSPU Publishing House, 1996. - 104 p.</p> <p>4. V.D. Turovtsev, V.S. Krasnov. Bioindication: Proc. allowance. - Tver: Tver. state un-t, 2004. - 260 p.</p> <p>5. Viktorov S. V., Remezova G. L. Indicative geobotany: Proc. allowance. - M.: Publishing House of Moscow. un-ta, 1988. - 168 p.</p> <p>6. Sibiryakova V.D., Vernander T.B. Key to forest types based on indicator plants. M., L., 1957.</p> <p>7. Schubert R. (ed.) Bioindication of pollution of terrestrial ecosystems "M. Mir, 1988, - 352 p.</p>

Discipline designation	Urban floristry and green architecture
Credit points	9
Semester in which the module is taught	3
Relation to curriculum	Elective component
Teaching methods	lectures, laboratory work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Seminar, total 60 Contact hours. 180 self-study hours
Person responsible for the discipline	Akhtayeva Nursulu Ziyakhanovna, Associate Professor of the Department of Biodiversity and Bioresources
Language of instruction	Kazakh, Russian
Required and recommended prerequisites for joining the discipline	The discipline "Urban Floristry and Green Architecture" is based on the knowledge gained in the study of higher and lower plant systematics, plant physiology, and plant ecology.
Discipline objectives/intended learning outcomes	"Urban Floristics and Green Architecture" are the formation of a complex of scientific knowledge for masters on issues related to the study of the composition, structure, functioning, genesis and development trends of the floras of settlements.
Content	The content of the discipline covers a range of issues related to the modern concept of urban flora, the genesis of the floras of settlements and their characteristics, goals and ways of creating a favorable environment for living in cities and small towns.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Antipina G. N. Urban flora of European Russia: knowledge and research prospects. // Study of the flora of Eastern Europe: achievements

	<p>and prospects. Moscow–St. Petersburg: Association of Scientific Publications KMK. 2005.</p> <p>2. Berezina N. A., Afanas'eva N. B. Ecology of plants. Textbook for university students. M.: Publishing Center "Academy", 2009. - 400 p.</p> <p>3. Marshalkovich A.S. Ecology of the urban environment: a course of lectures / A.S. Marshalkovich, M.I. Afonina. - M.: Moscow State University of Civil Engineering, IP Air Media, EBS DIA, 2016. - 319 p. — 978-5-7264-1269-6.</p> <p>4. Pertsik E. N. Geourbanistics: a textbook for students of higher educational institutions. M.: Publishing Center "Academy", 2009. - 432 p.</p> <p>5. Tetior A.N. Urban ecology: Textbook for universities. M.: Publishing Center Academy, 2006. - 336 p.</p> <p>6. Ecology of the city: textbook / Ed. F. V. Solberg. - Kyiv: Libra. 2000. - 264 p.</p>
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M-6 New technologies in human and plant genetics

Module Objectives. Students will be able to:

1. carry out analyzes using DNA profiling methods: polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), short tandem repeats (SRT);
2. apply the methods of DNA diagnostics in forensics and determining the relationship of a person;
3. to practice the skills of molecular diagnostics of hereditary diseases at any stage of the development of the organism, including before birth (prenatal diagnosis);
4. determine the appropriate method of molecular diagnostic tests for specific samples of biomaterials.
5. analyze the features of the methods used to obtain new vector systems and superproducers of target proteins;
6. use theoretical knowledge and methodological skills of genetic engineering in professional activities;
7. use plasmids and vectors used in genetic engineering for specific purposes; use the methods of genetic engineering and selection in obtaining vaccines, transgenic and environmentally resistant plants, gene therapy and regenerative medicine.

Discipline designation	Molecular diagnostics
Credit points	9
Semester(s) in which the discipline is taught	3
Relation to curriculum	Elective component New technologies in human and plant genetics
Teaching methods	<i>Lectures, seminars, IWS</i>
Workload (incl. contact hours, self-study hours)	<i>15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Seminar, total 60 Contact hours. 180 self-study hours</i>
Person responsible for the discipline	<i>Zhussupova Aizhan Izbasarovna, PhD, Senior lecturer of the Department of Molecular Biology and Genetics Omirbekova Nargul Zhapparovna, d.b.s., Professor of the Department of Molecular Biology and Genetics</i>
Language	<i>Kazakh, Russian, English</i>
Required and recommended prerequisites for joining the discipline	<i>To master this module, knowledge is required in the field of: genetics, molecular genetics, molecular biology, cell biology, medical genetics, embryogenetics.</i>

