

**FEDERAL STATE BUDGETARY
EDUCATIONAL INSTITUTION OF HIGHER EDUCATION
«AMUR STATE MEDICAL ACADEMY»
MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION**

AGREED

Vice-Rector for Academic Affairs,

 N.V. Loskutova

April 17, 2025

Decision of the CCMC

April 17, 2025

Protocol No. 7

APPROVED

by decision of the Academic Council of the FSBEI
HE Amur SMA of the Ministry of Health of the
Russian Federation

April 22, 2025

Protocol No. 15

Acting Rector of the FSBEI HE Amur SMA of the
Ministry of Health of the Russian Federation



 I.V. Zhukovets

April 22, 2025

EDUCATIONAL PROGRAM
discipline «HISTOLOGY, EMBRYOLOGY, CYTOLOGY»

Specialty: 31.05.01 General Medicine

Course: 1, 2

Semester: 2, 3

Total hours: 216 hrs.

Total credits: 6 credit units

Control form: examination, 3 semester

Blagoveshchensk, 2025

The educational program of the discipline is designed in accordance with the requirements of the Federal State Educational Standard of Higher Education - specialist in specialty 31.05.01 General Medicine, approved by the order of the Ministry of Education and Science of Russia dated 08.12.2020 No. 988 (registered with the Ministry of Justice of Russia on 08.26.2020 No. 59493), BPEP HE (2021).

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Protocol No. 17 dated April 3, 2025

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Associate Professor

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Conclusion of the Expert Commission on the review of the Educational Programs:
Protocol No. 3 dated April 9, 2025

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APPROVED at the meeting of the CMC No.2:
Protocol No. 7 dated April 10, 2025

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Holder of the Advanced Doctorate in Biological Sciences,

Associate Professor

 I.Yu. Sayapina

AGREED: Dean of the Faculty of Medicine,
Ph.D. of Medical Sciences
April 17, 2025

 N.G. Brush

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1. Explanatory note

1.1. Characteristics of the discipline

The discipline "Histology, Embryology, Cytology" combines three sciences, each of which is an established branch of modern biology. Cytology studies the general patterns of development, structure and function of cells. Histology studies the patterns of development, structure and function of tissues, the object of study of special histology is intertissue interactions in the composition of organs. Embryology studies the patterns of embryonic development of the organism at all the specified levels. Thus, only in the educational process are these sciences combined into a common course. However, such unification is not a simple formality. Studying the discipline "Histology, Embryology, Cytology" in a medical university is necessary for the formation of an idea in future doctors about the levels of structural and functional organization of the human body, their interrelation and continuity.

Deep knowledge of the structure and function of the human body at all levels of its organization is extremely necessary for a modern doctor, since only on their basis is it possible to conduct a qualified analysis of the etiopathogenesis of diseases and prescribe pathogenetically substantiated therapy. For the medicine of the future, which should have a preventive nature, knowledge of the structural foundations and patterns of ensuring the stability and reliability of living systems is especially important, since the progressive development of civilization is accompanied by the emergence of new factors that adversely affect the human body.

In accordance with the requirements of the Federal State Educational Standard of Higher Education, presented to the specialty 31.05.01 General Medicine, and the professional tasks that the future specialist will have to solve, the work program for the discipline widely presents issues of reactivity and regeneration of tissues and organs, which ensures the proper level of medical and biological training of students for studying clinical disciplines and the formation of general professional and professional competencies.

1.2. The purpose and objectives of the discipline, its place in the structure of the main professional educational program of higher education

The purpose of teaching the discipline: the formation of systemic knowledge about the structure, general patterns of development and functioning of the human body at the cellular, tissue and organ levels of organization in order to understand the essence of structural and functional changes occurring in cells and tissues in pathological conditions.

Learning objectives of the discipline:

- to form in the student an understanding of the biological patterns of development of human tissues and organs in the embryonic period, and the features of their development in the postnatal period of ontogenesis;
- to study at the microscopic and submicroscopic levels the structural, functional features, protective and adaptive changes of organs and their structural elements;
- study the basic concepts and terms according to modern international histological nomenclature;
- to develop skills in microscopy of histological preparations using a light microscope, the ability to identify organs, their tissues, cells and non-cellular structures at the light-optical level;
- to develop in students an understanding of modern methods of morphological research, analysis of its results for making a preliminary diagnosis, the ability to calculate the leukocyte formula and its interpretation;
- developing students' skills for independent analytical and research work, and skills for working with scientific literature;
- developing students' skills in organizing occupational health and safety measures, and

understanding the storage conditions of chemical reagents and medicines;

- developing students' communication skills for interaction with society, teams, families, partners, patients and their relatives.

1.3. The place of the discipline in the structure of the main professional educational program of higher education

In accordance with the Federal State Educational Standard of Higher Education (2020), the discipline "Histology, Embryology, Cytology" refers to Block 1. Basic part, and is taught in years 1-2. The total workload of the discipline is 216 hours (6 credits). Of these, 120 classroom hours, 60 hours are allocated for independent work of students. The discipline is studied in the 2nd and 3rd semesters. Type of control: exam in the 3rd semester.

The discipline "Histology, Embryology, Cytology" includes three independent sciences: histology, embryology and cytology. Based on the principle of trinity, the discipline distinguishes the corresponding sections, which present the most important and necessary information that determines the educational process.

The first section of the discipline is cytology, or the study of the cell. Modern cytology, based on the achievements of morphology, biochemistry, biophysics, molecular biology and genetics, is a science about the nature and phylogenetic relationships of cells, the basics of their structure and vital activity. It should be noted that cytology is of particular importance for medicine, since the development of many pathological conditions is based on cell pathology.

The second section of the discipline is represented by embryology – a science that studies the patterns of the embryonic period of ontogenesis, which is a series of successive biological processes – fertilization, cleavage, gastrulation, separation of a complex of organ and tissue rudiments, histogenesis and organogenesis. Medical embryology studies the patterns of human embryonic development, knowledge of which allows solving a number of problems: prevention of developmental anomalies, treatment of infertility, development of a set of measures to prevent the death of the fetus and newborn.

The third section of the discipline is general histology, or the study of tissues, which studies the patterns of development, structure and function of tissues in the human body.

The fourth section of the discipline is represented by special histology, which studies the interactions of cells and tissues within organs and organ systems.

1.4 . Requirements for students

To study a discipline, knowledge, skills and abilities formed by previous disciplines are necessary.
Latin
Knowledge: anatomical and histological terminology in Latin.
Skills: be able to apply acquired knowledge for communication and obtaining information from educational and scientific literature.
Foreign language. Professional foreign language
Knowledge: basic anatomical, histological and medical terminology in a foreign language.
Skills: be able to apply acquired knowledge for communication and obtaining information from foreign sources (Internet resources, global citation databases, educational and scientific periodicals in English).
History of Medicine
Knowledge: outstanding domestic and foreign scientists who have contributed to the development of cytology, histology and embryology, outstanding discoveries in the field of cytology, embryology and cytology.
Skills: be able to correctly present and analyze the contribution of scientists to the development of cytology, embryology, cytology, and maintain chronological order in presenting facts.
Psychology and Pedagogy
Knowledge: a holistic approach to a person, a positive definition of health, a sanocentric orientation in helping the patient (“cultivating” health, not just fighting diseases); responsibility for one’s own health (the ability to manage one’s behavior, control one’s condition).
Skills: be able to build relationships with students and teachers, analyze the results of their activities, participate in educational activities.
Physics, Mathematics. Adaptive information and communication technologies
Knowledge: theoretical foundations of computer science, collection, storage, search, processing, transformation, distribution of information in medical and biological systems, rules for creating presentations, programs for creating presentations. Internet browsers. Sites, pages, services, portals. Electronic libraries. Distance learning technologies.
Skills: be able to use Internet resources, electronic library systems, distance learning technologies for professional activities, create presentations.
Chemistry. Biochemistry. Bioorganic chemistry in medicine
Knowledge: chemical and biological essence of processes occurring in a living organism at the molecular and cellular level. Structure and chemical properties of the main classes of organic compounds, biochemical bases of the main metabolic reactions occurring in the cell, general principles of interaction of signal molecules with their ligands, mechanisms of interaction of humoral factors with target cells.
Skills: be able to analyze chemical processes at the molecular and cellular levels, tissue and organ features of chemical processes. Be able to analyze biochemical processes occurring in cells, their contribution to the functioning of individual types of cells, tissues and organs.
Biology
Knowledge: cell theory, structure of eukaryotic cells, processes of plastic and energy metabolism occurring in cells, mechanisms of their regulation, basic patterns of heredity and variability in living systems, the role of the nucleus, mutational variability as the cause of congenital malformations, principles of embryogenesis and phylembryogenesis of vertebrates.
Skills: be able to analyze the role of heredity and variability as the cause of the development of hereditary or multifactorial developmental defects, be able to apply the acquired knowledge about the structure when studying the sections Cytology and Embryology.

Anatomy. Human radiation anatomy	
Knowledge:	anatomical and physiological features of organs and systems.
Skills:	be able to analyze the anatomical and physiological characteristics of organs and systems at the macroscopic level.

1.5. Interdisciplinary links with subsequent disciplines

Item No.	Name of subsequent disciplines	Section numbers of the discipline, necessary for studying subsequent disciplines			
		1	2	3	4
1	All disciplines of Block I	+	+	+	+

1.6. Requirements for the results of mastering the discipline

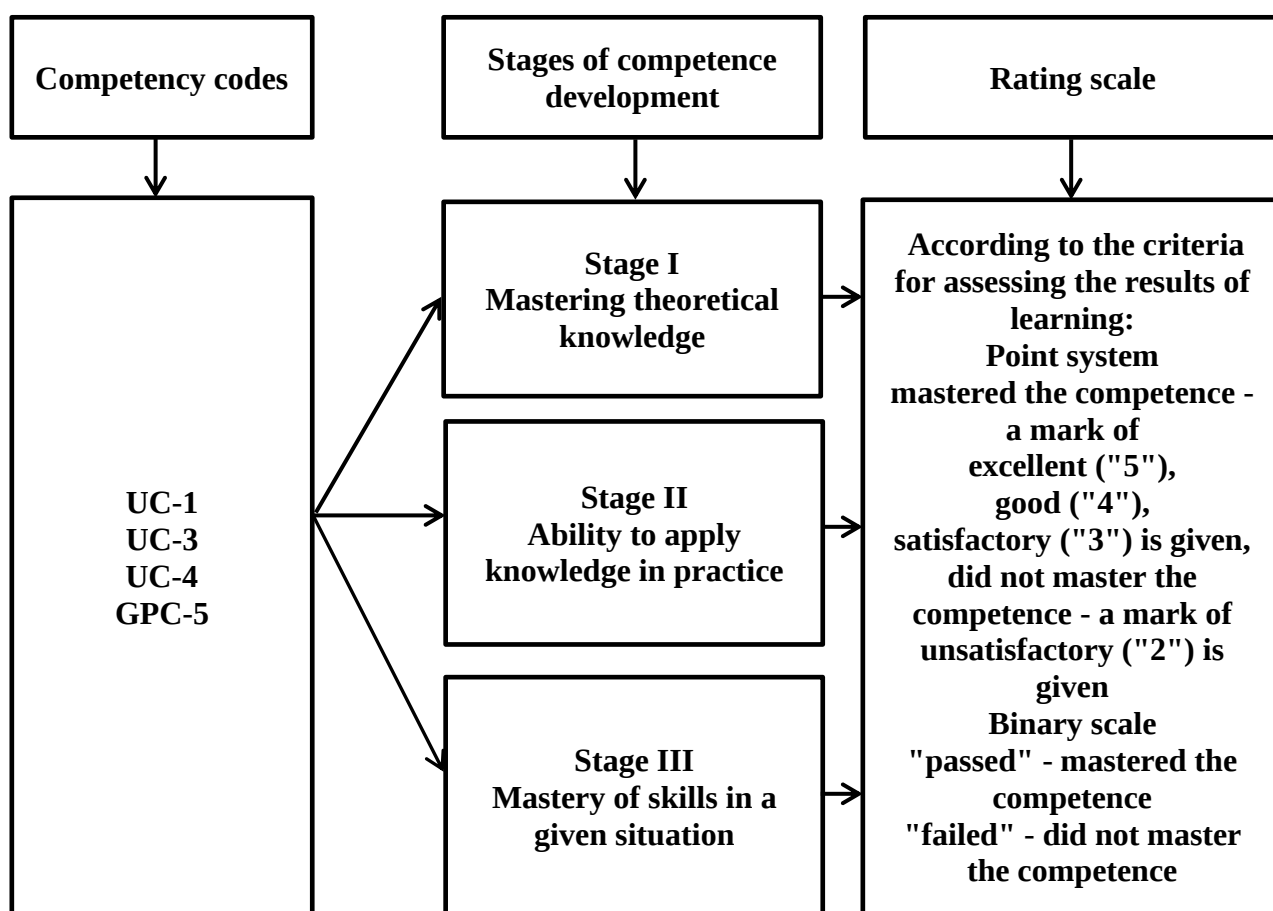
The study of the discipline "Histology, Embryology, Cytology" is aimed at the formation/improvement of the following competencies: universal (UC-1, UC-3, UC-4), general professional (GPC-5).

No. p/p	Code and name of competence	Code and the name of the indicator of achievement of competence
Universal competencies		
1	UC-1. Capable of carrying out a critical analysis of problematic situations based on a systems approach, developing an action strategy	AI UC-1.1 Analyzes a problem situation as a system, identifying its components and the connections between them. AI UC-1.2 Identifies gaps in information needed to solve problem situations and designs processes to eliminate them . AI UC-1.3 Applies systems analysis to resolve problematic situations in the professional sphere.
	UC-3. Able to organize and manage the work of a team, developing a team strategy to achieve the set goal	AI UC-3.1 Works in a team, tolerates social, ethnic, religious and cultural differences. AI UC-3.3 Selects constructive methods for resolving conflicts and contradictions in business communication. AI UC-3.4 Organizes discussions on a given topic and discussion of the results of the team's work with the involvement of opponents, developed ideas.
	UC-4. Able to apply modern communication technologies, including in foreign language(s), for academic and professional interaction	AI UC-4.1 Uses communicative and linguistic tools to build effective partnerships with patients and colleagues. AI UC-4.2 Uses modern communication resources to search, process and transmit information necessary for the high-quality performance of professional tasks and the achievement of professionally significant goals.
General professional competencies		
2	GPC-5. Capable of assessing morphofunctional, physiological states and pathological processes in the human body to solve professional problems	AI GPC-5.1 Knows the functional systems of the human body, their regulation and self-regulation when interacting with the external environment under normal conditions and in pathological processes. AI GPC-5.3 Knows the indicators of the morphofunctional, physiological state of a healthy person and can measure/determine them. AI GPC-5.4 Uses indicators of morphofunctional, physiological state and pathological process to examine the human body in order to establish a diagnosis, prescribe treatment and monitor its effectiveness and safety. AI GPC-5.5 Analyzes and interprets macroscopic and microscopic changes in normal and pathologically altered tissues and organs.

Modules of the discipline and the code of the competence being formed

Item No.	Module name	Code of the competence being formed
1	Section 1. Cytology	UC-1, UC-3, UC-4 GPC-5
2	Section 2. Embryology	UC-1, UC-3, UC-4 GPC-5
3	Section 3. General histology	UC-1, UC-3, UC-4 GPC-5
4	Section 4. Special histology	UC-1, UC-3, UC-4 GPC-5

1.7. Stages of competencies formation and description of assessment scales



1.8. Forms of organization of students' training and types of control

Forms of organization of students' education	Brief description
Lectures	The lecture material contains key and most problematic issues of the discipline, which are most significant in the training of a specialist.
Practical classes	They are intended for the analysis (reinforcement) of theoretical principles and monitoring of their assimilation with subsequent application of the acquired knowledge during the study and drawing of micropreparations and interpretation of electron diffraction patterns.
Work in a teaching histology laboratory	It is carried out to reinforce safety rules when working in biological laboratories with reagents and devices, and to practice practical skills.
Interactive forms of learning	Solving situational problems with subsequent discussion, completing creative tasks, peer review of notes, role-playing games, discussions, conference classes, an online course in the discipline in the EIS (Moodle platform).

Participation in the department's research work, student circle and conferences	Preparation of oral presentations for a circle, abstracts, oral and poster presentations, review of literary and Internet sources
Types of control	Brief description
Incoming inspection	The entrance control is aimed at checking the students' basic knowledge, skills, abilities, and competencies necessary for the successful mastery of the academic discipline, and is carried out in the form of testing in the Moodle system (entrance knowledge control test). The results of the incoming inspection are systematized, analyzed and used by the teaching staff of the department to develop measures to improve and update the teaching methods of the discipline.
Current control	Conducted at each practical lesson, includes computer testing, frontal survey, checking of albums, solving situational problems, checking the acquisition of practical skills when working with micropreparations.
Border control	It is carried out after studying a certain section of the discipline to generalize and test students' knowledge and master practical skills.
Interim assessment	It is presented by an exam that students take in the 3rd semester. Before the exam, students take a final test in the Moodle system. The exam includes checking the mastery of practical skills of microscopy of preparations, an oral interview on the questions of the ticket, and solving a situational problem.

