al -Farabi Kazakh National University
Faculty of Biology and Biotechnology
Department of Biodiversity and Bioresources

APPROVED
Dean of the Faculty
_____ Kurmanbayeva M.S.
«____» «_____» 2024

EDUCATIONAL AND METHODOLOGICAL COMPLEX OF DISCIPLINE

100365 - Cytology, Histology and Embryology

Educational program **«6B05105 – Genetics»**

Course	2
Semester	1
Number of credits	9
Lectures	3
Seminars	6
IWST	6

Almaty, 2024

The educational and methodological complex of discipline was completed by Zaparina Ye., Senior Lecturer of department of Biodiversity and Bioresources

Based on the working curriculum for the educational program «6B05105 – Genetics» of the Faculty of Biology and Biotechnology.

Considered and recommended at meaning of the Department of Biology and Bioresources Protocol № 1 «02» September 2024

Head of the Department _____ Kegenova G.B.

SYLLABUS
Autumn semester 2024-2025 academic years
on the educational program 6B05105 – Genetics

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Sem. classes (SC)	Prac. classes (PC)		
101558 Cytology, Histology and Embryology	4	3	0	6	9	6

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of seminar classes	Form and platform final control
Offline	major disciplines (MD). University component (UC)	Information with visualization	Solution of situational problems	Oral offline form

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ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) * As a result of studying the discipline the undergraduate will be able to:	Indicators of LO achievement (ID) The undergraduate:
Discipline aims to develop the ability to identify and analyze the main cells and tissues and the general patterns of human and animal embryonic development. It will consider the primary body cells and tissues and their characteristics; general patterns characteristic for the tissue level of the organization; features of the structure, development and vital activity of specific tissue systems; and general patterns of embryonic development in the early stages of ontogenesis.	1. To understand and explain the essence of key concepts and classifications.	1.1 Understands and knows the stages of historical development in cytology, histology, and embryology.
		1.2 Possesses the conceptual framework and specialized terminology
	2. To understand and know the structure of the cell, types of tissues, the details of their structure, and their primary functions.	2.1 Knows the structural features of cells, tissues, organs, and organ systems.
		2.2 Understands the general patterns of the structural organization of human organs and organ systems
	3. To identify the structural components of cells and tissues in histological specimens.	3.1 Identifies the structural components of cells and tissues on models, atlases, and histological specimens.
		3.2 Performs microscopy of histological specimens using light microscopy.
		3.3 Draws and describes histological and cytological specimens.
	4. To conduct comparative analysis of observed structural changes, and formulate conclusions and justifications for them.	4.1 Solves subject-specific tasks.
		4.2 Conducts comparative analysis

	5. To establish connections between the studied material and other disciplines. Apply the acquired knowledge in practical and scientific activities.	5.1 Can accurately present and evaluate data 5.2. Designs and conducts simple experiments to study the function of individual organs and organ systems
Prerequisites	Biodiversity of plants and animals	
Postrequisites	Microscopic technology and anatomy of humans and animals	
Learning Resources	**Literature:** 1. Dalton L. and Young R. Fundamentals of Cell Biology. Oregon State University. – 2024. – 586 p. ISBN 978-1-955101-38-7. 2. Mescher A.L. Junqueira's Basic Histology: Text and Atlas, 17th Edition. – 2023. – 486p. 3. Sorenson R.L. Atlas of Human Histology. - A Guide to Microscopic Structure of Cells, Tissues and Organs– 2nd Edition, All Rights Reserved. – 2008. – 359 p. 4. Shubnikova E.A. Functional tissue morphology: study. Pos. M., Publishing House of Moscow State University, 1981 5. Gilbert, S.F. & Raunio, A.M., eds. Embryology: Constructing theOrganism. Sunderland, MA: Sinauer Associates. (2012) page 223-260. **Internet resources:** http://elibrary.kaznu.kz/ru/ https://study.com/academy/topic/introduction-to-plant-anatomy.html https://botanydepot.com/2021/01/20/videos-plant-systematics-lectures-by-bruce-kirchoff/	