Discipline objectives/intended learning outcomes	<p>Purpose: to form undergraduates' ideas about the principles and possibilities of effective diagnostics based on specific methods of DNA, RNA and protein analysis to identify existing pathologies, individual risk assessment of the development of hereditary and oncological diseases, DNA fingerprinting in forensic science and forensic medicine.</p> <p>As a result of studying the discipline, the undergraduate will be able to:</p> <ul style="list-style-type: none"> - carry out analyzes using DNA profiling methods: polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), short tandem repeats (STR);
	<ul style="list-style-type: none"> - apply the methods of DNA diagnostics in forensics and determining the relationship of a person; - use world databases of DNA profiles; - to practice the skills of molecular diagnostics of hereditary diseases at any stage of development of the organism, including before birth (prenatal diagnosis); - determine the appropriate method of molecular diagnostic tests for specific samples of biomaterials.
Content	<p>The variability of the human genome. Methods of analysis of hypervariable markers. Features of mitochondrial DNA analysis. DNA profiling methods: polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), short tandem repeats (STR). Databases of DNA profiles. Molecular cytogenetic methods of chromosome analysis - FISH method and its modifications, spectral karyotyping, microarray analysis of chromosomes. Modern approaches to comparative mapping of genomes at the level of chromosomes. Organizational and procedural foundations of forensic medical examination. Forensic genetics. Methods of DNA diagnostics in forensics and determination of human kinship.</p>
Examination forms	<p><i>Written or oral examination</i></p> <p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p> <p>Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes</p>

Reading list	<p>1. Chang-Hui Shen. <i>Diagnostic Molecular Biology. 1st Edition, 2019. ISBN: 9780128028230. 472p.</i></p> <p>2. William B. Coleman, Gregory J. Tsongalis. <i>Molecular Diagnostics for the Clinical Laboratorian. 2005. ISBN: 9781588293565. 596p.</i></p> <p>3. George P. Patrinos, Wilhelm Ansorge, Phillip B. Danielson. <i>Molecular Diagnostics. 2016. ISBN: 9780128029718. 520p.</i></p> <p>4. David E. Bruns, Edward R. Ashwood, Carl A. Burtis. <i>Fundamentals of Molecular Diagnostics. 2007. ISBN 9781416037378. 288p.</i></p> <p>5. Zhussupova A.I., Omirbekova N.Zh., Biyasheva Z.M. <i>Modern issues in molecular diagnostics. Almaty: Qazaquniversity, 2015.</i></p>
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Discipline designation	Technologies in genetics
Credit points	9
Semester(s) in which the discipline is taught	3
Relation to curriculum	<i>Elective component</i> New technologies in human and plant genetics
Teaching methods	<i>Lectures, Seminar</i>
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Laboratory work, total 60 Contact hours. 120 self-study hours
Person responsible for the discipline	Taipakova Sabira Mykytbekkyzy, PhD, Senior Lecturer of the Department of Molecular Biology and Genetics
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the discipline	school courses in biology, botany and zoology
Discipline objectives/intended learning outcomes	<p>Purpose: to form masters' ideas about molecular cloning strategies, methods for obtaining recombinant DNA, amplification and sequencing, the fundamental provisions for the use of breeding technologies and their compliance with genetic patterns, the practical application of genetic engineering and breeding in obtaining vaccines, transgenic and environmentally resistant plants, genetic therapy and regenerative medicine.</p> <p>As a result of studying the discipline, the undergraduate will be able to:</p> <ul style="list-style-type: none"> -demonstrate in-depth knowledge of the biochemical and molecular biological foundations of genetic engineering; -analyze the features of the methods used to obtain new vector systems and super-producers of target proteins; -use theoretical knowledge and methodological skills of genetic engineering in professional activities; -use plasmids and vectors used in genetic engineering for specific purposes; -use genetic engineering and breeding methods to obtain vaccines, transgenic and environmentally resistant

	plants, gene therapy and regenerative medicine
Content	Enzymes of genetic engineering. General principles of gene cloning. Methods for constructing hybrid (recombinant) DNA molecules (recDNA). Vector DNA molecules. Introduction of DNA molecules into cells; methods for selection of hybrid clones of bacterial cells. Expression of cloned genes in pro- and eukaryotic cells. Genetic engineering system of yeast <i>Saccharomyces cerevisiae</i> . Genetic engineering of cultured mammalian cells. Vector systems of animal and plant cells. Methods for obtaining transgenic plants; methods for creating transgenic animals. Approaches to gene therapy and prospects for the development of these studies; evolution of genomic analysis.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of
	education; exam – 2 hours for 2-3 questions