2. Structure and content of the discipline

2.1. Scope of the discipline and types of academic work

Types of educational work	Total hours	Semesters	
		2	3
Lectures	34	20	14
Practical classes (seminars)	86	52	34
Independent work of students	60	36	24
Exam	36	-	36
Total labor intensity in hours	216	108	108
Total workload in credit units	6	3	3

2.2. Thematic plan of lectures and their content

Item No.	Topics and content of lectures	Codes of formed competencies	Labor intensity (hours)
2nd semester			
1	Introduction to the discipline. Forms of organization of living matter. Morphological evolution of the cell The subject and tasks of histology, its place among other biological sciences and its importance for solving current problems of medicine. History of development. Creation of the cell theory and its role in the development of biological sciences. Founders of Russian histology (A.I. Babukhin , F.V. Ovsyannikov , E.A. Arshtein , P.I. Peremeshko , etc.). The Soviet period in the development of cytology, embryology, histology (A.A. Zavarzin , A.V. Rumyantsev , B.I. Lavrentiev , D.N. Nasonov, N.G. Khlopin, G.K. Khrushchov , V.G. Eliseev, A. Knorre, etc.). The concept of a cell as an elementary living system. Morphological evolution of a cell. General plan of organization of animal cells.	UC-1 UC-3 UC-4 GPC-5	2
2	Modern concepts of cell ultrastructure. Cytoplasm. Organelles. Inclusions Chemical characteristics and physicochemical properties of the cytoplasm. Submicroscopic structure of the cytoplasm. Concept of the elementary biological membrane, physicochemical properties. Outer cell membrane. Organelles of general and special significance. Structure, functional significance of membrane (ER, lysosomes, Golgi complex, mitochondria, peroxisomes) and non-membranous (ribosomes, cell center, cytoskeleton). Inclusions, their classification and role in cell life.	UC-1 UC-3 UC-4 GPC-5	2
3	Cell Nucleus. Protein Biosynthesis. Cell Vital Signs Chemical characteristics, microscopic and ultramicroscopic structure of the nucleus. The importance of the nucleus in the vital activity of the cell and the transfer of genetic information. The life cycle of the cell. The mitotic cycle. Interphase, characteristics of the main periods. G0 period of interphase. Cell differentiation. Mitosis. Amitosis. Reactions of plastic metabolism. Synthesis of species-specific protein. Energy metabolism of the cell. Cellular respiration, the role of mitochondria. Pathways of substance penetration into the cell, active and passive transport. Phagocytosis and pinocytosis. Cell response to external influences. Adaptation. Cell death. Necrosis, apoptosis.	UC-1 UC-3 UC-4 GPC-5	2
4	Fundamentals of Embryology. Bird Embryogenesis The concept of ontogenesis and phylogenesis. The subject and tasks of embryology. The role of Russian scientists in the development of comparative and evolutionary embryology. Sex cells. Microscopic structure, ultrastructure, functional and genetic features. Stages of individual development. Stages of	UC-1 UC-3 UC-4 GPC-5	2

	embryogenesis. Fertilization and zygote formation. Cleavage: definition, essence of the process and its characteristics. Gastrulation. The concept of germ layers and axial organs. The concept of cell determination and differentiation. Histo - and organogenesis. Derivatives of the three germ layers and mesenchyme. The concept of embryonic induction and embryonic histogenesis. Works of I.I. Mechnikov, A.O. Kovalevsky, K. Baer. Comparative characteristics of the stages of embryogenesis. Characteristics of the stages of embryogenesis in birds. Features. Provisional organs (amnion, allantois, yolk sac). Sources of development, mechanism of formation, biological role.		
5	Embryogenesis of mammals. Types of placentas Features of mammalian embryogenesis. Characteristics of stages embryogenesis. Fertilization. The nature of cleavage in connection with the peculiarities of the egg cells and conditions of intrauterine development, morphological expression of the process of cleavage. Gastrulation. Separation of the embryo from the extraembryonic parts. Provisional organs (chorion, placenta, umbilical cord). Sources of development, mechanism of formation, biological role. Types of placentas.	UC-1 UC-3 UC-4 GPC-5	2
6	The study of tissues. Epithelial tissue. Muscle tissue The study of tissues, the contribution of domestic and foreign scientists. General characteristics of epithelial tissues in connection with their position in the body. Histogenesis. Morphofunctional and genetic classification. Cell structure. Structure of various types of epithelial tissues. Age-related features of integumentary epithelia. Physiological and reparative regeneration of the epithelium. The concept of secretory function. Glandular epithelium. Glandulocytes, structure, secretory cycle. Types of secretion. Morphological classification and structure of exocrine glands. Morphofunctional characteristics of muscle tissues, their classification, sources of development. Smooth muscle tissue. Histogenesis. Structure, functional and morphological characteristics. Organization of the contractile apparatus. Regeneration. Striated muscle tissue of the somatic type. Histogenesis. Muscle fiber as a structural unit of tissue. Structure of muscle fiber. Symplastic part of fiber, myosatellite cells. Sarcomere as a structural unit of myofibril. Molecular mechanism of muscle contraction. White and red muscle fibers. Muscle as an organ. Microscopic structure. Connection of muscle with tendon. Age-related features of skeletal muscles. Regeneration of muscle tissue.	UC-1 UC-3 UC-4 GPC-5	2
7	Mesenchyme. Blood. Loose fibrous connective tissue. Tissues of the internal environment as derivatives of mesenchyme. General characteristics, classification and principles of morphofunctional organization. Blood, its functions. The concept of the blood system. Blood plasma, its chemical characteristics and role. Formed elements of the blood. Classification, quantity, structure, functional significance. The concept of a hemogram, leukocyte formula, their significance for the clinic. Age-related features of blood. The phenomenon of leukocyte formula crossing.	UC-1 UC-3 UC-4 GPC-5	2

	Connective tissues. Classification. Loose fibrous connective tissue. General structure plan. Cellular composition. Morphofunctional characteristics of cells. Intercellular substance (fibrous structures and amorphous substance), chemical composition, structure, significance. Significance of loose fibrous connective tissue in the body. Age-related features of the amorphous component of loose connective tissue.		
8	Cardiovascular system Development of the heart and blood vessels in embryogenesis. General principle of the structure of the blood vessel wall. Features of the structure of the wall of elastic, mixed and muscular arteries. Vessels of the microcirculatory link (arterioles, venules , hemocapillaries). Structure of the wall of fibrous and muscular veins. Tissue composition of the membranes of the heart (endocardium, myocardium, pericardium), valve apparatus. Structure of contractile, secretory and conductive cardiomyocytes. Conduction system of the heart. Cellular composition of the sinoatrial and atrioventricular nodes, bundle of His, Purkinje fibers. Lymphatic vessels. Age-related features of the heart and blood vessels.	UC-1 UC-3 UC-4 GPC-5	2
9	Immune system. Cellular interactions in immune responses General structure of the lymphoid system. Primary and secondary organs of the immune system, skin-associated lymphoid tissue, mucous membrane-associated lymphoid tissue. Thymus. General structure, histophysiology , participation in T- lymphopoiesis . Spleen. General structure, red and white pulp, functions of the spleen. Lymph nodes, lymph circulation pathways, role in lymphopoiesis . Lymphoepithelial organs: palatine tonsils, vermiform appendix. Age-related features of lymphoid organs. Immunity, its types. Antigens. Complement. Antibodies. Antigen-presenting cells. Characteristics of immunocompetent cells (B-lymphocytes, T-lymphocytes and their subpopulations). Antigen-dependent and antigen-independent proliferation and differentiation of lymphocytes. Interactions of cells in cellular immunity reactions. Humoral immunity reactions, the role of plasma cells. The concept of primary and secondary immune response. Participation of tissue basophils and eosinophils in inflammatory and immune reactions.	UC-1 UC-3 UC-4 GPC-5	2
10	Endocrine system General structure of the endocrine system. Morphological features of the endocrine glands. Hypothalamic-pituitary system. Structure of the hypothalamic nuclei and its connection with the anterior pituitary gland. Structure of the pituitary gland. The role of the anterior pituitary gland in regulating the peripheral links of the endocrine system. Hypothalamic- neurohypophyseal system. Pineal gland. Structure and role of the pineal gland in the body. Development, general structure and function of the thyroid and parathyroid glands. The role of the thyroid gland in regulating the level of metabolic processes in various tissues. Adrenal gland. Structure of the cortex and medulla. The role of adrenal hormones in the body. Age-related features of the endocrine glands.	UC-1 UC-3 UC-4 GPC-5	2
3rd semester			

1	Nervous tissue. Reflex arc Embryonic histogenesis of nervous tissue. Morphofunctional characteristics of nervous tissue. Neuron. Morphological and functional classification. Structure. The importance of a high level of protein biosynthesis for intracellular regeneration and mediator synthesis. The role of the cytoplasmic membrane in the generation and conduction of excitation. Macroglia. Structure, importance, neuroglial relationships in the central nervous system. Microglia. Structure, importance. Genetic affiliation with the macrophage system. Nerve fiber. Myelinated and unmyelinated nerve fibers. Synapses. Structure, mechanism of synaptic transmission of nerve impulses. Age-related features of nervous tissue. The role of the nervous system in the vital activity of the organism. Sources of embryonic development of organs of the nervous system. Reflex arcs as structural and functional units of the nervous system. Elements of a simple reflex arc. Afferent link: receptor nerve endings, spinal nodes. Spinal cord. Histological structure of gray and white matter, nuclear composition of gray matter. Efferent link. Spinal nerves, efferent nerve endings. Age-related features of the spinal cord and spinal nerves.	UC-1 UC-3 UC-4 GPC-5	2
2	Central nervous system. Autonomic nervous system Brain. Cerebellum. Structure and neuronal composition of the cerebellar cortex. Pear-shaped cells, basket and stellate neurons, granule cells. Afferent and efferent nerve fibers. Interneuronal connections, inhibitory neurons. Cerebellar glomerulus. Cerebellar gliocytes. Brainstem, structural features and relationships between gray and white matter, nuclear composition. Cerebral cortex. Embryonic and postembryonic histogenesis. Cytoarchitecture of the cerebral cortex. Neuronal composition, characteristics of pyramidal neurons. Concept of modular organization of the cortex. Interneuronal connections, structural features of synapses. Inhibitory neurons. Gliocytes of the cortex. Myeloarchitectonics - radial and tangential nerve fibers. Structural features of the cortex in the motor and sensory zones. The blood-brain barrier, its structure and function. Age-related features of the central nervous system. Autonomic (vegetative) nervous system. General characteristics of the structure of the central and peripheral parts of the parasympathetic and sympathetic systems. The structure and neuronal composition of ganglia (extramural and intramural). Pre- and postganglionic nerve fibers.	UC-1 UC-3 UC-4 GPC-5	2
3	The concept of sensory systems. Visual analyzer. Auditory analyzer The concept of analyzers. General structure of the eyeball. Sources of embryonic development and histogenesis. Structure of the sclera and cornea; choroid, retina. Neural composition of the retina. Ultramicroscopic structure of photoreceptor cells. The mechanism of photoreception. Features of the structure of the central fossa and optic nerve head. Pigment epithelium of the retina, structure and significance. Features of the blood supply to the eyeball. Morphological bases of intraocular fluid circulation. Age-related features of the organ of vision. Outer ear: structure of the external auditory canal and eardrum. Middle ear: auditory ossicles, characteristics of the epithelium of the tympanic cavity and auditory tube. Inner ear: bony and membranous labyrinths. Structure of the cochlea. Relationship between the bony and membranous labyrinths.	UC-1 UC-3 UC-4 GPC-5	2

	Structure of the membranous labyrinth. Cellular composition of the spiral organ. The mechanism of sound perception. Age-related features of the organ of hearing.		
4	General issues of the digestive system organization. Oral cavity and its derivatives. Teeth. Salivary glands Development and structure of the anterior section of the digestive tract. General plan of the structure of the wall of the digestive tract. Structure of the mucous, submucosa, muscular and adventitial membranes. Oral cavity. Structure of the mucous membrane in connection with the function and features of digestion in the oral cavity. Structure of the lip, cheek, hard and soft palate, gum. Major salivary glands. Classification, sources of development, structure and functions. Structure of the secretory sections, excretory ducts. Endocrine function. Age-related features of the salivary glands. Tongue. General plan of structure. Papillae of the tongue, their types, structure, functions. Teeth. General plan of structure, tissue composition of the crown, neck and root. Early and late stages of tooth development. Teeth eruption, change of generation of milk teeth to permanent teeth.	UC-1 UC-3 UC-4 GPC-5	2
5	Digestive tract. Liver. Pancreas. The structure and tissue composition of the esophagus wall. The stomach. The structure of the mucous membrane in different parts of the organ. Localization, structure and cellular composition of glands in different parts of the stomach. Micro- and ultramicroscopic features of exo- and endocrine cells. Regeneration of the integumentary epithelium and epithelium of the gastric glands. Blood supply and innervation of the stomach. General plan of the structure of the small intestinal mucosa. Villus. Ultramicroscopic structure of the limbic epithelium of the villus. The mechanism of absorption of lipids, carbohydrates and proteins by villus cells. Features of the structure of the wall of the large intestine. Age features of different parts of the digestive tract. Glands of the digestive tract (liver, pancreas). Development and general structure of the liver. Features of the location of hepatocytes within the liver lobule. Vascular bed of the liver. Alternative structural and functional units of the liver (portal lobule, hepatic acinus). Histophysiology of the liver. Pancreas. Structure. Secretory part of the pancreas. Structure of the endocrine apparatus of the pancreas. Ultrastructural organization of pancreatic islet cells, main hormones and their effects. Age-related features of the liver and pancreas.	UC-1 UC-3 UC-4 GPC-5	2
6	Urinary system. Male reproductive system Development of the excretory system in mammals and humans: structure of the head kidney, primary and definitive kidneys. General structure of the kidneys. Nephron. Ultramicroscopic and histophysiological characteristics of individual parts of the nephron. Juxtaglomerular apparatus of the kidney. Its role in regulating water-salt metabolism. Age-related features of the kidney. Structure of the ureter, bladder. General structure of the reproductive system, development of the reproductive system in humans. Anlage of the male sex glands. General structure of the male sex gland. Testicle. Structure of the wall of the convoluted seminiferous tubule. Spermatogenic epithelium. Morphofunctional characteristics of sustentocytes, their role in the formation of the hemato - testicular barrier.	UC-1 UC-3 UC-4 GPC-5	2

	Morphofunctional characteristics of spermatogenic cells: spermatogonia , spermatocytes, spermatids and spermatozoa. Spermatogenesis and its regulation. Morphofunctional characteristics of interstitial glandulocytes of the testicle, their role in the synthesis of male sex hormones. Age-related features of the testicle. Epididymis. Prostate: structure, functions, age-related features.		
7	Female reproductive system Embryonic development of the female reproductive system. General structure of the ovary. Oogenesis. Morphological characteristics of ovarian follicles at different stages of development. Ovulation. Corpus luteum, structure, stages of development. Atresia of follicles, atretic bodies. Structure of the uterine wall and oviducts. Cyclic changes in the uterine mucosa, morphological characteristics of the endometrium during the menstrual, postmenstrual and premenstrual periods. Ovarian-menstrual cycle and its hormonal regulation. Mammary glands. General structure. Changes associated with puberty, pregnancy and childbirth. Features of the structure of the lactating and non-lactating mammary gland.	UC-1 UC-3 UC-4 GPC-5	2
Total hours			34

2.3. Thematic plan of practical classes and their content

No. p/p	Name of the topics of practical classes	Contents of practical classes	Codes being formed competencies and indicators their achievements	Types control	Labor intensity (hours)
2nd semester					
1	Cytology . Cell. Cytoplasm	Theoretical part: History of the development of the doctrine of the cell. Methods used in cytology. Cell theory. The structure of the eukaryotic animal cell. Plasmalemma . Cytoplasm , hyaloplasm . Organelles and their classification. The structure and functions of membrane and non-membrane organelles. Inclusions, classification, role. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Incoming inspection (testing in the Moodle system). Current control: Frontal survey Solving situational problems Interpretation of electron diffraction patterns Answers to questions	3.05

				after watching the video "Life of a Cell" Checking the album	
2	Nucleus. Signs life activity	Theoretical part: Structure and functions of the nucleus. Life cycle of the cell. Interphase. Mitosis, amitosis. Transport of substances into the cell (active, passive), endocytosis. Metabolic processes in the cell. Protein synthesis, main stages (transcription, translation). Energy metabolism. Cell response to external influences. Cell death. Necrosis, apoptosis. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Solving situational problems Interpretation of electron diffraction patterns Answers to questions after watching the presentation "Protein Synthesis" Checking the album	3.05
3	General Embryology. Development of Birds and Mammals	Theoretical part: Structure of male and female gametes. Classification of eggs. Embryogenesis. Characteristics of the main stages. Types of cleavage, types of blastula. Methods of gastrulation. Primary organogenesis (formation of the notochord, neural tube, intestinal tube). Embryonic induction and determination. Histo- and organogenesis. Embryogenesis of birds. Fertilization, cleavage, gastrulation. Provisional organs in birds, structure, functions performed. Features of mammalian embryogenesis. Provisional organs of mammals (chorion, umbilical cord, placenta). Structure, functions performed. Types of placentas. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing system " Moodle " Frontal survey Solving situational problems Working with microslides Checking the album	3.05

		micropreparations with album design.			
4	Control class	Theoretical part: Testing mastery of competencies (test on theoretical issues, solving situational problems). Practical part: Album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Solving situational problems Answers to ticket questions	3.05
5	Epithelial tissues	Theoretical part: The study of tissues, the contribution of domestic and foreign scientists. The concept of cellular differon. Epithelial tissue. Covering and lining epithelia. Sources of embryonic development, morphological features, functions performed. Classification, structure, localization in the body and functions of individual types of epithelia (single-layer, multilayer), sources of regeneration. Glandular epithelia, glands. Age-related features of integumentary and glandular epithelia. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing system "Moodle" Frontal survey Solving situational problems Interpretation of electron diffraction patterns Working with microslides Checking albums	3,05
6	Muscular tissues	Theoretical part: General morphofunctional characteristics of muscle tissues. Classification. Embryonic histogenesis of skeletal muscle tissue. Structure of myosimplast and myosathelitocytes . Structure of sarcomere . Mechanism of muscle contraction. Types of muscle fibers. Skeletal muscle as an organ. Cardiac muscle tissue. Structure of contractile cardiomyocytes. Smooth muscle tissue of vascular and visceral types. Histogenesis, structure and mechanism of smooth myocyte contraction. Innervation, vascularization , regeneration of muscle tissues. Age-related features of muscle tissues.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing system "Moodle" Frontal survey Solving situational problems Interpretation of electron diffraction patterns Working with microslides Checking albums	3.05

		Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.			
7	Blood	Theoretical part: General morphofunctional characteristics of connective tissues. Blood. Concept of formed elements and blood plasma, blood functions. Chemical composition of plasma, blood plasma proteins. Erythrocytes (quantity, structure, functions), their role in determining blood group affiliation. Platelets, structure, role in hemostasis. Leukocytes (quantity, structure, functions). Leukocyte formula. Morphofunctional characteristics of granulocytes (neutrophils, eosinophils, basophils) and agranulocytes (lymphocytes, monocytes). Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in system "Moodle" Frontal survey Solving situational problems Interpretation of electron diffraction patterns Blood smear examination Checking albums	3,05
8	Loose connecting tissues	Theoretical part: General plan of the structure of the RCT, functions, localization in the human body. Cellular- differenton organization of the RCT. Fibroblastic differon . Histiocytic differon. The concept of the mononuclear phagocyte system. Plasma cells, their role in antibody production. Differentiation of tissue basophils. Intercellular substance of PCT. Age-related features of PCT. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	3.05
9	Bone tissue	Theoretical part: Morphofunctional characteristics of bone tissue.	UC-1: AI 1.1, 1.2, 1.3.	Testing in the Moodle system	3.05

		Cellular- differential organization. Direct and indirect osteogenesis. Coarse-fibrous and lamellar bone tissue. Bone as an organ. Structure of the periosteum, compact and spongy bone substance. Bone remodeling . Blood supply, regeneration. Age-related features of bone tissue. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	
10	Dense fibrous connective tissue. Cartilaginous tissue	Theoretical part: Histogenesis, cellular and differential organization of cartilaginous tissue. Features of cartilage trophism, role of perichondrium. Morphofunctional characteristics of hyaline, elastic and fibrous cartilage, localization in the human body. Dense irregular connective tissue. Dense formed connective tissue. Tendons and ligaments. Age-related features of cartilage tissue. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	3.05
11	Control lesson with diagnostics of samples	Theoretical part: Checking the acquisition of competencies (test on section questions, solving situational problems). Practical part: Checking the acquisition of competencies (working with albums and methodological recommendations for classroom independent work, diagnostics of silent micropreparations).	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Diagnostics and description of "silent" samples Solving problems of increased complexity	3.05
12	Cordially-vascular system	Theoretical part: Development of the heart and blood vessels in embryogenesis. General principle of the structure of the blood vessel wall. Features of the structure of the wall	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4.	Testing in the Moodle system Frontal survey Interpretation of	3,05

		of elastic, mixed and muscular arteries. Vessels of the microcirculatory link (arterioles, venules, hemocapillaries). The structure of the wall of fibrous and muscular veins. Tissue composition of the heart membranes. The structure of contractile, secretory and conductive cardiomyocytes. Age-related features of the heart and blood vessels. Lymphatic vessels. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	electron diffraction patterns Solving situational problems Working with microslides Checking albums	
13	Hematopoiesis	Theoretical part: Embryonic hematopoiesis. Postembryonic hematopoiesis. The concept of myeloid and lymphoid hematopoiesis. Red bone marrow as the central organ of myeloid hematopoiesis. Modern scheme of myeloid hematopoiesis. The concept of stem, semi-stem and progenitor cells. Morphofunctional characteristics of erythroid, megakaryocytic, granulocytic and monocytic differon cells. The role of the microenvironment. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Work in small groups to create differentiations myelopoiesis Working with micropreparations (smear of red bone marrow) Checking albums	3.05
14	Immune system	Theoretical part: The concept of the central and peripheral organs of the immune system. The thymus is the central organ of T-lymphopoiesis. The structure of the thymus, its role in T-lymphocytopoiesis. The spleen. General structure, red and white pulp, T- and B-dependent zones, functions of the spleen. The structure of the lymph nodes, T- and B-dependent zones, lymph circulation pathways, functions. Lymphoepithelial organs: tonsils, appendix.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Testing Frontal survey Interpretation of electron diffraction patterns Solving situational problems	3.05

		Immunity, its types. Immunocompetent cells. Cellular immunity. Humoral immunity. Intercellular cooperation. Age-related features of the immune system. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.		Working with microslides Checking albums	
15	Endocrine system	Theoretical part: General structure of the endocrine system. Hypothalamus, nuclei of the anterior and middle hypothalamus, neurohormones and neurotransmitters. Hypothalamic-adenohypophyseal and hypothalamic-neurohypophyseal systems. Tissue and cellular composition of the adenohypophysis, tropic hormones. Pineal gland, structure, role in regulation of cyclic processes. Age-related features of the adenohypophysis and pineal gland. Peripheral endocrine glands: thyroid gland, parathyroid gland, Adrenal glands. Tissue and cellular composition, hormones produced. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	3.05
16	Control lesson with diagnostics of samples	Theoretical part: Checking the acquisition of competencies (test on section questions, solving situational problems). Practical part: Checking the acquisition of competencies (working with albums and methodological recommendations for classroom independent work, diagnostics of silent micropreparations).	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Checking albums Diagnostics and description of "silent" micropreparations	3.05
17	Final lesson (test)	Theoretical part: Test on tickets (checking the assimilation of competencies). Summing up the results of training in the	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3,	Checking albums Ticket Interview	3,05

		2nd semester. Practical part: Solving situational problems with subsequent discussion.	3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.		
Total hours 2 semester					52
3rd semester					
1	Nervous tissue. Reflex arc	Theoretical part: General characteristics of nervous tissue. Classification and structure of neurons. Classification, structure, localization and functions of macroglia . Microglia . Nerve fiber, structure of myelinated and unmyelinated nerve fibers. Classification and structure of synapses, mechanisms of nerve impulse transmission. Age-related features of nervous tissue. Sources of embryonic development of organs of the nervous system. Reflex arcs as the basis for the functioning of the nervous system. Classification and structure of nerve endings, spinal nodes, peripheral nerves. Spinal cord. Histological structure of gray and white matter, nuclear composition of gray matter. Regeneration in the peripheral nervous system. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2
2	Central nervous system. Autonomic nervous system.	Theoretical part: Structures of the brainstem, structure of gray and white matter. Cerebellum. Layered structure of the cortex, interneuronal connections, afferent and efferent pathways. The cerebral cortex, cytoarchitectonics , characteristics of pyramidal neurons. The concept of the modular principle of organization. Myeloarchitectonics . Granular and agranular types of cortex. Blood-brain	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC- 5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with	2

		barrier. Age-related features of the cerebral cortex and white matter of the central nervous system. Autonomic nervous system. Structures of the central and peripheral parts of the parasympathetic and sympathetic systems. Structure, neuronal composition of intramural ganglia. Preganglionic and postganglionic nerve fibers, nerve endings. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.		microslides Checking albums	
3	Visual analyzer, olfactory analyzer.	Theoretical part: General plan of the structure of analyzers. Functional apparatus and membranes of the eyeball. Tissue composition of the sclera and cornea. Structure of the choroid and its derivatives (iris, ciliary body). Retina, neuronal composition, structure of rod and cone receptors, photoreception mechanism. Age-related features of the visual analyzer. Olfactory lining (localization, cellular composition). Olfactory tract. Vomeronasal organ. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2
4	Auditory and vestibular analyzer, taste analyzer.	Theoretical part: General characteristics and embryogenesis of the organ of hearing and balance. Structure of the auricle, external auditory canal and eardrum. Structure of the middle ear structures (auditory ossicles, auditory tube). Bony and membranous labyrinths of the inner ear. Cochlear canal, cellular composition of the spiral organ. Mechanism of sound perception. Elliptical and spherical saccules, semicircular canals. Structure and cellular composition	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with	2

		of the maculae and ampullar ridges, histophysiology of the vestibular labyrinth. Organ of taste. Structure of taste buds, perception of taste. Age-related features of the organ of hearing and balance, organ of taste. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.		microslides Checking albums	
5	Control lesson with diagnostics of samples.	Theoretical part: Checking the acquisition of competencies (test on section questions, solving situational problems). Practical part: Checking the acquisition of competencies (working with albums and methodological recommendations for classroom independent work, diagnostics of silent micropreparations).	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Diagnostics and description of "silent" samples Solving problems of increased complexity	2
6	Oral cavity. Teeth. Salivary glands.	Theoretical part: Sources of embryonic development and general plan of the structure of the digestive tract. The oral cavity and its derivatives (lips, cheeks, tongue, hard and soft palate, gums). Salivary glands, structure of the terminal sections and excretory ducts. Age-related features of the salivary glands. Structure of the tooth, hard tissues (enamel, dentin, and cement), pulp. Periodontium. Blood supply and innervation of the tooth. Development of teeth. Change of teeth. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	
7	Digestive tract.	Theoretical part: The structure and tissue composition of the pharynx and esophagus. Esophageal glands. Stomach. The structure of the mucous membrane in different parts of the organ.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4.	Testing in the Moodle system Frontal survey Interpretation of	2

		Localization, structure and cellular composition of glands in different parts of the stomach. Regeneration of the integumentary epithelium and epithelium of the gastric glands. The structure of the wall of the small intestine. The villus-crypt system. The cellular composition of the border epithelium of the crypts and villi, the role in parietal digestion. Mechanisms of absorption of lipids, carbohydrates and proteins. The structure and functions of the large intestine. Age-related features of different parts of the alimentary canal. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	electron diffraction patterns Solving situational problems Working with microslides Checking albums	
8	Liver. Pancreas gland.	Theoretical part: Development and general structure of the liver. Structure of the liver lobule (hepatic beams, sinusoidal capillaries). Hepatocyte polarity, ultrastructure and functions of hepatocytes. Structure of the wall of sinusoidal capillaries. The role of macrophages and pit cells in the protective reactions of the liver. Blood supply to the liver lobule. Liver regeneration. Exocrine part of the pancreas (pancreatic acini , excretory duct system). Endocrine part. Cellular composition of the islets of Langerhans , ultrastructural organization of islet cells . Hormones and their effects. Age-related features of the liver and pancreas. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2
9	Respiratory	Theoretical part:	UC-1: AI 1.1, 1.2,	Testing in the Moodle	2

	system. Skin.	Embryogenesis of the respiratory organs. General plan of the structure of the airway wall, cellular composition of the epithelium. Features of the structure of large, medium and small caliber bronchi. Respiratory section of the lung. Structure of the acinus , alveolocytes of types 1 and 2, surfactant -alveolar complex. Mechanism of gas exchange. General plan of the structure and function of the skin. keratinization processes , concept of epidermal proliferative unit. Dermis, its composition, structure and role. Sebaceous and sweat glands. Vascularization and innervation of the skin. Derivatives of the epidermis (hair, nails). Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	
10	Control lesson with diagnostics of samples.	Theoretical part: Checking the acquisition of competencies (test on section questions, solving situational problems). Practical part: Checking the acquisition of competencies (working with albums and methodological recommendations for classroom independent work, diagnostics of silent micropreparations).	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Diagnostics and description of "silent" samples Solving problems of increased complexity	2
11	Urinary system.	Theoretical part: Development of the excretory system. General plan of the kidney structure. Nephron. Ultramicroscopic and histophysiological characteristics of individual nephron links. Juxtaglomerular apparatus of the kidney. Its role in regulating water-salt metabolism. Age-related features of the cortex and medulla of the kidney, features of the concentration function of the kidneys in newborns and young children. Structure of the ureter,	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with	2

		urinary bladder. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.		microslides Checking albums	
12	Male reproductive system	Theoretical part: General plan of the structure of the reproductive system, development of the reproductive system in humans. Formation of male gonads. General plan of the structure of the testicle. Structure of the convoluted seminiferous tubules, cellular composition of the spermatogenic epithelium. Hemato- testicular barrier. Spermatogenesis. Interstitium of the testicle, structure and functions of interstitial endocrinocytes . Epididymis, cellular composition and functions of the epithelium of the epididymis. Prostate, morphological characteristics of the stromal and glandular components. Age-related changes in the main and accessory glands. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2
13	Female reproductive system	Theoretical part: Embryonic development of the female reproductive system. General plan of the ovary structure. Oogenesis. Morphological characteristics of ovarian follicles at different stages of development. Ovulation. Corpus luteum, structure, stages of development. Corpus atreticus . Development, structure of the uterus and oviduct. Mammary glands. Ovarian-menstrual cycle and its hormonal regulation. Practical part: Working with methodological recommendations for	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5:AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2

		classroom independent work, studying and sketching micropreparations with album design.			
14	Embryogenesis	Theoretical part: The structure of male and female gametes. Morphological characteristics of the main stages of human embryogenesis (fertilization, cleavage, implantation, gastrulation, histo- and organogenesis). Sources of development, structure and functions of provisional organs (yolk sac, allantois, umbilical cord, chorion). Placenta. Structure of the fetal and maternal parts. Structural and functional unit of the placenta - cotyledon. Mother-placenta-fetus system. Critical periods of development. Practical part: Working with methodological recommendations for classroom independent work, studying and sketching micropreparations with album design.	UC-1: ID 1.1, 1.2, 1.3. UC-3: ID 3.1, 3.3, 3.4. UC-4: ID 4.1, 4.2. GPC-5: ID 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Frontal survey Interpretation of electron diffraction patterns Solving situational problems Working with microslides Checking albums	2
15	Control lesson with diagnostics of samples.	Theoretical part: Checking the acquisition of competencies (test on section questions, solving situational problems). Practical part: Checking the acquisition of competencies (working with albums and methodological recommendations for classroom independent work, diagnostics of silent micropreparations).	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Testing in the Moodle system Diagnostics and description of "silent" samples Solving problems of increased complexity	3
16	Final lesson (test).	Theoretical part: Test on tickets (checking the assimilation of competencies). Summing up the results of training in the 2nd semester. Practical part: Solving situational problems with subsequent discussion.	UC-1: AI 1.1, 1.2, 1.3. UC-3: AI 3.1, 3.3, 3.4. UC-4: AI 4.1, 4.2. GPC-5: AI 5.1, 5.3, 5.4, 5.5.	Checking albums Ticket Interview	3
Total hours 3 semester					34
Total hours:					86

2.4. Interactive forms of learning

In order to increase the efficiency of the educational process, strengthen the motivation to study the discipline "Histology, Embryology, Cytology", develop communication skills, skills of analysis and reflexive manifestations, interactive teaching methods (group discussions, creative tasks, small group work method, dramatization method, work with mandatory and demonstration histological preparations) are widely used during practical classes. Students participate in the work of the histological laboratory, educational and research and scientific research work of the department.

Item No.	Topic of the practical lesson	Labor intensity in hours	Interactive form of learning	Labor intensity in hours, in % of the lesson
1	2	3	4	5
2nd semester				
1	Cytology. Cell. Cytoplasm	3.05	Watching the video "Life of a Cell" (HD animation) followed by discussion	15 minutes (0.33 hours) 11.1%
2	Nucleus. Signs life activity	3.05	Watch the video "Protein Synthesis" (HD animation) followed by discussion	30 minutes (0.5 hours)/ 17.2%
3	General Embryology. Development of Birds and Mammals	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) /2 2.2%
4	Control class	3.05	Brainstorming. Mutual reviews taking notes.	15 minutes (0.33 hours) 11.1%
5	Epithelial tissues	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
6	Muscular tissues	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
7	Blood	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
8	Loose connecting tissues	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
9	Bone tissues	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
10	Dense fibrous connective tissue. Cartilaginous tissue.	3.05	Small group method. Working with micropreparations	30 minutes (0.66 hours) 22.2%
11	Control lesson with diagnostics of	3.05	Small group method. Solving situational	15 minutes (0.33 hours)

	samples.		problems of increased complexity with subsequent discussion	11.1%
12	Cardiovascular system .	3.05	Completing the table “Comparative characteristics of arteries and veins of the muscular type” with subsequent mutual review	25 minutes (0.55 hours) 14.8%
13	Hematopoiesis .	3.05	Work in small groups. Technology "Pen in the center of the table". Drawing up different myelopoiesis	30 minutes (0.66 hours) 22.2%
14	Immune system .	3.05	Method of staging (business theater) "Interaction of cells in the immune response"	30 minutes (0.66 hours) 22.2%
15	Endocrine system .	3.05	Filling in the table "Hormones, producer cells, target cells" with subsequent mutual review	30 minutes (0.66 hours) 22.2%
16	Control lesson with diagnostics of samples.	3.05	Small group method. Solving situational problems of increased complexity with subsequent discussion.	15 minutes (0.33 hours) 11.1%
17	Final lesson (test).	3.05	Small group method. Solving situational problems of increased complexity with subsequent discussion.	15 minutes (0.33 hours) 11.1%
	3rd semester			
1.	Nervous textile . Reflex arc .	2	Filling out the table “Comparative characteristics of myelinated and unmyelinated nerve fibers” with subsequent mutual review.	20 minutes (0.44 hours)
2.	Central nervous system. Autonomic nervous system	2	Small group method. Working with micropreparations	15 minutes (0.33 hours)
3.	Visual analyzer , olfactory analyzer	2	Small group method. Working with micropreparations	20 minutes (0.44 hours)
4.	Auditory and vestibular analyzer,	2	Watching the video “Auditory Analyzer”	20 minutes (0.44 hours)

	taste analyzer		followed by discussion.	
5.	Control lesson with diagnostics of samples	2	Small group method. Solving situational problems of increased complexity with subsequent discussion.	15 minutes (0.33 hours)
6.	Oral cavity. Teeth. Salivary glands.	2	Small group method. Working with micropreparations	20 minutes (0.44 hours)
7.	Digestive channel .	2	Watching the video "The Digestive System" followed by discussion.	20 minutes (0.44 hours)
8.	Liver . Pancreas iron .	2	Small group method. Working with micropreparations	20 minutes (0.44 hours)
9.	Respiratory system . Skin .	2	Carrying out a creative task. Filling in the table "Structure of the wall of large, medium and small caliber bronchi".	20 minutes (0.44 hours)
10.	Control lesson with diagnostics of samples.	2	Small group method. Solving situational problems with subsequent discussion.	15 minutes (0.33 hours)
11.	Urinary system .	2	Watching the video "Physiology of Urine Formation" followed by discussion.	20 minutes (0.44 hours)
12.	Male sexual system .	2	Small group method. Working with micropreparations	15 minutes (0.33 hours)
13.	Women's sexual system .	2	Small group method. Working with micropreparations	20 minutes (0.44 hours)
14.	Embryogenesis human being .	2	Watching the video "Human Development" followed by discussion.	25 minutes (0.55 hours)
15.	Control lesson with diagnostics of samples.	2	Small group method. Solving situational problems of increased complexity with subsequent discussion.	15 minutes (0.33 hours)
16.	Final lesson (test).	2	Small group method. Solving situational problems of increased complexity with subsequent discussion.	20 minutes (0.44 hours)
Total hours:		17.2 hours (20% of classroom time)		

2.5. Criteria for assessing students' learning outcomes

The assessment of learning outcomes is carried out in accordance with the “Regulations on the assessment system for the learning outcomes of students of the Federal State Budgetary Educational Institution of Higher Education Amur State Medical Academy of the Ministry of Health of Russia”.