Academic course policy	The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University . Documents are available on the main page of IS Univer . **Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. **Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. **Academic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings". Documents are available on the main page of IS Univer . **Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail 8 702 46 16 800 / zaparina.elena06@gmail.com MS Teams **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				**Assessment Methods**
Grade	**Digital equivalent points**	**points, % content**	**Assessment according to the traditional system**	**Criteria-based assessment** is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment. **Formative assessment is** a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the
A	4.0 _	95-100	Great	
A-	3.67	90-94		

B+	3.33	85-89	Fine	best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed. **Summative assessment** - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.	
B	3.0	80-84		**Formative and summative assessment**	**Points % content**
B-	2.67	75-79		Activity at lectures	3
C+	2.33	70-74		Work in seminar classes	20
C	2.0	65-69	Satisfactorily	Independent work	25
C-	1.67	60-64		Design and creative activity	10
D+	1.33	55-59	Unsatisfactory	Final control (exam)	40
D	1.0	50-54		TOTAL	100

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

A week	Topic name	Number of hours	Max. ball
	MODULE 1 Cytology		
1	**Lecture 1.** Introduction to Morphological Sciences. Research Methods. Levels of Organism Structure. Terminology.	2	1
	Laboratory class 1. Cell Theory. Microscopy Techniques, General Structure of the Cell. Cell Diversity.	4	7
2	**L2.** Structure of Membranes. Cellular Contacts. Membranous and Non-Membranous Organelles.	2	1
	LC 2. Study membranes and two- membranous organelles on specimens; non-membranous cellular components.	4	7
	IWST 1. Consultation on the implementation of IWS 1		
3	**L3.** The Nucleus and Its Components. Cell Cycle. Mitosis. Meiosis.	2	1
	LC 3. Study the structure of the nucleus on specimens. Cell Cycle. Mitosis. Meiosis.	4	7
	IWS 1. Modern Concepts of Cell Death (Apoptosis, Necrosis, etc.).		14
	MODULE 2 Histology		
4	**L 4.** Tissues. Classification and Origin of Tissues. Epithelial Tissues.	2	1
	LC 4. Study epithelial tissues on specimens.	4	7
	IWST 2. Consultation on the implementation of IWS 2		
5	**L 5.** Connective Tissues.	2	1
	LC 5. Study connective tissues and connective tissues with specialized properties on specimens.	4	7
6	**L 6.** Muscle Tissues. Cartilage and Bone Tissues.	2	1
	LC 6. Study the structure of muscle, cartilage, and bone tissues on specimens.	4	7
	IWS 2 Tissue Evolution. A.A. Zavarzin's Theory of Parallel Series of Tissue Evolution and N.G. Khlopin's Theory of Divergent Differentiation.		14
	IWST 3. Consultation on the test or exam for Modules 1-2.		
7	**L 7.** Nervous Tissue.	2	1
	LC 7. Study the structure of nervous tissue on specimens.	4	7
	Control work		16
Midterm control 1			**100**
	MODULE 3 Embriology		
8	**L 8.** Subject, History, Methods, Significance, and Objectives of Reproductive and Developmental Biology. Current Achievements and Issues in Individual Development Biology as a Science.	2	1
	LC 8. Study spermatozoa of different animal species (microslides), morphology of male reproductive organs (on models and atlases), and micromorphology of mammalian testes.	4	6
9	**L 9.** Periodization of Ontogeny in Vertebrates (Periods: Embryonic, Larval, Metamorphosis, Juvenile, Adult, Aging). Impact of Environmental Factors on Ontogeny.	2	1
	LC 9. Study the structure of female reproductive organs in invertebrates and vertebrates. Micromorphological and biochemical features of animal oocytes. Structure of egg membranes and biochemical composition of ooplasm.	4	7
	IWST 4. Consultation on Lectures 8-9.		
10	**L. 10.** Reproductive Cycles and Their Regulation. Parthenogenesis. Fertilization and Artificial Insemination, Use in Agriculture and Medicine.	2	1