Reading list

1. Muminov T.A., Kuandyko E.U. Fundamentals of molecular biology: lecture course. - Almaty: SSK, 2017. - 222 p. (In Russian)
2. Kuznetsov V. The theory of laboratory biochemical studies. Fundamentals of Biochemistry. – Rostov-D.D: Phoenix, 2014. - 397 p. (In Russian)
3. Ogurtsov A.N., Bliznyuk O.N., Masalitina N.Yu. Fundamentals of genetic engineering and bioengineering. Study guide. Part 1.: Molecular foundations of gene technologies. Kharkiv: NTU "KhPI", 2018. 288 p. (In Russian)
4. Nefedova L. N. Introduction of molecular methods of research in genetics: a scientific post. - M.: nits Infra-m, 2012. - 104 p. (In Russian)
5. Bissenbaev A.K., Smekenov I.T. Genetic engineering: laboratory workshop. - Almaty: Qazaq University, 2021. – 94 P. (In Russian)
6. Wilson K., Walker J.: Principles and methods of Biochemistry and Molecular Biology. Series: methods inbiology. Development: laboratory knowledge, 2021.

M-6 Research method sinbiology, phylogenetics and evolutionary biology

Module Objectives. Students will be able to:

1. systematize and present the latest achievements in the field of phylogenetics and evolutionary biology and the prospects for their use in various fields of practice and medicine;
2. use the methods and knowledge of phylogenetics and evolutionary biology in solving theoretical, practical issues and performing research work;
3. be able to use the transformation of information contained in all mantids (DNA) into an evolutionary tree to solve the problem of molecular phylogenetics, which consists in research in experimental biology to explain the most important biological processes;
4. To form a systematic understanding and understanding of the foundations of modern methods of phylogenetic research, which are the necessary basis for conducting research work, in subsequent scientific, industrial, pedagogical activities.
5. solve specific problems in choosing the most promising method of analysis and competently select the equipment necessary for conducting research.
6. correctly evaluate the reliability of the results obtained using metrological characteristics (interval of permissible errors, correctness, reproducibility, convergence), as well as analytical (sensitivity coefficient, selectivity, duration, performance).
7. evaluate the significance of the results obtained in their own professional development and in the development of scientific ideas about the role of modern methods of biophysical research in medical and preventive and scientific institutions.
8. apply the scientific knowledge of modern biophysical research methods in practical professional activities in clinical diagnostic laboratories, medical and preventive and scientific institutions.

Module designation	Modern botanical and biophysical research methods
Credit points	9
Semester(s) in which the module is taught	3
Relation to curriculum	elective component Modern botanical and biophysical research meth-ods
Teaching methods	lectures, seminars
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for seminar, total 60 Contact hours. <i>180 self-study hours</i>
Person responsible for the discipline	Gumarova L.Zh. Candidate of biological sciences, professor Department of Biophysics, Biomedicine and Neuroscience Akhmetova Aigul Bazylbekovna Professor of Biological Sciences of the Department of Biophysics, Biomedicine and Neuroscience, Candidat of Biological Science Shapovalov Yuriy Aleksandrovich Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences
Language	<i>Kazakh, Russian, English</i>