The basis for determining the level of knowledge, skills, and abilities are the assessment criteria - completeness and correctness:

- correct, precise answer;
- correct but incomplete or imprecise answer
- incorrect answer; no answer.

When assigning marks, the classification of errors and their quality are taken into account:

- gross errors;
- similar errors;
- minor errors; shortcomings.

The success of students in mastering the topics of the discipline "Physics, Mathematics" is determined by the quality of mastering knowledge, skills and practical abilities; the assessment is given on a five-point scale: "5" - excellent, "4" - good, "3" - satisfactory, "2" - unsatisfactory.

No. p/p	Topic of the practical lesson	Theoretical part	Practical part	General grade	Forms control
2nd semester					
1.	Cytology. Cell. Cytoplasm.	2-5	2-5	2-5	Theoretical Part Testing Frontal survey on questions for the lesson Practical part Working with micropreparations, electronograms Interview on situational tasks Designing albums (sketching preparations, designating necessary structures) Completing creative tasks in workbooks
2	Nucleus. Signs of vital activity.	2-5	2-5	2-5	
3	General embryology. Development of birds and mammals.	2-5	2-5	2-5	
4	Control lesson.	2-5	2-5	2-5	
5	Epithelial tissue.	2-5	2-5	2-5	
6	Muscle tissue.	2-5	2-5	2-5	
7	Blood.	2-5	2-5	2-5	
8	Loose connective tissue.	2-5	2-5	2-5	
9	Bone tissue.	2-5	2-5	2-5	
10	Dense fibrous tissue. Cartilaginous tissue.	2-5	2-5	2-5	
11	Control lesson with diagnostics of samples.	2-5	2-5	2-5	
12	Cardiovascular system.	2-5	2-5	2-5	
13	Hematopoiesis.	2-5	2-5	2-5	
14	Immune system.	2-5	2-5	2-5	
15	Endocrine system.	2-5	2-5	2-5	
16	Control lesson with diagnostics of samples.	2-5	2-5	2-5	
17	Final lesson (test).	3-5	3-5	done	
		2	2	unfulfilled eno	
3rd semester					
1	Nervous tissue. Reflex arc.	2-5	2-5	2-5	Theoretical Part Testing Frontal survey on questions for the lesson Practical Part Working with histological preparations, electronograms Interview on situational tasks Designing albums (sketching preparations, designating necessary structures) Completing creative tasks in workbooks
2	Central nervous system. Autonomic nervous system.	2-5	2-5	2-5	
3	Visual analyzer, olfactory analyzer.	2-5	2-5	2-5	
4	Auditory and vestibular analyzer, taste analyzer.	2-5	2-5	2-5	
5	Control lesson with diagnostics of samples.	2-5	2-5	2-5	
6	Oral cavity. Teeth. Salivary glands.	2-5	2-5	2-5	
7	Digestive tract.	2-5	2-5	2-5	
8	Liver. Pancreas.	2-5	2-5	2-5	
9	Respiratory system. Skin.	2-5	2-5	2-5	
10	Control lesson with diagnostics of samples.	2-5	2-5	2-5	
11	Urinary system.				
12	Male reproductive system.	2-5	2-5	2-5	
13	Female reproductive system.	2-5	2-5	2-5	
14	Human embryogenesis.	2-5	2-5	2-5	
15	Control lesson with diagnostics of samples.	2-5	2-5	2-5	
16	Final lesson (test).	3-5		done	
		2		unfulfilled But	
Abstract				2-5	
19	Midterm assessment (exam)	3-5	3-5	3,4,5	
		2	2	2	

Evaluation criteria

Quality of development	Mark on a 5-point scale
90 - 100%	"5"
80 - 89%	"4"
70 - 79%	"3"
less than 70%	"2"

Incoming inspection

Conducted at the first lesson in the 2nd semester. Includes 200 questions studied during the development of supporting disciplines (anatomy, biology, physics, biochemistry). Test assignments are located in the Moodle system .

Access mode: <https://educ-amursma.ru/mod/quiz/view.php?id=5335>

Current control

Current control includes initial and final control of knowledge.

Initial control **is** carried out by the teacher at the beginning of each lesson in the form of testing in the Moodle system (2nd semester - <https://educ-amursma.ru/course/view.php?id=75> ; 3rd semester - <https://educ-amursma.ru/course/view.php?id=76>), a frontal survey on questions for the lesson, completing assignments in workbooks and albums.

Final control – includes solving situational problems, checking albums.

The final grade during the current knowledge assessment is given on the day of the lesson, as the arithmetic mean result for all types of activities provided for in the given lesson by the work program of the discipline.

Criteria for assessing the oral response

- **“5” (excellent)** – the student demonstrates deep and complete knowledge of the educational material, does not allow inaccuracies or distortions of facts when presenting, presents the material in a logical sequence, is well oriented in the presented material, and can provide justification for the judgments expressed.
- **“4” (good)** - the student has mastered the educational material in full, is well oriented in the educational material, presents the material in a logical sequence, but makes inaccuracies when answering.
- **“3” (satisfactory)** – the student has mastered the basic principles of the topic of the practical lesson, but when presenting the educational material, he/she makes inaccuracies, presents it incompletely and inconsistently, requires leading questions from the teacher to present it, and has difficulty substantiating the judgments expressed.
- **“2” (unsatisfactory)** – the student has fragmented and unsystematic knowledge of the educational material, is unable to distinguish between the main and the secondary, makes mistakes in defining basic concepts, distorts their meaning, and cannot independently present the material.

Assessment criteria for the practical part

- **“5” (excellent)** – the student has fully mastered the practical skills and abilities provided for by the course work program.
- **“4” (good)** – the student has fully mastered the practical skills and abilities provided for in the course program, but makes some inaccuracies.
- **“3” (satisfactory)** – the student has only some practical skills and abilities.
- **“2” (unsatisfactory)** – the student demonstrates the performance of practical skills and abilities with gross errors.

Criteria for assessing independent extracurricular work:

- the level of student mastery of the educational material;

- the completeness and depth of educational concepts, knowledge and skills on the topic being studied, to which this independent work relates;
- development of universal and general professional competencies (ability to apply theoretical knowledge in practice).
- the problems were solved correctly, the exercises were completed, and the test assignments were answered accurately – “passed”.
- Problems were not solved correctly, exercises were not completed correctly, test questions were not answered accurately – “failed”.

Essay evaluation criteria:

- **“5” (excellent)** – awarded to a student if he has prepared a complete, detailed, and formatted according to requirements, abstract on the chosen topic, presented his work in the form of a report with a computer presentation, and answered questions on the topic of the report;
- **“4” (good)** – awarded to a student for a complete, detailed essay that is formatted according to requirements, but poorly presented;
- **“3” (satisfactory)** – the abstract does not contain information on the issue being studied in full, is formatted with errors, and is poorly presented;
- **“2” (unsatisfactory)** – given to a student if the abstract is not written, or is written with gross errors, the report and computer presentation are not prepared, or their content does not correspond to the topic of the abstract.

Working off disciplinary debts

1. If a student misses a class for a valid reason, he/she has the right to make it up and receive the maximum grade provided for by the course work program for that class. A valid reason must be documented.
2. If a student misses a class for an unjustified reason or receives a "2" mark for all activities in the class, he/she is required to make it up. In this case, the mark received for all activities is multiplied by 0.8.
3. If a student is excused from a class at the request of the dean's office (participation in sports, cultural and other events), then he is given a grade of "5" for this class, provided that he submits a report on the completion of mandatory extracurricular independent work on the topic of the missed class.

Assessment criteria for midterm assessment

Midterm assessment (exam) – is designed to assess the degree of achievement of planned learning outcomes upon completion of the course and allows assessing the level and quality of its mastery by students. The success of students' mastery of the course is assessed on a 5-point scale: "5" - excellent, "4" - good, "3" - satisfactory, "2" - unsatisfactory.

"5" (excellent) - for the depth and completeness of mastery of the educational material, in which the student easily navigates, for the ability to connect theoretical questions with practical ones, express and justify their judgments, correctly and logically present the answer; when testing, allows up to 10% of erroneous answers. Practical skills and abilities provided for by the work program of the discipline "Histology, Embryology, Cytology" are fully mastered.

"4" (good) - the student has fully mastered the educational material, is well oriented in it, presents the material competently, but makes some inaccuracies when presenting it; makes up to 20% of erroneous answers when testing. The practical skills and abilities provided by the course program have been mastered, but the student makes some inaccuracies when passing the practical skills test.

"3" (satisfactory) - the student has mastered the knowledge of the discipline, knows and understands the basic theoretical principles, but presents the educational material inconsistently, does not know how to express and justify his/her judgments; allows up to 30% of incorrect answers during testing. Has partial practical skills and abilities.

"2" (unsatisfactory) - the student has fragmented and unsystematic knowledge of the educational material, is unable to distinguish between the main and secondary, makes mistakes in

defining concepts, distorts their meaning, presents the material in a disorderly and uncertain manner, and makes more than 30% of erroneous answers during testing. Performs practical skills and abilities with gross errors.

A student may qualify for an "excellent" grade automatically if he/she has won a prize in disciplinary or interdisciplinary Olympiads (university, regional) and has an average score for the current academic performance of at least 4.8 points . A student may refuse an "excellent" grade automatically and take the exam on a general basis.

Intermediate certification in the discipline "Histology, Embryology, Cytology" is carried out in 3 stages:

1. Test control in the " Moodle " system.
Access mode: <https://educ-amursma.ru/mod/quiz/view.php?id=655>
2. Completion of practical skills (diagnostics and description of “silent” micropreparations);
3. Answers to ticket questions and tasks.

Assessment criteria for midterm assessment

Stages	Mark out of 5 point scale	Final grade
Test control in the system " Moodle "	3-5	Satisfactory, good, excellent
Delivery of practical skills (control of the formation of competencies)	3-5	
Answers to ticket questions and tasks	3-5	
Test control in the system " Moodle "	2	Unsatisfactory
Delivery of practical skills (control of the formation of competencies)	2	
Answers to ticket questions and tasks	2	

2.6. Independent work of students: in-class and out-of-class

Independent classroom work of students

The modern model of training specialists is based on the fact that independent work of students should have an educational function, and not be limited to consolidation of the information received. The organization of independent classroom work of students is carried out during a practical lesson under the supervision of a teacher. Independent classroom work includes solving situational problems, individual tasks, working in a histological laboratory, performing creative tasks in a workbook (drawing up algorithms, filling in tables), working with a microscope, studying and sketching in an album of micropreparations with subsequent designation of structures, describing electron diffraction patterns. To manage the independent classroom work of students, the department staff has developed methodological manuals for working with histological preparations, containing an algorithm of actions, indicating morphological features that allow differentiating certain structures, and giving recommendations on the design of an album. Sets of tables, tablets with diagrams, microphotographs and electron diffraction patterns help students in their independent work.

Extracurricular independent work of students

It is independent work of students in preparation for practical classes, diagnostics of preparations, control lesson on the section. The main forms of extracurricular independent work are studying the main and additional educational literature, reading lecture notes, solving situational problems, solving test tasks, working with Internet sources, with electronic atlases, preparing oral reports, writing notes on the topic of the practical lesson, designing a workbook. This section of the work is of particular importance in preparation for diagnostics of preparations.

The second section of students' extracurricular independent work is the preparation of essays and the compilation of test assignments. The materials are heard and discussed in group classes, at a club meeting, and at course conferences. This form provides the ability to work with scientific literature, the acquisition of the ability to analyze the phenomena being studied, the development of communication skills, and the ability to reflect.

Organization of extracurricular independent work of students

Item No.	Topic of the practical lesson	Time for student preparation for the lesson	Forms of extracurricular independent work of a student	
			Mandatory and the same for all students	At the student's choice
2nd semester				
1	Cytology. Cell. Cytoplasm	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Morphological evolution of the cell", a short oral report on the topic of the lesson "Modern methods in cytology", making a model of the tablet "The structure of a light microscope" in electronic form
2	Nucleus. Signs of vital activity	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and	Computer presentation "Transport of substances", a short

			additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	oral report on the topic of the lesson "Chromatin. Chemical composition. Types", making a model of the tablet "Mitosis. Amitosis" in electronic form
3	General Embryology. Development of Birds and Mammals	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Cleavage. Types of blastulas", a short oral report on the topic of the lesson "Embryonic induction", making a model of the tablet " Histo- and organogenesis" in electronic form
4	Control lesson	2.0	Preparation for the test lesson on theoretical questions of task cards	
5	Epithelial tissue	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Endothelium: structure, localization, functions", a short oral report on the topic of the lesson " Cytokeratins ", making a model of the tablet "Secretory cycle of the glandulocyte " in electronic form
6	Muscle tissue	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Molecular mechanisms of muscle contraction", a short oral presentation on the topic of the lesson "Types of muscle fibers", making a model of the tablet "Structure of myofibrils" in electronic form
7	Blood	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks,	Computer presentation "Blood functions", a short oral presentation on the topic of the lesson "Erythrocyte antigens", making a

			designing an album, working with Internet sources)	model of the tablet "Platelet hemostasis" in electronic form
8	Loose connective tissue	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "The system of mononuclear phagocytes", a short oral report on the topic of the lesson "Chemical composition of amorphous matter", making a model of the tablet "Fibroblastic differon » in electronic form
9	Bone tissue	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Development of bone in place of cartilage", a short oral presentation on the topic of the lesson " Bone remodeling ", making a model of the tablet "Tubular bone as an organ" in electronic form
10	Dense fibrous connective tissue. Cartilaginous tissue	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Tendons, ligaments, aponeuroses", a short oral presentation on the topic of the lesson "Age-related changes in cartilage tissue", making a model of the tablet "Fibrous cartilage" in electronic form
11	Control lesson with diagnostics of samples	2.0	Working with "silent" micropreparations using methodological manuals for SRS, albums, electronic atlases	
12	Cardiovascular system	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation " Organ specificity of blood capillaries", a short oral presentation on the topic of the lesson "Reactive changes in the myocardium", making a model of the tablet

				"Conducting system of the heart" in electronic form
13	Hematopoiesis	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Red bone marrow", a short oral report on the topic of the lesson "Regulation of erythropoiesis", making a model of the tablet "Granulocytopoiesis" in electronic form
14	Immune system	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Lymphopoiesis", a short oral presentation on the topic of the lesson "Lymphoepithelial organs", making a model of the tablet "Cellular immune response" in electronic form
15	Endocrine system	2.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Hormones of the adenohypophysis and their biological effects", a short oral presentation on the topic of the lesson "Secretory cycle of the T- thyrocyte", making a model of the tablet "Hypothalamic-adenohypophysial system" in electronic form
16	Control lesson with diagnostics of samples	2.0	Working with "silent" micropreparations using methodological manuals for SRS, albums, electronic atlases	
17	Final lesson (test)	2.0	Revision of theoretical material on the topics of practical classes of the 2nd semester (lecture material, reading of basic and additional educational literature, working with Internet sources)	
Labor intensity in hours		34 hours	34 hours	2 hours
Total workload for 2nd semester			36 hours	

3rd semester				
1	Nervous tissue. Reflex arc.	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Types of nerve fibers", a short oral report on the topic of the lesson "Synapses. The mechanism of synaptic transmission of nerve impulses", making a model of the tablet "Receptor nerve endings" in electronic form
2	Central nervous system. Autonomic nervous system.	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Viscero-visceral reflex arcs", a short oral presentation on the topic of the lesson "Modular principle of organization of the cerebral cortex", making a model of the tablet "Cellular composition of vegetative ganglia" in electronic form
3	Visual analyzer, olfactory analyzer.	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Structural and molecular bases of color perception and its disorders", a short oral presentation on the topic of the lesson "Circulation and outflow paths of aqueous humor", making a model of the tablet "Photoreceptors" in electronic form
4	Auditory and vestibular analyzer, taste analyzer.	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "The structure of the cochlea. Cochlear duct", a short oral presentation on the topic of the lesson "The emergence of microphone potential", making a model of the tablet "Spiral organ" in electronic form