	LC 10. Study diagrams and tables of hormone secretion dynamics in ontogeny and seasonal variations. Influence of sex hormones on the CNS, behavior, and other organs and tissues of animals.	4	7
	IWST 5. Consultation on the implementation of IWS 3		
11	**L 11.** Types of Cleavage, Their Dependence on Yolk Distribution. Blastulation, Types of Blastulas. Structure of Blastula in Animals with Different Cleavage Types. Features of Cleavage and Blastocyst Formation in Mammals.	2	1
	LC 11. Study cell division during cleavage in representatives of different animal species using diagrams, models, video films, and microslides. Rules of Cell Division by Hertwig-Sachs.	4	7
	IWS 3. Pre-embryonic Development - Gametogenesis, Morphology and Physiology of Female and Male Gametes, Fertilization, and Cleavage.		14
12	**L 12** Gastrulation in Different Animal Species and Its Mechanisms. Neurulation and Somite Formation. Concepts of Determination and Embryonic Induction.	2	1
	LC 12. Study gastrulation processes in various vertebrate species using microslides, atlases, and video materials.	4	7
13	**L 13.** Cytophysiological Foundations of Morphogenesis and Epigenetic Inheritance of Cells. Role of the Genome in Development.	2	1
	LC 13. Cellular division: mitosis and meiosis. Cellular migration. Cellular adhesion and fusion. Apoptosis. Study using microslides, photographs, and video materials.	4	7
	IWST 6. Consultation on the implementation of IWS 4		
14	**L 14.** General Concepts of Developmental Genetics.	2	1
	LC 14. Study the development of somites and tissues derived from them, as well as limbs and eyes using diagrams, atlases, and video materials.	4	7
	IWS 4. Cloning of Valuable Breeding Livestock and Rare Endangered Wild Fauna Species.		14
15	**L 15.** Biotechnological and Biomedical Aspects of Developmental Biology. Issues of Correcting Hereditary Defects, Transplantation and Regeneration of Tissues and Organs, Cell and Organ Conservation, Reproductive Issues; Problems of Increasing Organism Resistance to Environmental Impacts; Human and Animal Reproductive Biology.	2	1
	LC 15. Watch educational and popular science films on the creation of transgenic animals with targeted genome modifications, creation of genetically modified stem cells and their use for studying mechanisms of genetic information implementation during morphogenesis and cellular differentiation processes, as well as solving transplantation problems.	4	7
	Control work		9
	IWST 7. Consultation about the Final exam		
Midterm control 2			**100**
Final control (exam)			**100**
TOTAL for course			**100**

Dean **Kurmanbayeva M.S.**

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

Head of Department **Kegenova G.B.**

Lector **Zaparina Ye.G.**

RUBRICATOR OF THE SUMMATIVE ASSESSMENT

CRITERIA EVALUATION OF LEARNING OUTCOMES

SIW 1: A group presentation « Modern concepts of cell death" (10% of 100%)

Criterion	"Excellent" 8-10 %	"Good" 6-7 %	"Satisfactory" 4-5 %	"Unsatisfactory" 1-3 %
Understanding the theories and concepts of cell death variants	Deep understanding of cell death concepts. Relevant and relevant links (citations) to key sources are provided.	Understanding of cell death concepts. Links (citations) to key sources are provided.	Limited understanding of cell death concepts. Limited references (citations) to key sources are provided.	Superficial understanding / lack of understanding cell death concepts. of cell death concepts. Relevant references (citations) to key sources are not provided.
Awareness of key issues	Wide awareness of the mechanisms of cell death, the importance of cell death in physiological and pathological processes. Excellent justifies its answers with examples.	Awareness of the mechanisms of cell death, the importance of cell death in physiological and pathological processes. Substantiates his answers, sometimes justifying them with examples.	Limited knowledge of the mechanisms of cell death, the importance of cell death in physiological and pathological processes. Limited number of reasoned examples for answers.	Not understanding regarding key issues of cell death. There is no logical connection in the answers, which are not supported by arguments and are not supported by examples.
Consideration of the main provisions, giving comparative aspects and examples, putting forward statements and conclusions.	The answer is clear, deep logically structured and directly connected with question. Maintains consistent, clearly formulated answers to the questions posed, is able to connect theory with practice, illustrate with examples, facts, and scientific research data; makes interdisciplinary connections, proposals, conclusions.	The answer is structured, there are some inaccuracies (insignificant errors) in the presentation of theoretical and practical material; the answer is less thorough, deep, valid and complete. The results and conclusions are partially summarized.	The answer is not structured; answers to questions are presented in a chaotic order, without any logical relationship. There are no results or conclusions.	There is absolutely no logical connection in the answer.
Presentation, Teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality of visuals, slides or other materials, good level of teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low level of involvement, low quality of materials, poor level of teamwork.