Required and recommended prerequisites for learning the module	<i>Human and animal physiology, Biochemistry, Biophysics</i>
Discipline objectives/intended learning outcomes	<p>The purpose of the discipline is the formation of competencies in undergraduates in the application of knowledge about the fundamental biological concepts of modern biology, research methods and the ability to apply the acquired skills and knowledge in the organization of scientific, industrial activities.</p> <p>During the study of course, students should be competent in:</p> <ul style="list-style-type: none"> - Deep knowledge of the features and objects of modern plants and methods of botanical research, the main botanical approaches to the analysis of the biodiversity of plant organisms; - basic laws and principles of modern methods of biophysical research, - Acquaintance with modern methods of biophysical and botanical research.
Content	<p>When studying the discipline, students will study the following issues: the basic concepts of modern botany and biophysics, the analysis and interpretation of modern methods of botanical and biophysical research. Theoretical developments in the field of fundamental laws and concepts of these sciences, as well as theoretical and applied research, the application of methods that form the basis of the achievements of botany and biophysics, which are used in medicine and modern biology.</p>
Exam form	<p>Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes</p>
Reading list	<ol style="list-style-type: none"> 1. Antonov V.F. CERN Wrote A.M. It's Kozlova.K. Korzhuev A.V. Physics and Biophysics. Practicum: textbook. More. - M.: Gə-media, 2012. - 336 C. 2. Jackson M. Молекулярная и клеточная биофизика.- М.- Peace.- 2012.- 552s. 3. Иню V.M. Tulleukhanov S.T. Gumarova L.WH. Kulbayeva M.S. Schwecova E.V. Э биофизика. School stuff. - Алматы: қ universityi, 2016. - Page 100. 4. Kovaleva L. V. Медицинская биофизика: учеб. пособие / L. V. Kovaleva; Госс. мед. ун-т Г. Самой. - 2nd ed. - Алматы: АҚҰ, 2019. - 324 с. 5. Оры Z.S. Tulleukhanov S.T. Gumarova L.WH. Kulbayeva M.S. It's Swiss.V. Видеогигиена в кинематографии биологического процесса: школьная работа пособие-Алматы: қ universityi, 2020. - 89 C. Internet resources: Electronic library of KazNU - https://elib.kaznu.kz/ Electronic library - http://elibrary.ru/ Website of the Faculty of Biology of Moscow State University - http://www.bio.msu.ru

Discipline designation	Problems of taxonomy, phylogeny of vertebrates and evolutionary biology
Credit points	9
Semester(s) in which the discipline is taught	3
Relation to curriculum	<i>Elective component</i> Research methods in biology, phylogenetics and evolutionary biology
Teaching methods	<i>Lecture, Seminar</i>
Workload (incl. contact hours, self-study hours)	<i>15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Seminar, total 60 Contact hours. 180 self-study hours</i>
Person responsible for the discipline	<i>Biyasheva Zarema Maratovna</i> <i>Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science</i>
Language	<i>Kazakh, Russian, English</i>
Required and recommended prerequisites for joining the discipline	-
Discipline objectives/intended learning outcomes	Aim of discipline: formation of an idea of phylogenetic systematics as a taxonomic information base that reveals the structure, content and genealogy of biological diversity. <i>As a result of studying the discipline, the masters will be able to:</i> 1 establish kinship relationships between various taxa of animals; 2 use methods for constructing genealogical trees, in which the real picture of ancestor-descendant relationships is reconstructed; 3 analyze the results of paleontological, biogeographical, morphological and molecular genetic studies; 4 understand the current problems of the synthetic theory of evolution; 5 explain the essence of the unresolved questions of evolutionary biology.
Content	Principles and methods of phylogenetic systematics. The main aspects of the study of animal diversity (body plan, construction of phylogenetic trees (cladograms), the use of a functional approach). Cladistic method based on the reconstruction of animal phylogeny. Methods of evolutionary biology: paleontological, biogeographical, morphological, molecular genetic. Theoretical foundations of evolutionary biology: the neutral theory of molecular evolution, theory of Punctuated equilibrium, theory of evolutionary epigenetics, principles of evolutionary developmental biology. Modern problems of the synthetic theory of evolution; achievements of experimental evolutionary biology and unresolved questions of evolutionary

	biology.
Examination forms	<p><i>Written or oral examination</i></p> <p>Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions</p> <p>Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes</p>
Reading list	<ol style="list-style-type: none"> 1. Van Wyhe, John. Darwin: The Story of the Man and His Theories of Evolution, London: Andre Deutsch, 2013 – 387p. 2. Warwick Collins. A Silent Gene Theory of Evolution, University of Buckingham Press, 2014 – 151p. 3. Max K. Hecht, Ross J. MacIntyre, Michael T. Clegg. Evolutionary Biology, Springer Science & Business Media, 2013 – 370p. 4. Brian Wiegmann, David K. Yeates. The Evolutionary Biology of Flies, Columbia University Press, 2012 – 440p. 5. Michael P. Muehlenbein. Human Evolutionary Biology, Cambridge University Press, 2015 – 624p. 6. Young N.M., Hallgrímsson B. Serial homology and the evolution of mammalian limb covariation structure // Evolution. — 2015. — T. 59, № 12. — C. 2691–704. 7. Tagaybekova D.S., Kemelbekova G.A. Evolutionary theory: a textbook. - Almaty: TechSmith, 2021. - 212 p.