5	Control lesson with diagnostics of samples.	2.0	Working with "silent" histological preparations using methodological manuals for SRS, albums, electronic atlases	
6	Oral cavity. Teeth. Salivary glands.	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "General plan of the structure of the digestive tract", a short oral report on the topic of the lesson "Papillae of the tongue", making a model of the tablet "Early stage of tooth development" in electronic form
7	Digestive tract	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Types of digestion. Parietal digestion", a short oral report on the topic of the lesson "Digestion and absorption of lipids", making a model of the tablet "The villus-crypt system" in electronic form
8	Liver. Pancreas	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	A short oral presentation on the topic "Reactive changes in the liver", a computer presentation "B-cells of the pancreas", making a model of the tablet "Liver lobule" in electronic form
9	Respiratory system. Skin	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Lung development", a short oral presentation on the topic of the lesson "Changes in the respiratory epithelium in smokers", making a model of the tablet "Epidermal proliferative unit" in electronic form

1 0	Control lesson with diagnostics of samples	2.0	Working with "silent" histological preparations using methodological manuals for SRS, albums, electronic atlases	
11	Urinary system	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Endocrine apparatus of the kidney", a short oral report on the topic of the lesson "Countercurrent multiplier apparatus of the kidneys", making a model of the tablet "Glomerular filter" in electronic form
1 2	Male reproductive system	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Development of the reproductive system", a short oral presentation on the topic of the lesson "Regulation of spermatogenesis", making a model of the tablet "Hemato-testicular barrier" in electronic form
13	Female reproductive system	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Phases of the menstrual cycle and their hormonal regulation", a short oral report on the topic "Changes in the mammary gland associated with pregnancy and childbirth", making a model of the tablet "Oogenesis" in electronic form
14	Human embryogenesis	1.0	Study of theoretical material on the topic of a practical lesson using task cards (lecture material, reading basic and additional educational literature, writing notes, solving test tasks, designing an album, working with Internet sources)	Computer presentation "Critical periods of development", a short oral presentation on the topic of the lesson "Implantation", making a model of the tablet "Cotyledon

				- a structural and functional unit of the placenta" in electronic form
15	Control lesson with diagnostics of samples	1.5	Working with "silent" histological preparations using methodological manuals for SRS, albums, electronic atlases	
16	Final lesson (test).	1.5	Review of theoretical material on the topics of practical classes of the 3rd semester (lecture material, reading of basic and additional educational literature, working with Internet sources).	
Labor intensity in hours		20 hours	20 hours	4 hours
Total workload for 3rd semester			24 hours	
Total labor intensity (in hours)			60 hours	

2.7. Research (project) work of students

Research (project) work of students is a mandatory section of the discipline aimed at developing general cultural, general professional and professional competencies of students. This type of work of students involves studying scientific literature with subsequent preparation of an abstract, preparation of a computer presentation and an oral report on the topic of the abstract. Preference is given to oral reports with discussion of the material at a conference class, departmental conference, SSS meeting, presentation at a university student conference. The second direction of research work of students involves the implementation of applied work, participation in scientific research together with teachers of the department.

Topics of abstracts:

1. Evolution of tissues. The theory of A.A. Zavarzin on parallel series of tissue evolution and N.G. Khlopin on divergent differentiation.
2. Primary and secondary embryonic induction.
3. Cellular processes underlying the formative movements of early development.
4. Cellular differentiation and developmental processes.
5. Regenerative processes in tissues and organs.
6. Vegetative regulation of organ systems. Morphological manifestations.
7. The principle and mechanism of parietal digestion.
8. Structural foundations of photoreception.
9. Mechanisms regulating the sexual cycle.
10. Means of controlling the activity of the nervous system.
11. Endocrine regulation of the digestion process. Morphological substantiation.
12. Cellular energetics. Regulation.
13. Structural organization of tissue barriers.
14. Interorgan interactions in the immune system. Morphological aspects.
15. Limits of tissue variability: the concept of stem cell population kinetics.
16. Blood. Morphological criteria for assessing blood smear elements. Leukocyte formula.
17. Central organs of hematopoiesis and immunogenesis. Thymus. Hematothymus barrier.
18. Peripheral organs of hematopoiesis and immunogenesis.
19. Protective immune responses, participation of immunocompetent cells (morphological basis of responses).
20. Hemocytopoiesis . Modern scheme. Regulation of the process.

21. Structural and functional characteristics of the neuroendocrine system as a whole and its individual parts. Mechanisms of hormone influence on target cells.
22. Secretory cycle of the thyroid gland. Morphological criteria for assessing the functional state of the gland.
23. Adrenal medulla and cortex. Histophysiology.
24. Histophysiology of parietal digestion. Morphological aspects.
25. Aero- hematic barrier. Structure and function of the surfactant system of the lungs.
26. Juxtaglomerular complex of the kidney. Structure and function of its components.
27. Hematotesticular barrier.
28. Sexual cycle - hormonal regulation. Morphological expression of the process.
29. Nervous system. Analyzers. Structural and functional organization.
30. Signs of cell vital activity. Differentiation. Regulation of the process.
31. Compensatory-adaptive reactions in morphology. Structural homeostasis.
32. Adaptive reactions of cells and tissues. Morphological manifestations of adaptation processes to unfavorable physical and chemical environmental factors.
33. Modern concepts of transport routes in a cell.
34. Structure of the cell membrane and intercellular interactions.
35. Structural and functional organization of the cell.
36. The structure of the connective tissue of the body. Amorphous substance. Justification of the trophic function.
37. Morphological substantiation of the mechanism of muscle contraction.
38. Bone. Reparative osteogenesis. Regenerative capabilities of other organs.
39. Microcirculatory bed.

Applied work:

1. Preparation and staining of blood smear.
2. Preparation and staining of red bone marrow smear.
3. Preparation of original tables and tablets for practical classes and lectures.

3. Educational, methodological, material, technical and informational support of the discipline

3.1. Primary literature

1. Bykov, V. L. Histology, cytology and embryology. Atlas: a textbook / Bykov V. L., Yushkantseva S. I. - Moscow: GEOTAR-Media, 2013. - 296 p. - ISBN 978-5-9704-2437-7. - Text: electronic (date accessed: 12.05.2021). - Access mode: by subscription.
<http://www.studmedlib.ru/book/ISBN9785970424377.html>
2. Afanasyev, Yu. I. Histology, embryology, cytology: textbook / Yu. I. Afanasyev, B. V. Aleshin, N. P. Barsukov [etc.]; edited by Yu. I. Afanasyeva, N. A. Yurina. - 7th ed. , processed and additional - Moscow: GEOTAR-Media, 2021. - 832 p. - ISBN 978-5-9704-6158-7. - Text: electronic (date of access: 05/03/2021). - Access mode: by subscription.
<http://www.studmedlib.ru/book/ISBN9785970461587.html>
3. Danilov, R. K. Histology, embryology, cytology: textbook / Danilov R. K., Borovaya T. G. - Moscow: GEOTAR-Media, 2020. - 528 p. - ISBN 978-5-9704-5361-2. - Text: electronic (date accessed: 05/03/2021). - Access mode: by subscription.
<http://www.studmedlib.ru/book/ISBN9785970453612.html>

3.2. Further reading

1. Bykov, V. L. Histology, cytology and embryology. Atlas: a textbook / Bykov V. L., Yushkantseva S. I. - Moscow: GEOTAR-Media, 2015. - 296 p. - ISBN 978-5-9704-3201-3. - Text: electronic // URL: <http://www.studmedlib.ru/book/ISBN9785970432013.html> (date accessed: 11.05.2021). - Access mode: by subscription.
2. Banin , V. V. Cytology and general histology: atlas [electronic resource] / V. V. Banin , A. V. Pavlov, A. N. Yatskovsky. - Moscow: GEOTAR-Media, 2021. - Text: electronic // URL: <http://www.studmedlib.ru/book/06-COS-2411.html> (date accessed: 03.05.2021). - Access mode: by subscription.

3.3. Educational and methodological support of the discipline prepared by the department

Monographs:

- Regeneration of human tissues and organs/S.S. Tseluiko , N.P. Krasavina, T.V. Zabolotskikh, I.Yu. Sayapina, D.A. Semenov, L.S. Korneeva, T.L. Ogorodnikova, V.S. Kozlova, Blagoveshchensk. – 2017, 303 p.
- Functional morphology of the male reproductive system organs during adaptation to low temperatures against the background of correction with dihydroquercetin /I.Yu. Sayapina, S.S. Tseluyko/Blagoveshchensk, 2018. 179 p.
- Morphofunctional characteristics of the pancreas and lungs in experimental hyperglycemia against the background of the use of dihydroquercetin Tseluiko S.S., Krasavina N.P., Korneeva L.S., /Amur State Medical Academy. Blagoveshchensk, 2017. 152 p.

Study guides:

- Organ regeneration / S.S. Tseluiko , N.P. Krasavina, I.Yu. Sayapina, D.A. Semenov, L.S. Korneeva, T.L. Ogorodnikova, V.S. Kozlova, Blagoveshchensk. - 2018, 208 p.

Approved by the Coordinating Council for the field of education "Healthcare and Medical Sciences".

- Tissue regeneration / S.S. Tseluiko, N.P. Krasavina, D.A. Semenov, Blagoveshchensk. - 2016, 136 p. Approved by the Coordinating Council for the field of education "Healthcare and Medical Sciences".
- Histophysiology of the respiratory organs (morphology, physiology and evolution of the respiratory system organs). / S.S. Tseluiko, N.P. Krasavina, D.A. Semenov, A.D. Chertov, N.R. Grigoriev, V.A. Smirnov - Blagoveshchensk, 2016. - 130 p. Approved by the Coordinating Council for the Field of Education "Healthcare and Medical Sciences".
- Situational tasks in histology. / S.S. Tseluiko, N.P. Krasavina - Blagoveshchensk, 2017. - 66 p. Approved by the Coordinating Council for the field of education "Healthcare and Medical Sciences".
- Test tasks in histology: Part one. / S.S. Tseluiko, N.P. Krasavina - Blagoveshchensk, 2016. - 88 p. Approved by the Coordinating Council for the field of education "Healthcare and Medical Sciences".
- Test tasks in histology: Part two. / S.S. Tseluiko, N.P. Krasavina - Blagoveshchensk, 2017. - 89 p. Approved by the Coordinating Council for the field of education "Healthcare and Medical Sciences".

Item No.	Tablets for independent classroom work of students on topics of private histology	Quantity
	2nd semester	
1	Cardiovascular system.	28
2	Hematopoiesis.	28
3	Immune system.	28
4	Endocrine system.	28
	3rd semester	
1	Nervous tissue. Reflex arc.	28
2	Central nervous system. Autonomic nervous system.	28
3	Visual analyzer, olfactory analyzer.	28
4	Auditory and vestibular analyzer, taste analyzer.	28
5	Oral cavity. Teeth. Salivary glands.	28
6	Digestive tract.	28
7	Liver. Pancreas.	28
8	Respiratory system. Skin.	28
9	Leather and its derivatives	28
10	Urinary system.	28
11	Male reproductive system.	28
12	Female reproductive system.	28
13	Human embryogenesis.	28

List of histological preparations

Cytology. Cell. Cytoplasm

General Cell Morphology (Axolotl Liver) Hematoxylin and eosin. Golgi apparatus. Osmic acid. Zymogen granules. Iron hematoxylin. Chondriosomes. According to Altman. Striated muscles. Secretory granules. Hematoxylin and eosin. Fat inclusions. Osmic acid. Pigment inclusions. Unstained preparation. Yolk inclusions. Hematoxylin and eosin. Cilia. Iron hematoxylin. Glycogen inclusions. With carmine according to Best, counterstained with hematoxylin.

Nucleus. Signs of vital activity

Onion skin. Epithelium of the oral mucosa. Hematoxylin and eosin. Frog blood. Hematoxylin and eosin. Hyaline cartilage. Karyokinesis in onion root cells. Mitosis in an ascaris egg. Amitosis in urinary bladder cells. Mitosis of a plant cell. Iron hematoxylin. Mitosis of an animal cell. Centrosomes and achromatic spindle. Iron hematoxylin.

General Embryology. Bird Embryogenesis. Mammal Embryogenesis

Blastula of amphibian. Hematoxylin and picrofuchsin . Gastrula of amphibian. Hematoxylin and picrofuchsin . Neurula of frog. Hematoxylin and picrofuchsin . Primitive streak. Hematoxylin. Somites, notochord, neural tube. Hematoxylin. Trunk fold. Hematoxylin. Chicken embryo. Hematoxylin and picrofuchsin . Cross-section of 96-hour chicken embryo. Hematoxylin and eosin. Sagittal section of chicken embryo. Hematoxylin. Toothless egg. Hematoxylin and eosin. Frog egg. Hematoxylin and eosin. Cleavage of ascaris egg. Iron hematoxylin. Cleavage of frog egg. Hematoxylin and picrofuchsin . Chicken allantois. Hematoxylin and eosin.

Mammalian egg. Hematoxylin and eosin. Rooster sperm. Iron hematoxylin. Guinea pig sperm. Iron hematoxylin. Fertilization. Hematoxylin and eosin. Synkaryon . Hematoxylin and eosin. Chorionic villi. Carmine. Pig umbilical cord. Hematoxylin and eosin. Human amnion. Hematoxylin and eosin.

The study of tissues. Epithelial tissue

Stratified squamous epithelium. Hematoxylin and eosin. High columnar epithelium. Hematoxylin and eosin. Low columnar epithelium. Hematoxylin and eosin. Mesothelium. Silvering of borders. Transitional epithelium. Hematoxylin and eosin. Ciliated epithelium. Hematoxylin and eosin. Glandular epithelium (apocrine secretion). Hematoxylin and eosin.

Muscle tissue

Smooth muscle tissue. Hematoxylin and eosin. Striated muscle tissue. Iron hematoxylin. Leech muscle fibers. Iron hematoxylin. Histogenesis of muscle tissue. Iron hematoxylin.

Blood

Frog blood. Hematoxylin and eosin. Human blood. Hematoxylin and eosin.

Loose fibrous connective tissue

Mesenchyme. Hematoxylin. Reticular tissue. Hematoxylin and eosin. Loose connective tissue. Iron hematoxylin. Accumulation of dye in histiocytes. Trypan blue, alum carmine. Adipose tissue. Hematoxylin and eosin. Pigment cells of amphibians. Unstained preparation.

Bone tissue. Dense connective and cartilaginous tissue

Development of bone in place of cartilage. Hematoxylin and eosin. Bone cells. Unstained preparation. Development of bone from connective tissue. Hematoxylin and eosin. Bone in cross section. Thionin - picric acid. Bone in longitudinal section. Thionin - picric acid. Iron hematoxylin. Tendon in longitudinal section. Hematoxylin and eosin. Tendon in cross section. Hematoxylin and eosin. Longitudinal section of elastic ligament. G / picrofuchsin . Dense connective tissue. Orcein . Hematoxylin and picrofuchsin . Hyaline cartilage. Hematoxylin and eosin. Elastic cartilage. Orcein . Fibrocartilage. Hematoxylin and eosin.

Cardiovascular system

Arterioles, venules, capillaries. Hematoxylin and eosin. Muscular arteries. Hematoxylin and eosin. Elastic arteries. Orcein . Femoral vein. Hematoxylin and eosin. Myocardium Iron hematoxylin. Purkinje fibers. Hematoxylin and eosin.

Immune system

Thymus. Hematoxylin and eosin. Spleen . Hematoxylin and eosin. Lymph node. Hematoxylin and eosin. Palatine tonsil. Hematoxylin and eosin.

Endocrine system

Pituitary gland. Hematoxylin and eosin. Thyroid gland. Hematoxylin and eosin. Parathyroid gland. Hematoxylin and eosin. Adrenal glands. Hematoxylin and eosin. Islets of Langerhans . Hematoxylin and eosin.

Nervous tissue Reflex arc.

Nerve cells. Methylene blue. Neurofibrils. Silvering. Tigroid . Toluidine blue. Fleshy nerve fibers. Osmic acid. Anmellasty nerve fibers. Hematoxylin and eosin. Spinal ganglion. Hematoxylin and eosin. Lamellar corpuscle of Vater-Pacini. Hematoxylin and eosin. Cross-section of peripheral nerve. Hematoxylin and eosin.

Central nervous system. Autonomic nervous system

Spinal cord. Hematoxylin and eosin. Spinal cord. Silvering. Cerebral cortex. Silvering. Cerebellum. Silvering.

Visual analyzer. Olfactory analyzer.

Cornea. Hematoxylin and eosin. Angle of the eye. Hematoxylin and eosin. Back wall of the eye. Hematoxylin and eosin.

Auditory and vestibular analyzer. Taste analyzer

Axial section of the cochlea. Organ of Corti . Hematoxylin and eosin. Foliate papillae of the tongue. Hematoxylin and eosin.

Oral cavity and its derivatives. Teeth. Glands

Parotid gland. Hematoxylin and eosin. Mixed gland. Hematoxylin and eosin. Tongue (filiform papillae). Hematoxylin and eosin. Development of the tooth (enamel organ). Hematoxylin and eosin. Formation of dentin and enamel. Hematoxylin and eosin.

Digestive tract

Esophagus. Hematoxylin and eosin. Esophagus-to-stomach transition. Hematoxylin and eosin. Fundus of the stomach. Congo red, hematoxylin. Pyloric part of the stomach. Hematoxylin and eosin. Duodenum. Hematoxylin and eosin. Small intestine. Hematoxylin and eosin. Large intestine. Hematoxylin and eosin.

Liver. Pancreas.

Pancreas. Hematoxylin and eosin. Pig liver. Hematoxylin and picrofuchsin . Human liver. Hematoxylin and eosin. Kupffer cells (dye accumulation). India ink, alum carmine.

Respiratory system. Skin

Trachea. Hematoxylin and eosin. Lung. Hematoxylin and eosin. Skin with hair. Hematoxylin and eosin. Finger skin. Hematoxylin and eosin.