SIW 2: "Evolution of tissues. The theory of A.A. Zavarzin on parallel series of tissue evolution and N.G. Khlopin on divergent differentiation." (10% of 100%)

Criterion	"Excellent" 8-10 %	"Good" 6-7 %	"Satisfactory" 4-5 %	"Unsatisfactory" 1-3 %
Understanding the theories of A.A. Zavarzin and N.G. Khlopin	Deep understanding of the laws of divergent evolution of tissues and parallel series. Relevant and relevant links (citations) to key sources are provided.	Understanding the laws of divergent evolution of tissues and parallel series Links (citations) to key sources are provided.	Limited understanding of the laws of divergent tissue evolution and parallel series. Limited references (citations) to key sources are provided.	Superficial understanding/lack of understanding of the laws of divergent evolution of tissues and parallel rows. Relevant references (citations) to key sources are not provided.
Awareness of key issues in unraveling tissue evolution	Broad awareness of key issues in tissue evolution. Excellent justifies its answers with examples.	Awareness of key issues in tissue evolution. Substantiates his answers, sometimes justifying them with examples.	Limited awareness of key issues in tissue evolution. Limited number of reasoned examples for answers.	Little awareness/competence about key issues in tissue evolution. There is no logical connection in the answers, which are not supported by arguments and are not supported by examples.
Consideration of the main provisions, giving comparative aspects and examples, putting forward statements and conclusions.	The answer is clear, deep logically structured and directly connected with question. Maintains consistent, clearly formulated answers to the questions posed, is able to connect theory with practice, illustrate with examples, facts, and scientific research data; makes interdisciplinary connections, proposals, conclusions.	The answer is structured, there are some inaccuracies (insignificant errors) in the presentation of theoretical and practical material; the answer is less thorough, deep, valid and complete. The results and conclusions are partially summarized.	The answer is not structured; answers to questions are presented in a chaotic order, without any logical relationship. There are no results or conclusions.	There is absolutely no logical connection in the answer.
Presentation, Teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality of visuals, slides or other materials, good level of teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low level of involvement, low quality of materials, poor level of teamwork.

SIW 3: A group presentation « Pre-embryonic development - gametogenesis, morphology and physiology of female and male gametes, fertilization and cleavage» (10% of 100% MC)

Criterion	"Excellent" 8-10 %	"Good" 6-7 %	"Satisfactory" 4-5 %	"Unsatisfactory" 1-3 %
Knowledge of the theory and basic principles of embryology	Deep knowledge of the material on pre-embryonic development –	Knowledge of pre-embryonic development – gametogenesis	Limited knowledge of material on pre-embryonic development – gametogenesis	Superficial understanding / lack of understanding of the material on pre-

concerning the process of pre-embryonic development, knowledge of professional terms and definitions.	gametogenesis (the process of formation of sex cells – gametes), deep understanding of the features of the morphological structure and physiological processes of female and male gametes (oogenesis, spermatogenesis). Relevant and relevant links (citations) to key sources are provided.	(the process of formation of sex cells – gametes), understanding of the features of the morphological structure and physiological processes of female and male gametes (oogenesis, spermatogenesis). Links (citations) to key sources are provided.	(the process of formation of sex cells – gametes), partial understanding of the features of the morphological structure and physiological processes of female and male gametes (oogenesis, spermatogenesis). Limited references (citations) to key sources are provided.	embryonic development - gametogenesis (the process of formation of sex cells - gametes), lack of understanding of the features of the morphological structure and physiological processes of female and male gametes (oogenesis, spermatogenesis). Relevant references (citations) to key sources are not provided.
Awareness of the main stages of fertilization, the processes preceding it, as well as the features of the first period of embryonic development, which is present in the ontogenesis of all multicellular animals - cleavage	Wide awareness of the main stages of fertilization, the processes preceding it, as well as the features of the first period of embryonic development, which is present in the ontogenesis of all multicellular animals - cleavage. Excellently substantiates his answers, arguing them with examples.	Awareness of the main stages of fertilization, the processes preceding it, as well as the features of the first period of embryonic development, which is present in the ontogenesis of all multicellular animals - cleavage. Substantiates his answers, sometimes justifying them with examples.	Limited awareness of the main stages of fertilization, the processes preceding it, as well as the features of the first period of embryonic development, which is present in the ontogenesis of all multicellular animals - cleavage. Limited number of reasoned examples for answers.	Little awareness/incompetence about the main stages of fertilization, the processes preceding it, as well as the features of the first period of embryonic development, which is present in the ontogenesis of all multicellular animals - cleavage There is no logical connection in the answers, which are not supported by arguments and are not reinforced by examples.
Consideration of the main provisions, giving comparative aspects and examples, putting forward statements and conclusions.	The answer is clear, deep logically structured and directly connected with question. Maintains consistent, clearly formulated answers to the questions posed, is able to connect theory with practice, illustrate with examples, facts, and scientific research data; makes interdisciplinary connections, proposals, conclusions.	The answer is structured, there are some inaccuracies (insignificant errors) in the presentation of theoretical and practical material; the answer is less thorough, deep, valid and complete. The results and conclusions are partially summarized.	The answer is not structured; answers to questions are presented in a chaotic order, without any logical relationship. There are no results or conclusions.	There is absolutely no logical connection in the answer.
Presentation, Teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality of visuals, slides or other materials, good level of teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low level of involvement, low quality of materials, poor level of teamwork.