REASEARCH

work of master-students under master thesis or dissertation

Objectives. Students will be able to:

1. plan research practice according to topic of own master dissertation
2. create the scientific materials for seminars
3. analyze and know the content of new scientific articles in topic of own master dissertation
4. be able to use the principles of assessment and statistical evaluation of results of research practice
5. write the article for publications in available journals and International Conferences;
6. argue the importance of main key components of own master dissertation;
7. write the master dissertation and apply modern educational technologies at writing of dissertation at necessary
8. do public defence the master dissertation.

Module designation	REASEARCH WORK
Credit points	
Semester(s) in which the module is taught	1-4
Relation to curriculum	University Component
Teaching methods	1 scientific work, publications, conferences and more
Workload (incl. contact hours, self-study hours)	60 weeks, scientific work, publications, conferences and more Research Seminar 1-3 Dissertation Writing 2-14 Scientific Internship 3-3 Publication in the Proceedings of International Conferences 4-4
Person responsible for the module	Kurmanbayeva M.S. Doctor of Biological Sciences, Professor of the Department of Biodiversity and Bioresources Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity Zharkova Irina Maratovna Senior Lecturer of the Department of Biodiversity Nurmahanova Akmaral Sadykovna Associate Professor of the Department of Biodiversity and Bioresources, PhD
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	General biology, biochemistry, biophysics, biotechnology and microbiology, genetics, physiology, histology, pedagogy, pedagogy of higher education, psychology, methodology of biology teaching
Discipline objectives/intended learning outcomes	Publications, conferences and more

Content	The aim of practice: to conduct research using advanced international experience and new technologies. Practice forms the ability to achieve new scientifically based theoretical / experimental research results, to determine the relevance, content, scientific novelty, practical relevance of the study, to correlate research / experimental research methodological, practical) sections with the main defense rules.
Examination forms	Oral examination and publications Practical/laboratory exercises, SIW should be independent, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.

Module designation	MASTER THESIS WRITING AND DEFENCE
Credit points	
Semester(s) in which the module is taught	1,2,3,4
Relation to curriculum	Master's student research
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	1 weeks, 12 ECTS
Person responsible for the module	<p>Kurmanbayeva M.S. Doctor of Biological Sciences, Professor of the Department of Biodiversity and Bioresources</p> <p>Abdullayeva Bagila Aidarovna Senior lecturer of the Department of Biodiversity and Bioresources</p> <p>Zharkova Irina Maratovna Senior Lecturer of the Department of Biodiversity and bioresources, Candidate of Biological Sciences</p> <p>Nurmahanova Akmaral Sadykovna Associate Professor of the Department of Biodiversity and Bioresources, PhD</p>
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	-
Content	<p>The final certification of master students is carried out in the form of writing and defending a master's thesis. To conduct the final attestation of students, an Attestation Commission (AC) for education is created. Students who have fully completed the educational process in accordance with the requirements of the working and individual curriculum and working curricula, and who have received admission to the defense by the supervisor, are allowed to the final certification.</p> <p>Programmes for a comprehensive exam in educational programmes of higher education are developed by graduating departments and approved by the Academic Council of the Faculty and the Academic Council of the University. The defense of the master's thesis is held at an open meeting of the attestation commission. On the topic of the master's thesis, students must publish at least one scientific publication. Before defending master's theses, they undergo a mandatory check for plagiarism in the UNIVER system.</p> <p>The results of the comprehensive examinations and the defense of final work are announced on the day they are held. Decisions on defense assessments, as well as on awarding qualifications, awarding a degree and issuing a state diploma (without distinction, with honors) are made by the certification commission at a closed meeting by open voting by a simple majority of votes of the commission members participating in the meeting.</p> <p>A student who has passed the final certification and confirmed the</p>

	<p>mastery of the educational programmes is awarded a master's degree by the decision of the attestation commission and is awarded a qualification in the relevant educational programmes and is issued a diploma with an application free of charge. The diploma appendix (transcript) indicates the latest grades according to the point-rating letter system of assessments for all academic disciplines, completed term papers (projects), research or experimental research work, types of professional practices, final certification, indicating their volume in academic credits and hours.</p> <p>Graduates of master's degree programs receive a European Diploma Supplement free of charge in addition to their diploma.</p>
Examination forms	Public defence