Urinary system

Kidney. Hematoxylin and eosin. Dye accumulation in the kidney. Trypan blue. Urinary bladder. Hematoxylin and eosin. Ureter. Hematoxylin and eosin.

Male reproductive system

Testicle. Hematoxylin and eosin. Epididymis. Hematoxylin and eosin. Prostate. Hematoxylin and eosin.

Female reproductive system

Ovary. Hematoxylin and eosin. Corpus luteum. Hematoxylin and eosin. Uterus. Hematoxylin and eosin. Mammary gland. Hematoxylin and eosin.

Human embryogenesis

Fetal part of the placenta. Hematoxylin and eosin. Maternal part of the placenta. Hematoxylin and eosin.

List of demonstration samples 2nd semester

Cytology. Cell. Cytoplasm

Chondriosomes in liver cells. According to Altman. Chondriosomes in intestinal epithelium. According to Altman. Zymogen granules. Iron hematoxylin. Secretory granules. Hematoxylin and eosin. Fatty inclusions. Osmic acid-safranin. Pigment inclusions. Unstained preparation. Yolk inclusions. Hematoxylin and picrofuchsin .

Nucleus. Signs of vital activity

Pod chromatin in women's blood leukocytes. Azure II -eosin. Mitosis of animal cell. Centrosomes and achromatic spindle. Amitosis.

General Embryology. Development of Birds

Chicken embryo at the stage of the primary streak (18 hours of incubation). Flat total preparation. Carmine. Chicken embryo at the stage of formation of the trunk and amniotic folds. Carmine.

Development of mammals

Mammalian egg. Azocarmine according to Heidenhain . Mammalian embryo at the stage of 2-4 blastomeres. Hematoxylin. Mammalian embryo at the blastocyst stage. Hematoxylin. Human embryo at the stage of formation of the axial complex of rudiments (5-6 weeks). Hematoxylin.

Muscle tissue

Smooth muscle tissue. Connective tissue fibers around muscle cells . SDH in muscle fibers (cross section). According to Burston . Regeneration of striated muscle tissue. Myotube stage . Iron hematoxylin. Glycogen in muscle fibers (cross section). Hematoxylin and eosin. Attachment of muscle to tendon. Mallory method .

Blood

Acid phosphatase in monocytes. Gomori method. Acid phosphatase in the cytoplasm of macrophages. Gomori method. Inorganic inclusions in cells (iron in spleen macrophages). According to Perls . Lymph smear. Hematoxylin and eosin. Formed elements. Azure II -eosin. Human blood reticulocytes. Brilliant- cresyl blue .

Loose connective tissue

Mesenchyme. Hematoxylin and eosin. Glycosaminoglycans and glycoproteins in the ground substance of loose connective tissue. Alcian blue - PAS reaction. Tissue basophils (labrocytes , mast cells). Alcian blue or basic brown. Plasma cells. Methyl green - pyronin . Section of the nuchal ligament. Picrofuchsin . Pigment cells. Section of skin in the nipple area. Hematoxylin and eosin. Brown adipose tissue. Aldehyde fuchsin .

Bone tissue

Glycosaminoglycans and glycoproteins in the intercellular substance of hyaline cartilage. Alcian blue - PAS reaction. Coarse fibrous bone tissue. Hematoxylin and eosin. Tuberosity of the tibia. Schmorl's method . Tendon (cross section). Hematoxylin and eosin. Insertion of the tendon to the bone. Hematoxylin and eosin. Tubular bone of an adult (section of the epiphysis of decalcified bone). Schmorl's method . Bone regeneration (cartilaginous callus stage). Schmorl's method . Bone regeneration (bone callus stage). Schmorl's method .

Cardiovascular system

Elastic fibers and membranes in the aortic wall. Orcein . Heart valve. Alcian blue and orcein . Nerve fibers and endings in the wall of a blood vessel. Silver impregnation and hematoxylin and eosin. Lymphatic capillaries. Hematoxylin and eosin. Human heart in the 2nd month of intrauterine development. Hematoxylin and eosin. Wall of the human heart aged 60-70 years. Iron hematoxylin. Intercalated discs in the muscle tissue of the heart. Iron hematoxylin. Atypical muscle cells of the bovine heart. Azocarmine . Glycogen in the conductive and contractile muscle tissue of the heart. According to Burston . Human aorta aged 60-70 years. Orcein . Wall of the heart of a newborn. Hematoxylin and eosin.

Immune system

Reticular fibers in a lymph node. Silver impregnation. Thymus of an adult. Hematoxylin and eosin. Adenohypophysis . Helmi-Dyban method . Spleen of a newborn. Hematoxylin and eosin. Thymus gland of a child. Hematoxylin and eosin. Vermiform appendix of a newborn. Hematoxylin and eosin.

Endocrine system

Frontal section of the hypothalamus at the level of the supraoptic nuclei. Hematoxylin and eosin. Neurohypophysis . Accumulation of neurosecretion. Aldehyde fuchsin . Pineal gland. Hematoxylin and eosin. Thyroid gland of the newborn. Hematoxylin and eosin. Adrenal gland of the newborn. Hematoxylin and eosin. Adrenal gland. Fatty inclusions in the cells of the cortex. Sudan III . Adrenocytes and noradrenocytes of the adrenal medulla. Wood's method.

3rd semester

Nervous tissue. Reflex arc

Pseudounipolar nerve cells of the spinal ganglion. Silver impregnation. Lipofuscin in nerve cells. Methylene blue. Neurosecretory cells. Methylene blue . RNA in spinal cord nerve cells. Methyl green pylonin . Free nerve endings in the epithelium. Silver impregnation. Sensory nerve ending (tactile corpuscle) in the skin. Silver impregnation. Sensory lamellar nerve ending (lamellar corpuscle) in the skin. Silver impregnation. Motor nerve ending (axo-muscle synapse). Silver impregnation and hematoxylin and eosin. Astroglia . Silver impregnation. Glial macrophage (microglia). Silver impregnation.

Central nervous system. Autonomic nervous system

Spines on the dendrites of pyramidal neurons. Golgi method. Medulla oblongata. Silvering. Section at the level of the inferior olives. Silver impregnation. Synapses on motor nerve cells of the spinal cord. Silver impregnation.

Visual analyzer. Olfactory analyzer.

Eye development (human embryo 7-8 weeks). Hematoxylin and eosin. Glycosaminoglycans in the cornea. Alcian blue – PAS reaction. The retina of the eye in the dark and after exposure to strong light. Hematoxylin and eosin. The retina of the eye. Hematoxylin and eosin. The exit point of the optic nerve (blind spot). Hematoxylin and eosin. The retina of the eye. The central fovea (place of best vision). Hematoxylin and eosin. The olfactory lining. Hematoxylin and eosin.

Oral cavity. Teeth. Salivary glands

Lip. Hematoxylin and eosin. Cheek. Intermediate part. Hematoxylin and eosin. Cross-section of the fusion line. Hematoxylin and eosin. Development of the tooth. Stage of differentiation of the tooth germ. Hematoxylin and eosin. Frontal section of the jaw of a human embryo (9 weeks). Hematoxylin and eosin. Development of the tooth. Stage of tooth histogenesis. Hematoxylin and eosin. Frontal section of the jaw of a human embryo (16 weeks). Hematoxylin and eosin. A child's falling out baby tooth. Longitudinal section. Resorption of the root of the baby tooth. Hematoxylin and eosin. A child's permanent tooth. Eruption stage. Hematoxylin and eosin. Longitudinal section of a decalcified

tooth with an alveolus. Hematoxylin and eosin. Tongue. Vallate papillae (papillae surrounded by a ridge). Hematoxylin and eosin. Mucous cells in the submandibular gland. Mucicarmine – hematoxylin.

Digestive tract

Alkaline phosphatase in the intestinal absorptive border. Gomori method. Unicellular endoepithelial glands (intestinal goblet cells). PAS – hematoxylin reaction. H-thymidine inclusions in the nuclei of intestinal epithelial cells. Autoradiography. Total mount of intestinal villi. Injection. Alkaline phosphatase in the intestinal absorptive border. Gomori method. Human stomach in the 2nd month of intrauterine development. Hematoxylin and eosin. Glycoproteins in the mucous cells of the surface epithelium and glands of the stomach. PAS – hematoxylin reaction. Injection of capillaries of small intestinal villi. Prussian blue. Argyrophilic cells in the intestinal epithelium. PAS – hematoxylin reaction. Acidophilic (apical granular) cells in the crypts of the small intestine. PAS reaction – hematoxylin. Glycoproteins in the mucous cells of the colon. PAS reaction. Intermuscular nerve plexus of the gastrointestinal tract. Silver impregnation. Human small intestine in the 2nd month of intrauterine development. Hematoxylin.

Liver. Pancreas

Endocrine islet cells of the pancreas. Hematoxylin and eosin. Anlage of the pancreas. Human embryo (2 months). Hematoxylin. Injection of liver vessels. Prussian blue - carmine. Liver macrophages. Introduction of ink - hematoxylin - carmine. Bile capillaries of the liver. Silver impregnation. Pancreas of the newborn. Hematoxylin and eosin. Liver of the human fetus (7 - 8 months). Hematoxylin and eosin. Liver of the newborn. Hematoxylin and eosin.

Respiratory system. Skin

Inclusions of H³-thymidine in the nuclei of epidermal cells. Autoradiography. Larynx. Longitudinal section. Hematoxylin and eosin. Lung. Elastic fibers in the parenchyma. Orcein. Human lung in the 2nd month of intrauterine development. Hematoxylin and eosin. Newborn lung (aerated). Hematoxylin and eosin. Newborn lung (unaerated). Hematoxylin and eosin. Lung of a 60-70 year old human. Hematoxylin and eosin. Fingernail. Hematoxylin and eosin. Sunburned skin. Hematoxylin and eosin. Human skin 60-70 years old. Hematoxylin and eosin.

Urinary system

Cytochrome oxidase in mitochondria of renal tubular cells. PAS reaction. Urinary bladder section. Van Gieson method. PAS reaction. Primary human embryonic kidney (7-8 weeks). Hematoxylin. Definitive fetal kidney (9 weeks). Hematoxylin. Total cross-section of newborn kidney. Hematoxylin. Injection of renal vessels. Carmine - Prussian blue. Glycoproteins in the vascular glomerulus of the kidney. PAS reaction. Dye accumulation by cells of the proximal nephron. Trypan blue. Newborn kidney. Hematoxylin.

Male reproductive system

Vas deferens. Hematoxylin and eosin. Seminal vesicle. Hematoxylin and eosin. Prostate gland of a boy. Hematoxylin and eosin. Prostate gland of an old man. Hematoxylin and eosin. Testicle of a 60-70 year old man. Hematoxylin and eosin. Testis of a newborn. Hematoxylin and eosin.

Female reproductive system

Ovary of an old woman. Hematoxylin and eosin. Uterus of a woman. Menstrual phase of the cycle. Hematoxylin and eosin. Ovary of a girl 4-5 years old. Hematoxylin and eosin. Ovary of a newborn girl. Hematoxylin and eosin. Uterus of a newborn girl. Hematoxylin and eosin.

Human embryogenesis

Histogenesis and organogenesis. Human embryo 8-9 weeks. Hematoxylin.

List of electron micrographs 2nd semester

Cytology. Cell. Cytoplasm.

Cytoplasmic membrane . Endoplasmic reticulum. Cytoplasmic inclusions . Mitochondria . Lysosomes . Peroxisomes . Golgi complex. Microtubules. Centrosomes.

Nucleus. Signs of vital activity .

Nuclear membrane. Cell nucleus in interkinesis . Nucleolus . Phagocytosis. Pinocytosis. Mitosis.

Epithelial tissue.

Epithelial cell. Epithelial cell with cilia. Desmosomes and tonofilaments in an epithelial cell. Goblet glandular cell.

Muscle tissue.

Smooth muscle cell. Striated muscle fiber. Two types of myofilaments of striated muscle fiber and the connection between them.

Blood.

Reticulocyte. Neutrophilic leukocyte. Eosinophilic leukocyte. Basophilic leukocyte. Lymphocyte. Monocyte. Blood platelet. Megakaryocyte.

Loose connective tissue. Bone tissue.

Macrophage. Fibroblast. Tissue basophil. Plasma cell. Collagen fibrils. Reticular cell and reticular fibrils. Chondrocyte and intercellular substance. Osteoblast. Osteocyte. Osteoclast.

Cardiovascular system.

Cardiomyocytes with intercalated discs. Cardiomyocytes of the cardiac conduction system. Blood capillary. Fenestrated blood capillary. Lymphatic capillary.

Immune system .

Sinus of the spleen. Sinus of the lymph node. Stellate (epithelial) cell of the thymus gland.

Endocrine system.

Thyroid cells in the follicle wall. Chromophobe cells of the anterior pituitary gland. Oxyphil cells of the anterior pituitary gland. Basophilic cells of the anterior pituitary gland. Secretory neurocyte . Cells of the zona fasciculata of the adrenal cortex. Chromaffin cells of the adrenal medulla.

3rd semester

Nervous tissue. Reflex arc.

Nerve cell (granular endoplasmic reticulum, basophilic substance). Synapses. Axomuscular synapse. Myelinated nerve fiber. Nodal interceptions in myelinated nerve fiber. Cable type of unmyelinated fiber.

Visual analyzer. Olfactory analyzer.

Rod-bearing visual cell of the retina. Cone-bearing visual cell of the retina. Receptor cells of the olfactory region of the nasal cavity.

Auditory and vestibular analyzer, taste analyzer.

Hair cells of the organ of equilibrium. Hair cells of the spiral organ. Taste bud.

Oral cavity. Teeth. Salivary glands.

Enamel. Secretion of enamel by ameloblasts .

Digestive tract.

The main cell of the gastric gland. The parietal cell of the gastric gland. The accessory cell of the gastric gland. The enterochromaffin cell of the gastrointestinal tract. The enterocyte .

Liver. Pancreas.

Exocrine pancreatocyte . Cells of the pancreatic endocrine islet.

Acino -islet cell. Hepatocyte. Bile capillary of the liver. Macrophage in the wall of a sinusoid blood capillary of the liver.

Respiratory system. Skin.

Ciliated cells of the airways. Alveolocytes type 1. Alveolocytes type 2. Brush cells. Cells of the granular and spinous layer of the skin.

Urinary system.

Renal corpuscle (capillaries, podocytes, mesangial cells). Juxtaglomerular cells in renal arterioles. Proximal nephron. Thin descending limb of the nephron loop. Distal nephron.

Male reproductive system. Female reproductive system.

Sustentocyte (Sertolli cell). Glandulocyte (Leydig cell). Spermatids . Sperm.

Oocyte of the ovarian follicle. Contact of the oocyte with follicular cells. Ciliated epithelial cell of the oviduct. Epithelial cell of the uterine mucosa. Epithelium of the terminal sections of the mammary gland. Apical secretion

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Structure of the cilium	1
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Nucleus. Signs of vital activity	
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Formed elements of blood	5
Blood development	3
Loose connective tissue.	
Adipose tissue	5
Reticular tissue	5
Formation of collagen fiber	4
Macrophage	3
Mesenchyme	2
Cell differentiation	3
Mast cell	3
Loose connective tissue cells	6

Scheme of fibroblast differentiation	1
Bone tissue.	
Lamellar bone tissue	4
Coarse fibrous bone tissue	5
Direct osteogenesis	5
Indirect osteogenesis	4
Bone tissue cells	5
Osteon	4
General plan of bone structure	1
Hyaline elastic fibrocartilage	5
Dense fibrous connective tissue	5
Histogenesis	4
Cardiovascular system.	
Cardiac muscle tissue	5
Pericytes and adventitial cells	2
Muscular vein	4
Conduction system of the heart	3
Purkinje fibers	6
Contraction of cardiac muscle tissue	4
Capillaries	4
Inferior vena cava	4
Muscular artery	4
Aorta	5
Circulation circles	3
Development of the heart	1
Hematopoiesis.	
Scheme of hematopoiesis	5
Red bone marrow	4
Thrombocytopoiesis and monocytopoiesis	3
Immune system.	
Spleen	6
Lymph node	3
Blood circulation of the spleen	3
Blood circulation of the lymph node	3
Palatine tonsil	5
Lymphopoiesis	4
Thymus	4
Peyer's patch	2
Appendix	3
Endocrine system.	
Diagram of the connection between the pituitary gland and the hypothalamus	7
Parathyroid	1
Scheme of thyrocyte secretion	4
Development of the thyroid gland	3
Epiphysis	4
Pituitary	4
Adrenal	4
Thyroid gland	4

Development of the pituitary gland	7
Development of the parathyroid gland	3
Development of the adrenal gland	2
Nervous tissue. Reflex arc.	
Neuroglia	5
Myelinated and unmyelinated nerve fibers	4
Myelinated nerve fibers	7
Unmyelinated nerve fibers	1
Tigroid substance in the cytoplasm of neurons	2
Peripheral nerve	4
Development of myelinated nerve fiber	1
Development of nervous tissue	4
Reflex arc	3
Secretory neurons	4
Motor plaque	4
Structure of a neurocyte	3
Morphological classification of synapses	4
Spinal cord	4
Synapse structure. Classification	4
Receptor nerve endings	3
Spinal ganglion	4
Central nervous system. Autonomic nervous system.	
Cerebellum	6
Interneuronal connections in the cerebellar cortex	4
Autonomic plexus	4
Cerebellar cortex	3
Diagram of the autonomic nervous system	4
Medulla oblongata	4
Complex reflex arc diagrams	6
Visual analyzer, olfactory analyzer.	
Corner of the eye	5
Cornea	5
Retina	5
Crystalline lens	1
Retinal cells	4
Conjunctiva	2
Retina in light and in darkness	5
Iris	4
Yellow spot	5
Blind spot	5
The receptor section of the olfactory organ	4
Visual pathway	1
General plan of the structure of the eye	3
Development of the eye	4
Accommodation of the eye	3
Auditory and vestibular analyzer, taste analyzer.	
Organ of Corti	6
Taste buds	4