SIW 4: A group presentation « Cloning of especially valuable breeding agricultural animals and rare endangered species of wild fauna » (10% of 100%)

Criterion	"Excellent" 8-10 %	"Good" 6-7 %	"Satisfactory" 4-5 %	"Unsatisfactory" 1-3 %
Knowledge of the theory and basic methods of cloning especially valuable breeding farm animals and rare endangered species of wild fauna; knowledge of professional terms and definitions.	Deep knowledge of the theory and basic methods of cloning especially valuable breeding farm animals and rare endangered species of wild fauna; knowledge of professional terms and definitions. Relevant and relevant links (citations) to key sources are provided.	Knowledge of the theory and basic methods of cloning especially valuable breeding farm animals and rare endangered species of wild fauna; knowledge of professional terms and definitions. Links (citations) to key sources are provided.	Limited knowledge of the theory and basic methods of cloning especially valuable breeding farm animals and rare endangered species of wild fauna; knowledge of professional terms and definitions. Limited references (citations) to key sources are provided.	Superficial understanding/lack of understanding of theories, basic methods of cloning especially valuable breeding farm animals and rare endangered species of wild fauna; lack of knowledge of professional terms and definitions. Relevant references (citations) to key sources are not provided.
Awareness of the environmental, ethical and legal aspects of cloning rare and endangered species and its potential impact on biodiversity and sustainable development.	Broad awareness of the environmental, ethical and legal aspects of cloning rare and endangered species, as well as its potential impact on biodiversity and sustainable development.	Awareness of the environmental, ethical and legal aspects of cloning rare and endangered species and its potential impact on biodiversity and sustainable development.	Limited awareness of the environmental, ethical and legal aspects of cloning rare and endangered species, as well as its potential impact on biodiversity and sustainable development.	Little awareness/competence about the environmental, ethical and legal aspects of cloning rare and endangered species, and its potential impact on biodiversity and sustainable development.
Consideration of the main provisions, giving comparative aspects and examples, putting forward statements and conclusions.	The answer is clear, deep logically structured and directly connected with question. Maintains consistent, clearly formulated answers to the questions posed, is able to connect theory with practice, illustrate with examples, facts, and scientific research data; makes interdisciplinary connections, proposals, conclusions.	The answer is structured, there are some inaccuracies (insignificant errors) in the presentation of theoretical and practical material; the answer is less thorough, deep, valid and complete. The results and conclusions are partially summarized.	The answer is not structured; answers to questions are presented in a chaotic order, without any logical relationship. There are no results or conclusions.	There is absolutely no logical connection in the answer.
Presentation, Teamwork	Excellent, attractive presentation, excellent quality of visuals, slides, materials, excellent teamwork.	Good engagement, good quality of visuals, slides or other materials, good level of teamwork.	Satisfactory level of involvement, satisfactory quality of materials, satisfactory level of teamwork.	Low level of involvement, low quality of materials, poor level of teamwork.