Cross section of a cochlea	3
Section of the ampulla of the semicircular canal and the utricle	4
General plan of the olfactory and gustatory analyzer	1
Diagram of the membranous labyrinth	4
General plan of the auditory analyzer	3
Auditory crest	3
Hearing spot	3
Taste analyzer diagram	3
General plan of the vestibular system	2
Oral cavity. Teeth. Salivary glands.	
Lips	1
Cheeks	1
General plan of the tooth structure	3
Early stage of tooth development	4
Late stage of tooth development	7
Parotid gland	4
Sublingual gland	6
Submandibular gland	4
Language	4
Structure of the tooth	4
Scheme of salivary glands	3
Sky	2
Digestive tract.	
Esophagus	4
The transition from the esophagus to the stomach	6
Fundus of the stomach	3
Glands of the stomach	6
Villi and crypt of the stomach	6
Jejunum	2
12 intestines	3
Small intestine	6
Colon	4
Gastrointestinal endocrinocytes	3
Pyloric part of the stomach	6
General plan of the structure of the digestive tract	4
Liver. Pancreas.	
Endocrine pancreas	4
Exocrine pancreas	4
Blood supply of the liver	8
Gallbladder	5
Liver	6
Pig liver	1
Liver beams	4
Hepatocytes	2
Respiratory system. Skin.	
Trachea	11
Air-blood barrier	7
Acinus	5

Skin of the finger	3
Skin with hair	6
Lung of a fetus, newborn and 7 year old child	5
Bronchial tree	2
Lung with bronchi	3
Respiratory department	4
Leather	4
Skin with hair	4
Sebaceous and sweat glands	4
Structure of the nail	3
Hair structure	3
Urinary system.	
Blood supply of the kidney	4
Ureter	4
Bladder	4
Primary kidney	3
Final kidney	4
Kidney development stage 3	4
Structure of the kidney	4
Kidney. Cortex	6
Kidney. Medulla	3
Kidney filter	5
General plan of the structure of the nephron	1
Male reproductive system.	
Prostate	3
Testicle	8
Development of the testicle	1
Spermatogenesis	3
Egg with appendage	2
Development of the male reproductive system	3
Prostate development	1
Female reproductive system.	
Breast	7
Uterus	2
Ovary	7
Menstrual cycle (changes in the uterus)	7
Ovarian-menstrual cycle	4
Fallopian tubes	1
Corpus luteum	2
Primordial follicle	3
Primordial follicle	3
Secondary follicle	4
Tertiary follicle	5
Oogenesis	5
Development of the female reproductive system	1
Human embryogenesis.	
Placenta	6

Formation of the amnion, yolk sac, placenta	4
Mother and fetus system	3
Differentiation of embryoblast and trophoblast	2
Embryo development on day 15	5
Embryo development on day 7	4
Embryo development on day 11	6
General scheme of fetal development up to 8 weeks	2
Cleavage, gastrulation, immigration with the formation of provisional organs	1
Development of the embryo (provisional organs)	2
Egg	1

Electronic and digital technologies (educational audio and video films, video fragments, educational visual aids (presentations))

No.	Name, title	View	Number of copies
1	Set of multimedia presentations		
	1) Respiratory system	CD-R	1
	2) Transport of substances through membranes	CD-R	1
	3) Cytology	CD-R	1
	4) Male reproductive system	CD-R	1
	5) Congenital malformations	CD-R	1
	6) Urinary system	CD-R	1
	7) Male reproductive system	CD-R	1
	8) Visual and olfactory analyzers	CD-R	1
	9) Epithelial tissue	CD-R	1
	10) Muscle tissue	CD-R	1
	11) Auditory analyzer	CD-R	1
2	Video films		
	Cytology (2 parts)	CD-R	1
	Physiology of urine formation	CD-R	1
	Hearing analyzer	CD-R	1
	Digestive system	CD-R	1
	Taste analyzer	CD-R	1

Electronic library systems (ELS)

Electronic library of the medical university "Student consultant"

http://www.studmedlib.ru/ru/kits/mb4/studmedlib_core/ed_med_hi-esf2k2z11-select-0014.html

3.4. Equipment used for the educational process

No. p/p	Name	Quantity	Form use
1	Histology laboratory (41)		A room for students to conduct research and practice their practical skills
	Student desks	4	Research work of students, development of practical skills
	Chairs	8	Research work of students, development of practical skills
	Multimedia projector	1	Demonstration of lecture materials, practical classes, educational and scientific video materials
	Screen on a tripod	1	Demonstration of lecture materials, practical classes, educational and scientific videos
	Personal computer with Internet access	2	Access to educational resources during independent work of students, work with multimedia materials in practical classes
	Thermostat	1	Research work of students
	Water distiller	1	Research work of students
	Fume hood	1	Research work of students
	Microscope	1	Research work of students
2	Audience No. 1 (51)		A room for practical classes, group and individual consultations, and midterm assessments

	Student desks	7	Conducting practical classes, consultations, midterm assessments
	Chairs	14	Conducting practical classes
	Teacher's desk	1	Conducting practical classes, consultations, midterm assessments
	Microscopes	7	Working with microscopic objects during practical classes, consultations, and midterm assessments
	Classroom board	1	At practical classes, consultations
	Sets of microscopic slides on various topics	7	During practical classes, consultations, and midterm assessments
	Sets of tablets on practical training topics	7	For independent classroom work of students during practical classes
	Sets of tables on the topics of practical classes		For independent classroom work of students
3	Audience No. 2 (29)		A room for practical classes, group and individual consultations
	Student desks	14	Conducting practical classes, group and individual consultations
	Chairs	28	Conducting practical classes, consultations, group and individual consultations
	Teacher's desk	1	Conducting practical classes, group and individual consultations
	Microscopes	14	Conducting practical classes, consultations, group and individual consultations
	Classroom board	1	Conducting practical classes, group and individual consultations
	Sets of microscopic slides on various topics	14	For independent classroom work of students
	Sets of tablets on practical training topics	14	For independent classroom work of students
	Sets of tables on the topics of practical classes		For independent classroom work of students
4	Audience No. 3 (27)		Room for independent work of students
	Student desks	22	For students' independent extracurricular work
	Chairs	45	For students' independent extracurricular work
	Teacher's desk	2	For consultations of students on independent extracurricular work
	Microscopes	12	Independent work of students with microscopic objects
	Table lamps	12	Independent work of students with microscopic objects
	Classroom board		During practical classes
	Laptop with Internet access, multimedia projector	1	Access to educational resources during students' independent work, demonstration of lecture materials, practical classes, educational and scientific videos
	Screen on a tripod	1	Demonstration of lecture materials, practical classes, educational and scientific videos
	Sets of preparations on the topics of practical classes	12	For students' independent extracurricular work

	Sets of tablets on practical training topics	12	For students' independent extracurricular work
	Sets of tables on the topics of practical classes		For extracurricular and independent work of students
5	Audience No. 4 (26)		A room for practical classes, group and individual consultations
	Student desks	14	Conducting practical classes, group and individual consultations
	Chairs	29	Conducting practical classes, consultations, group and individual consultations
	Teacher's desk	1	Conducting practical classes, group and individual consultations
	Microscopes	12	Work in practical classes with microscopic objects
	Classroom board		During practical classes
	Sets of microscopic preparations on the topics of practical classes	12	In practical classes, to prepare for drug diagnostics
	Sets of tablets on practical training topics	12	For students' independent work in and out of class
	Sets of tables on the topics of practical classes		For students' independent work in and out of class
6	Computer class / Internet class (52)		
	Computer desks	16	Testing (current control, midterm assessment), access to educational resources during independent extracurricular work
	Chairs	16	Testing (current control, midterm assessment), access to educational resources during independent extracurricular work
	Personal computers with Internet access	16	Testing (current control, midterm assessment), access to educational resources during independent extracurricular work

3.5. Professional databases, information reference systems, electronic educational resources

No. p/p	Resource name	Resource Description	Access	Resource address
Electronic library systems				
1	"Student Consultant" Electronic library of the medical university.	For students and teachers of medical and pharmaceutical universities. Provides access to electronic versions of textbooks, teaching aids and periodicals.	library, individual access	http://www.studmedlib.ru/
2	"Doctor's Consultant" Electronic	The materials posted in the library have been developed by leading Russian specialists based on modern scientific knowledge (evidence-based medicine).	library, individual access	http://www.rosmedlib.ru/cgi-bin/mb4x

	Medical Library.	The information has been prepared taking into account the position of the scientific and practical medical society (world, European and Russian) in the relevant specialty. All materials have undergone mandatory independent review.		
3	PubMed	Free search engine in the largest medical bibliographic database MedLine . Documents medical and biological articles from the specialized literature, and also provides links to full-text articles.	library, free access	http://www.ncbi.nlm.nih.gov/pubmed/
4	Oxford Medicine Online.	A collection of Oxford medical publications, bringing together over 350 titles into a single, cross-searchable resource. Publications include The Oxford Handbook of Clinical Medicine and The Oxford Textbook of Medicine , the electronic versions of which are constantly updated.	library, free access	http://www.oxfordmedicine.com
5	Human Biology Knowledge Base	Reference information on physiology , cell biology , genetics , biochemistry , immunology , pathology . (Resource of the Institute of Molecular Genetics of the Russian Academy of Sciences .)	library, free access	http://humbio.ru/
6	Medical online library	Free reference books, encyclopedias, books, monographs, abstracts, English-language literature, tests.	library, free access	http://med-lib.ru/
Information systems				
7	Russian Medical Association	Professional Internet resource. Objective: to facilitate the implementation of effective professional activities of medical personnel. Contains the charter, personalities, structure, rules of entry, information about the Russian Medical Union.	library, free access	http://www.rm-ass.ru/
8	Web medicine.	The site presents a catalog of professional medical resources, including links to the most authoritative subject sites, journals, societies, as well as useful documents and programs. The site is intended for doctors, students, employees of medical universities and scientific institutions.	library, free access	http://webmed.irktk.ru/
Databases				
9	World Health Organization	The site contains news, statistics on countries that are members of the World Health Organization, fact sheets, reports, WHO publications and much more.	library, free access	http://www.who.int/ru/
10	Ministry of Science and Higher Education of	The website of the Ministry of Science and Higher Education of the Russian Federation contains news, newsletters, reports, publications and more.	library, free access	http://www.minobrnauki.gov.ru

	the Russian Federation.			
11	Ministry of Education of the Russian Federation.	The website of the Ministry of Education of the Russian Federation contains news, newsletters, reports, publications and much more.	library, free access	https://edu.gov.ru/
12	Federal portal "Russian education"	A single window for access to educational resources. This portal provides access to textbooks on all branches of medicine and health care.	library, free access	http://www.edu.ru/ http://window.edu.ru/catalog/?p_rubr=2.2.81.1
Bibliographic databases				
13	Database "Russian Medicine"	It is created in the Central Scientific and Methodological Library and covers the entire collection, starting from 1988. The database contains bibliographic descriptions of articles from domestic journals and collections, dissertations and their abstracts, as well as domestic and foreign books, collections of institute proceedings, conference materials, etc. Thematically, the database covers all areas of medicine and related areas of biology, biophysics, biochemistry, psychology, etc.	library, free access	http://www.scsml.rssi.ru/
14	eLIBRARY.RU	Russian information portal in the field of science, technology, medicine and education, containing abstracts and full texts of more than 13 million scientific articles and publications. The eLIBRARY.RU platform provides electronic versions of more than 2,000 Russian scientific and technical journals, including more than 1,000 open access journals.	library, free access	http://elibrary.ru/defaultx.asp
15	Portal Electronic library of dissertations	Currently, the Electronic Library of Dissertations of the Russian State Library contains more than 919,000 full texts of dissertations and abstracts.	library, free access	http://diss.rsl.ru/?menu=disscatalog/
16	Medline.ru	Medical and biological portal for specialists. Biomedical journal. Last updated February 7, 2021.	library, free access	http://www.medline.ru

3.6. Licensed and freely distributed software used in the educational process

I. Commercial software products		
1	MS Operating System Windows 7 Pro	License number 48381779
2	Operating system MS Windows 10 Pro , MS Office	AGREEMENT R No. 142 A dated December 25, 2019
3	MS Office	Number licenses : 43234783, 67810502, 67580703, 64399692, 62795141, 61350919
4	Kaspersky Endpoint Security for	Agreement No. 977/20 dated 12/24/2020

	business Extended	
5	1C: PROF University	LICENSE AGREEMENT No. 2191 dated 15.10.2020
6	1C: PROF Library	LICENSE AGREEMENT No. 2281 dated 11.11.2020
II . Freely distributed software		
1	Google Chrome	Freely distributed Distribution conditions: https://play.google.com/about/play-terms/index.html
2	Browser "Yandex"	Freely distributed License agreement for the use of the Yandex Browser software https://yandex.ru/legal/browser_agreement/
3	Dr.Web CureIt !	Freely distributed License Agreement: https://st.drweb.com/static/new-www/files/license_CureIt_ru.pdf
4	OpenOffice	Freely distributed License: http://www.gnu.org/copyleft/lesser.html
5	LibreOffice	Freely distributed License: https://ru.libreoffice.org/about-us/license/

3.7. Resources of the information and telecommunications network "Internet"

<http://cytohistology.ru/> Website on histology, cytology and embryology. Structure, functions and development of human cells, tissues and organs

<https://nsau.edu.ru/images/vetfac/images/ebooks/histology/> Atlas-guide to histology, cytology and embryology with the appendix "Exam"

http://www.med-edu.ru/basic-science/gist_cist/ Lectures, videos, books on histology

4. Evaluation Fund

4.1. Incoming inspection

Conducted at the first lesson in the 2nd semester. Includes 200 questions studied during the development of supporting disciplines (anatomy, biology, physics, biochemistry). Test assignments are located in the Moodle system .

Access mode: <https://educ-amursma.ru/mod/quiz/view.php?id=5335>

4.2. Examples of test tasks for current control (initial level)

Test assignments are located in the Moodle system .

Access mode:

2nd semester <https://educ-amursma.ru/course/view.php?id=75>

3rd semester <https://educ-amursma.ru/course/view.php?id=76>

Topic #6: "Epithelial tissue"

Option 1

1. MULTILAYERED EPITHELIA INCLUDE

- 1) single row columnar
- 2) multi-row ciliated

- 3) flat keratinizing
- 4) single row flat

2. IN THE MULTILAYERED SQUAMOUS KERATINIZING EPITHELIUM LAYERS OF CELLS SUCCESSFULLY REPLACE EACH OTHER

- 1) granular, spiny, lustrous, basal, horny
- 2) shiny, basal, spiny, granular, horny
- 3) basal, granular, spinous, lucid, horny
- 4) basal, spinous, granular, lucid, horny

3. IN THE SINGLE-LAYERED MULTI-ROW EPITHELIUM THERE ARE CELLS

- 1) ciliated, intercalated, spinous, goblet-shaped
- 2) ciliated, intercalated, basal, goblet
- 3) spinous, granular, goblet-shaped, basal
- 4) goblet, granular, spinous, intermediate

Answer standards.

Option 1. 1-3; 2-4; 3-2;

4. 3. Examples of situational tasks for current control

Topic No. 6. "Epithelial tissue"

Task #1

The following structures are shown on the preparation: a) a layer of cells closely adjacent to each other. b) cells separated by intercellular substance. Which of these structures is related to epithelial tissues? Describe the types of contacts between epithelial cells .

Standard answer

First structure. Epithelial cells are connected to each other by various contacts – tight junctions, desmosomes, interdigitations .

Task #2

In the tissue culture, cells are seeded: in 1 flask - basal, in 2 - shiny layer of stratified squamous keratinizing epithelium. In which flask will the cell proliferation continue?

Standard answer

Cell proliferation will continue in 1 vial, since among the keratinocytes of the basal layer there are cambial cells capable of mitotic division.

Task #3

On a section of an organ, two tissues can be found. The first is located on the border with the external environment, the second is inside the organ. Which of the tissues is epithelial?

Standard answer

First.

4.4. Examples of test tasks for the final assessment

Test assignments are located in the Moodle system .

Access mode: <https://educ-amursma.ru/mod/quiz/view.php?id=655>

1. FUNCTION OF PRIMARY LYSOSOMES

- 1. deposition and transport of active enzymes
- 2. deposition of inactive enzymes and synthesis of polysaccharides

3. deposition of nucleic acids and transport of enzymes
 4. deposition and transport of inactive enzymes
2. BIOLOGICAL MEMBRANE FORMED
1. dense lipid phase
 2. liquid protein phase and lipid droplets freely moving in it
 3. liquid lipid phase and protein globules freely moving in it
 4. dense carbohydrate phase and protein globules freely located in it
3. THE CELL CYTOPLASM CONTAINS
1. organelles, karyoplasm, inclusions
 2. organelles, inclusions, hyaloplasm
 3. organelles, karyoplasm, inclusions
 4. organelles, hyaloplasm , cytoskeleton
4. IN THE APICAL PARTS OF GLANDULAR CELLS PERIODICALLY APPEAR
1. peroxisomes
 2. inclusions
 3. mitochondria
 4. lysosomes
5. MAIN EVENTS OF THE S-PERIOD OF THE INTERPHASE
1. DNA synthesis and centriole duplication
 2. DNA synthesis and microtubule duplication
 3. ATP synthesis and centriole duplication
 4. polysaccharide synthesis and centriole divergence

Answer samples:

question, no.	1	2	3	4	5
answer	4	3	2	2	1

4.5. List of practical skills required to pass the exam

- Skills in microscopy and description of histological, histochemical and embryological preparations;
- Skills in interpreting micrographs of histological and embryological structures corresponding to specific micropreparations;
- Skills in calculating the white blood cell count in a blood smear;
- Skills in sketching histological and embryological preparations with the designation of the corresponding cellular and tissue structures;
- Skills in interpreting electron micrographs of cells and non-cellular structures of various tissues and organs;
- Skills of independent work with educational and scientific literature, Internet resources in the context of future professional activities.

4.6. List of questions for the exam

1. Cell as a structural and functional unit of living matter. Definition. Other forms of organization of living matter.
2. Cell as a structural and functional unit of life. Definition. General plan of structure. Cytoplasm. Inclusions. Definition. Classification. Meaning.
3. Cell as a structural and functional unit of life. Definition. General plan of the structure of eukaryotic cells. Physicochemical properties of hyaloplasm and its importance in the vital activity of the cell. Inclusions, their classification, chemical and morphofunctional characteristics.
4. Cell as a structural and functional unit of life. Definition. General plan of structure. Cytoplasm. Classification of organelles, their structure and functions.
5. Cell as a structural and functional unit of tissue. General plan of the structure of eukaryotic cells. Cell membrane: structure, chemical composition, functions, intercellular interactions.
6. Cell as a structural and functional unit of tissue. Definition. General plan of structure. Biological membranes, their structure, chemical composition, main functions.
7. The cell as a structural and functional unit of life. Definition. General plan of the structure. Organelles. Definition. Mitochondria, structure, participation in the energy processes of the cell.
8. Cell as a structural and functional unit of tissue. Definition. General plan of the structure of eukaryotic cells. Nucleus, its importance in the vital activity of cells, main components and their structural and functional characteristics.
9. Cell as a structural and functional unit of life. Definition. Cell differentiation. Biological essence. Mechanisms underlying differentiation.
10. Cell as a structural and functional unit of tissue. Definition. Signs of cell vital activity: metabolism, pathways of transport of substances into the cell and from the cell to external influences (including damaging ones).
11. The cell as a structural and functional unit of life. Definition. Signs of cell vital activity: metabolism, pathways of transport of substances into the cell, growth.
12. Energy processes in the cell, ultrastructures providing them. Regulation of the energy formation process in the cell.
13. Cell as a structural and functional unit of tissue. Definition. General plan of structure. Interaction of cell structures in the process of their interaction (using protein synthesis as an example).
14. Cell as a structural and functional unit of tissue. Definition. General plan of structure. Life cycle of a cell, its stages.
15. Cell as a structural and functional unit of tissue. Definition. General plan of the structure of eukaryotic cells. Life cycle of a cell, its stages. Basic provisions of the cell theory and its significance in the development of biology and medicine.
16. The cell as a structural and functional unit of life. Definition. General plan of structure. The cell's response to external influences. Structural foundations of adaptation.
17. Cell as a structural and functional unit of tissue. Definition. General plan of the structure of eukaryotic cells. Methods of cell reproduction, their morphological characteristics.
18. Cell as a structural and functional unit of tissue. Definition. Methods of cell reproduction. Morphological homeostasis.
19. Modern concepts of stem cell morphology. Their types, significance and application in medicine and biology.
20. The cell as a structural and functional unit of life. Definition. The doctrine of intracellular and cellular regeneration, hyperplasia and hypertrophy.
21. General plan of the structure of eukaryotic cells. Interaction of cell structures in the process of its metabolism (using the example of the synthesis of proteins and non-protein substances).
22. The cell as a structural and functional unit of tissue. Peroxisomes, their structure, chemical composition, main functions.
23. Cell as a structural unit of tissue. Definition. Plan of the structure of the Golgi complex.
24. Classification of cell organelles. Structure and functions of microbodies .

25. The cell as a structural and functional unit of life. Definition. Structure and functions of lysosomes.
26. General plan of the structure of eukaryotic cells. Structure and function of the endoplasmic reticulum.
27. Morphological evolution of the cell.
28. Levels of organization of living things. Definition. Classification of tissues. Structural elements of tissues.
29. Tissue as one of the levels of organization of living things. Definition. Classification. Concept of cell populations. Regenerative capacity.
30. Tissue as one of the levels of organization of living things. Definition. Classification. Contribution of Soviet and foreign scientists to the study of tissues. The importance of histology for medicine.
31. Tissue as one of the levels of organization of living things. Definition. Forms of organization of living matter (structural components of tissues).
32. Loose fibrous connective tissue. Morphofunctional characteristics. Cellular elements. Structure, meaning.
33. Loose fibrous connective tissue. Morphofunctional characteristics. Mast cells, structure, meaning, functions.
34. Loose fibrous connective tissue. Morphofunctional characteristics. Fibrous structures, structure, meaning.
35. Loose fibrous connective tissue. Morphofunctional characteristics. Classification and sources of their development. Cellular elements and intercellular substance. Age-related changes. Regeneration.
36. Loose fibrous connective tissue. Morphofunctional characteristics. Macrophages, structure and sources of development. Concept of the macrophage system. Contribution of Russian scientists to the histophysiology of connective tissues.
37. Loose fibrous connective tissue. Morphofunctional characteristics. Intercellular substance, structure and significance. Fibroblasts and their role in the formation of intercellular substance. Fibrocytes, structure, role.
38. Mononuclear system of phagocytes. Cellular composition. Localization. Significance in the body.
39. The concept of the blood system and its tissue components. Blood as a tissue, its formed elements. Classification of leukocytes. Leukocyte formula. Non-granular leukocytes (agranulocytes), their varieties, quantity, size, structure, functions, life expectancy. The concept of T- and B-lymphocytes.
40. The concept of the blood system and its tissue components. The amount and composition of blood, its formed elements. Hemogram.
41. The concept of the blood system and its tissue components. Blood as a tissue, its formed elements. Classification of leukocytes. Leukocyte formula. Granular leukocytes (granulocytes), their varieties, quantity, size, structure, functions, life expectancy.
42. The concept of the blood system and its tissue components. Blood as a tissue, its formed elements. Classification of leukocytes. Blood platelets (thrombocytes), quantity, size, structure, functions, life expectancy.
43. The concept of the blood system and its tissue components. Blood as tissue. Erythrocytes, their number, size, structure, shape, functions and chemical composition, life expectancy. Reticulocytes.
44. General covering. Its morphofunctional characteristics. Sources of development. Structure of the skin and its derivatives – skin glands, hair.
45. Morphofunctional characteristics of glandular epithelium. Cytological characteristics of the secretory process. Types of secretion. Exocrine glands: classification, structure.
46. Epithelial tissues. Morphofunctional characteristics. Morphofunctional classification. Special organelles, their structure and functional significance. Basement membrane.
47. Bone tissues. Morphofunctional characteristics. Classification. Direct (from mesenchyme) and indirect (from mesenchyme in place of cartilage) osteogenesis.
48. Bone tissues. Morphofunctional characteristics. Classification. Bone as an organ. Reparative osteogenesis.

49. Muscle tissues. General morphofunctional characteristics. Classification, sources of development, structure and functional significance. Regeneration of muscle tissues.
50. Muscle tissues. General morphofunctional characteristics. Sources of development. Cross-striated skeletal muscle tissue, structure. Structural bases of muscle fiber contraction. Types of muscle fibers.
51. Muscle tissues. General morphofunctional characteristics. Sources of development. Histogenesis, structure, regeneration. Structure of muscle as an organ.
52. Muscle tissues. General morphofunctional characteristics. Sources of development. Smooth muscle tissue. Structural organization of smooth muscle tissue.
53. Muscle tissues. General morphofunctional characteristics. Sources of development. Cardiac muscle tissue. Structural and functional characteristics of cardiac muscle tissue. Sources of development and regeneration.
54. Cardiovascular system. General morphofunctional characteristics. Classification of vessels. Development, structure, dependence of vessel structure on hemodynamic conditions.
55. Heart. General morphofunctional characteristics. Sources of development. Structure and histochemical characteristics of the conduction system.
56. Arteries. Morphofunctional characteristics. Classification, development, structure and functions of arteries. Relationship between the structure of arteries and hemodynamic conditions. Age-related changes.
57. Vessels of the microcirculatory bed. Morphofunctional characteristics. Capillaries. Structure. Organ-specificity of capillaries. The concept of the histohematic barrier.
58. Vessels of the microcirculatory bed. Morphofunctional characteristics. Arterioles. Capillaries. Venules.
59. Hematopoiesis. The concept of stem and semi-stem cells. Modern scheme of hematopoiesis. Stages of progressive development of formed elements of the blood.
60. Hematopoiesis. The concept of stem cells. Features of embryonic and postembryonic hematopoiesis. Structure of red bone marrow. Myeloid hematopoiesis.
61. Hematopoiesis. The concept of stem and semi-stem cells. Features of embryonic and post-embryonic hematopoiesis. Characteristics of embryonic hematopoiesis in the yolk sac, liver, red bone marrow, spleen, thymus, lymph nodes.
62. Hematopoiesis organs. Spleen. Structure and functional significance. Features of blood supply. Embryonic and postembryonic hematopoiesis in the spleen (T- and B-zones).
63. The concept of the immune system and its tissue components. Classification and characteristics of immunocytes and their interaction in humoral and cellular immunity reactions. The thymus as an organ of central immunopoiesis, its role in the formation of T-lymphocytes. Types of T-lymphocytes. Other functions of the organ. The concept of organ involution.
64. The concept of the immune system. Principles of interaction of the system's organs. Lymph node. Structure, functional significance.
65. The concept of the immune system. Principles of interaction of the system's organs. Spleen. Structure, functional significance. Features of blood supply.
66. Concept of the immune system. Principles of interaction of the system's organs. Lymphoepithelial organs (tonsils, lymphoid nodules of the mucous membranes). Structure, functional significance.
67. Neuroendocrine system. Concept. The principle of interaction of the organs that form it. The concept of target organs, target cells. General morphofunctional characteristics of the system's organs.
68. Endocrine system. Morphofunctional characteristics. Hypothalamus. Neurosecretory sections. Structure. Large-cell and small-cell nuclei, features of organization and functions of neurosecretory cells.
69. Endocrine glands. Morphofunctional characteristics. Hypothalamic-adenohypophyseal and hypothalamic-neurohypophyseal systems. Structure and functional significance. Characteristics of neurosecretory cells.
70. Endocrine system. Morphofunctional characteristics. Pituitary gland. Sources of development. Tissue and cellular composition. Functional significance. Connection of the pituitary gland with the hypothalamus.

71. Endocrine system. Morphofunctional characteristics. Pituitary gland. Sources and main stages of embryonic development. Structure. Tissue and cellular composition of the adeno- and neurohypophysis . Morphofunctional characteristics of adenocytes . Regulation of functions.
72. Endocrine system. Morphofunctional characteristics. Thyroid gland. Sources and main stages of embryonic development. Structure: tissue and cellular composition. Functional significance. Features of the secretory process in thyrocytes , its regulation.
73. Endocrine system. Morphofunctional characteristics. Adrenal glands. Sources and main stages of development. Structure of the cortex and medulla. Morphofunctional characteristics of adrenocorticocytes , their changes in connection with the level of biosynthesis and secretion of hormones. Secretory function of the adrenal glands and its regulation.
74. Oral cavity. General morphofunctional characteristics. Sources of development, structural features of the mucous membrane. Major salivary glands. Structural and developmental features of various glands.
75. Oral cavity. General morphofunctional characteristics. Teeth. Structure, development.
76. Digestive canal. General plan of the wall structure, sources of development and histofunctional characteristics of the membranes of different sections. Esophagus. Its structure and functions.
77. Stomach. General morphofunctional characteristics. Sources of development. Features of the structure of various sections. Histophysiology of glands. Innervation and vascularization .
78. Small intestine. Development. General morphofunctional characteristics. Histophysiology of the crypt-villus system. Structural features of various sections. Innervation and vascularization . Regeneration.
79. Large intestine. Vermiform appendix. General morphofunctional characteristics. Sources of development. Structure.
80. Glands of the digestive system. Localization and structural organization. Pancreas. Development, structure of exo- and endocrine parts, histophysiology.
81. Liver. General morphofunctional characteristics. Sources of development. Features. Structure of the classical liver lobule. Structural and functional characteristics of hepatocytes and sinusoidal hemocapillaries . Gallbladder. Structure and functions.
82. Skin. Its structural components and functional significance. Sources of development. Structure of the skin of the soles and palms. The process of keratinization and physiological regeneration of the skin epidermis. Receptor apparatus of the skin. General covering. Structure of skin glands, hair. Regeneration.
83. Respiratory system. Morphofunctional characteristics. Respiratory and non-respiratory functions. Airways. Structure, functions of the trachea and bronchi of different calibers.
84. Respiratory system. Lungs. Morphofunctional characteristics. Surfactant system of the lungs.
85. Lungs. Morphofunctional characteristics. Sources of development. Air-blood barrier. Features of blood supply to the lung.
86. Ovary. Structure, functions, embryonic and postembryonic histogenesis. Cyclic changes in the ovary during puberty and their hormonal regulation. Endocrine function of the ovary, age-related changes.
87. Uterus, oviducts. Structure, functions, development. Cyclic changes in the organs of the reproductive system and their hormonal regulation.
88. Mammary gland. Development, structural features of the lactating and non-lactating gland. Regulation of lactation.
89. Testicle. Structure, functions, embryonic and postembryonic histogenesis. Spermatogenesis, its regulation. The role of the hematotesticular barrier in maintaining intratubular homeostasis. Endocrine function of the ovary.
90. Prostate gland. Structure, functions, embryonic and postembryonic development.
91. Urinary system. Its morphofunctional characteristics. Kidneys. Sources and main stages of development. Structure and features of blood supply. Nephrons, their varieties. Main sections, histophysiology.

92. Nervous tissue. Morphofunctional characteristics, sources of development. Classification of neurons (morphological and functional). Structural and functional characteristics of neurons.
93. Nervous tissue. Morphofunctional characteristics, sources of development. Nerve fibers. Morphofunctional characteristics of myelinated and unmyelinated nerve fibers. Myelination of nerve fibers. Regeneration of nerve fibers.
94. Nervous tissue. Morphofunctional characteristics, sources of development. Neuroglia. Classification. Structure and significance of different types of gliocytes.
95. Nervous tissue. Morphofunctional characteristics. Nerve endings. Classification. Structure of motor endings.
96. Nervous tissue. Morphofunctional characteristics. Structure of receptors. Classification.
97. Nervous system. Embryonic development is a morphological expression of the process.
98. Nervous system. Reflex arc. Concept. Spinal cord. Morphofunctional characteristics. Structure of gray and white matter.
99. Nervous system. General morphofunctional characteristics. Reflex arc. Concept. Structural and functional organization of a simple reflex arc. Spinal ganglia. Morphofunctional characteristics.
100. Nervous system. General morphofunctional characteristics. Reflex arc. Concept. Structural and functional organization of a simple reflex arc. Peripheral nerve. Structure.
101. Nervous system. General morphofunctional characteristics. Reflex arc. Concept. Structural and functional organization of a simple reflex arc. Synapses. Classification. Structure. Mechanism of transmission of a nerve impulse in synapses.
102. Nervous system. Complex reflex arcs. Concept. General morphofunctional characteristics of the cerebral cortex. Neural organization of the cerebral cortex. Cyto- and myeloarchitectonics .
103. Nervous system. Complex reflex arcs. Concept. Cerebellum. Structure and functional characteristics. Neuronal composition of the cerebellar cortex and gliocytes. Interneuronal connections.
104. Autonomic (vegetative) nervous system. General morphofunctional characteristics, sections. Structure of extra- and intramural ganglia and nuclei of the central sections.
105. Sense organs. The place of sense organs in the analyzer structure. The concept of analyzers. Eye. Sources of development. General plan of structure. Accommodation and dioptric apparatus of the eyeball. Structure, functional significance.
106. Sensory organs. The place of sensory organs in the analyzer structure. The concept of analyzers. Eye. Sources of development. General structure plan. Structure of photoreceptors of the eyeball apparatus. Retina. Neuronal composition. Cytophysiology of receptor cells. Photoreception mechanism.
107. Sense organs. The place of sense organs in the analyzer structure. The concept of analyzers. The organ of hearing. Morphofunctional characteristics. Development, structure, function.
108. Sex cells. Morphofunctional characteristics. The role of the nucleus and cytoplasm in the transmission and implementation of hereditary information.
109. Spermatogenesis and oogenesis. Comparative characteristics.
110. Fertilization, cleavage and structure of the blastula in humans.
111. Stages of embryonic development. Characteristics and significance of each stage (using human development as an example).
112. Stages of embryogenesis. Characteristics and significance of the gastrulation process. Gastrulation in humans.
113. Human embryogenesis, its stages: fertilization, cleavage, gastrulation. The connection of the embryo with the mother's organism.
114. Human embryogenesis and its stages. Peculiarities of embryo separation from extraembryonic organs. Connection of the embryo with the maternal organism. Structure of organs providing this connection.
115. The connection of the embryo with the mother's organism. Implantation. The human placenta: development, structure, function.

116. Human placenta. Its development, maternal and fetal components of the placenta (structure). Functional functions of the organ.
117. The relationship of the embryo with the mother's organism. Implantation. The human placenta: development, structure, function. Types of mammalian placentas.
118. Features of human embryogenesis – cleavage, gastrulation. Separation of the embryo from the extraembryonic part. Provisional organs, their structure and significance.
119. Formation, structure, functions of the embryonic membranes and provisional organs in humans.
120. The connection of the embryo with the mother's organism. The umbilical cord. The human placenta: formation, structure, functions.
121. Differentiation of germ layers, formation of the axial complex of organ rudiments in humans in the 3rd – 4th week of development. Mesenchyme.
122. The concept of critical periods in intrauterine and postnatal development. The influence of exogenous and endogenous factors on development.