

MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
Educational Institution
BELARUSIAN STATE MEDICAL UNIVERSITY

APPROVED

by Rector of the Educational
Institution «Belarusian State
Medical University»

S.P.Rubnikovich



24.06.2023

Reg. # UD-0911-03-04/2324/edu.

**Контрольный
экземпляр**

HISTOLOGY, CYTOLOGY, EMBRYOLOGY

**Curriculum of the educational institution
in the academic discipline for the specialty**

7-07-0911-03 «Dentistry»

Curriculum is based on the educational program «Histology, Cytology, Embryology» for the specialty 7-07-0911-03 «Dentistry», approved 27.06.2023, registration # УД-0911-03-04/2324/уч.; on the educational plan in the specialty 7-07-0911-03 «Dentistry», approved 17.05.2023, registration # 7-07-0911-03/2324/mf.

COMPILERS:

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RECOMMENDED FOR APPROVAL:

by the Department of Human Morphology of the educational institution «Belarusian State Medical University»
(protocol # 10 of 15.05.2023);

by the Scientific and Methodological Council of the educational institution «Belarusian State Medical University»
(protocol # 6 of 27.06.2023)

EXPLANATORY NOTE

«Histology, Cytology, Embryology» – the academic discipline of the Morphological Module, which contains systematized scientific knowledge about the microscopic structure of organs and systems of human body, patterns of structure and life activity of cells and prenatal development.

The aim of the discipline «Histology, Cytology, Embryology» is the formation of basic professional competencies which are based on scientific knowledge about the patterns of microscopic and submicroscopic organization of cells, tissues and organs, the structural basis of their functioning in the human body.

The objectives of the discipline «Histology, Cytology, Embryology» are to form students' scientific knowledge about the regularities of the structure of the human body using the methods of microscopic and ultramicroscopic observation, taking into account new scientific data, methodological and theoretical concepts necessary for the formation of the doctor's clinical thinking; causes and mechanisms typical for general and particular patterns of human pre- and postnatal development; manifestations of age-related changes in cells, tissues and organs as the basis individual and age-related variability of the human body.

The specifics of the training of dentists determines the need for students to purposefully study histophysiology and the processes of development of the organs of the face and oral cavity, which is a necessary prerequisite for the assimilation of clinical dental disciplines by students.

The knowledge, skills, and abilities acquired during the study of the academic discipline «Histology, Cytology, Embryology» are necessary for successful study of the academic disciplines «Human Anatomy», «Topographic Anatomy and Operative Surgery».

Studying the educational discipline «Histology, Cytology, Embryology» should ensure the formation of students' basic professional competence:

BPC. While providing medical care use knowledge about the structure of the human body at tissue, cellular and subcellular levels, human embryogenesis and its pathology.

As a result of studying the discipline «Histology, Cytology, Embryology» the student should

know:

general patterns of the microscopic structure of organs and systems of the human body;

general principles of histogenesis and organogenesis, features of the development of the human embryo;

general patterns inherent cellular level of organization of living matter;

microscopic structure of the cells of tissues;

be able to:

differentiate structural elements of cells and tissues in the microscopic examination of biopsy specimens;

indicate elements in the electron micrographs;

master:

methods of microscopic studies of biological objects;

methods of preparation of biological material for histological examination.

Total number of hours for the study of the discipline is 300 academic hours. Classroom hours according to the types of studies: lectures - 22 hours, laboratory classes - 144 hours, student independent work (self-study) - 134 hours.

Intermediate assessment is carried out according to the syllabus of the specialty in the form of a credit (1st and 2nd semester) and examination (3rd semester).

Form of higher education – full-time.

**ALLOCATION OF ACADEMIC TIME
ACCORDING TO SEMESTERS OF STUDY**

Code, name of the specialty	semester	Number of academic hours					Form of intermediate assessment
		total	in-class	including		out-of-class self-studies	
				lectures	laboratory studies		
7-07-0911-03 «Dentistry»	1	90	47	11	36	43	credit
	2	120	83	11	72	37	credit
	3	90	36	-	36	54	exam

THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	laboratory
1. Introduction into the course of histology. Histology as a science	-	2
2. Cytology	-	2
3. Embryology	1	4
4. General histology	7	28
4.1.Introduction to tissues	-	2
4.2.Epithelial tissues	1	2
4.3.Blood and hematopoiesis	2	8
4.4.Connective tissues	2	8
4.5.Muscle tissues	1	4
4.6.Nervous tissue	1	4
5. Special histology	14	72
5.1.Cardiovascular system	2	4
5.2.Lymphoid system	1	8
5.3.Endocrine glands	1	8
5.4.Nervous system and sense organs	2	12
5.5.Digestive system	3	16
5.6.Integumentary system	-	4
5.7.Respiratory system	2	4
5.8.Urinary and genital systems	3	16
6. Dentoalveolar system	-	36
6.1.Glands of the oral cavity	-	6
6.2.Tooth structure	-	9
6.3.Periodontium	-	9
6.4.Tooth development	-	6
6.5.Morphogenesis of the face and oral cavity	-	6
Total hours	22	144

CONTENT OF THE EDUCATIONAL MATERIAL

1. INTRODUCTION INTO THE COURSE OF HISTOLOGY. HISTOLOGY AS A SCIENCE

Connection of histology and cytology with other biomedical and clinical disciplines. Levels of structural organization of the body: sub-cellular, cellular, tissue, organ, system.

Methods of histological and cytological studies. Light, fluorescence and electron microscopy, morphometry, immunohistochemistry, autoradiography. Preparation of specimens for histological examination. Basic histological techniques.

2. CYTOLOGY

Cell membrane. General ideas about the basic biological membranes, their structure, chemical composition, functions. Morphofunctional characteristics of the cell membrane.

Nucleus. The value of the nucleus in the life of the cell, the structural components of the nucleus, their morphofunctional characteristics.

Cytoplasm, cytosol, physicochemical properties, chemical composition, participation in cell metabolism.

Organelles, definition, classification. General and special organelles of. Membranous and non-membranous organelles.

Inclusions, definition, classification, significance in the life of cells and the human body. Structure and chemical composition of various types of inclusions.

Intercellular contacts and cell interactions.

Cell response to external influences. Structural and functional changes in cells and individual cellular components in the processes of reactivity and adaptation. Physiological and reparative regeneration: essence and mechanisms.

The main manifestations of the vital activity of cells. The concept of the cell cycle. Features of the cell cycle in different types of cells. Methods of cell reproduction. Mitosis: phases, biological significance. Mechanism of polyploidy. Meiosis: features and biological significance. Reactive cellular changes.

Morphofunctional characteristics of the processes of growth and differentiation, the period of active functioning, aging and cell death.

3. EMBRYOLOGY

The concept of ontogeny and phylogeny. Periods of embryogenesis. Progenesis. Morphology of male and female gametes, their structural features. Spermatogenesis. Oogenesis.

Fertilization. Biological significance of fertilization, features and chronology of the process. Interactions between gametes.

Cleavage, chronology of the process. The structure of the embryo at different stages of cleavage. Blastocyst implantation. Implantation sites.

Gastrulation. Formation of germ layers and axial organs. Sources of development and formation of extraembryonic organs: amnion, yolk sac, allantois, chorion. The role of the extraembryonic mesoderm. Histogenesis and organogenesis.

Type, structure and functions of the human placenta. Changes in the endometrium during pregnancy, fetal membranes.

The concept of cell determination and differentiation, embryonic induction.

Critical periods in the development of the human embryo. Factors affecting development: genetic, endogenous (maternal), exogenous (chemical, physical, biological).

4. GENERAL HISTOLOGY

4.1. Introduction to tissues

Definition of tissue. Development and classification of tissues. Cells and extracellular matrix. Tissue regeneration. The concept of cell populations.

4.2. Epithelial tissues

Epithelial tissue. Morphofunctional characteristics. Classification. Characteristics of epithelial tissue types. Basement membrane. Cell surface modifications. Junctional complex. Epithelial cell renewal.

Surface epithelium: simple (squamous, cuboidal and columnar, pseudostratified, stratified squamous (keratinized and non-keratinized), stratified cuboidal (columnar), transitional. Specialized organelles of epithelial cells. Cell polarity. Intercellular junctions. Physiological and reparative regeneration of epithelial tissues.

Glandular epithelium. Endocrine and exocrine glands. Unicellular and multicellular exocrine glands. Classification of multicellular glands according to the structure, chemical composition of the secret. Secretory cycle and types of secretion.

4.3. Blood and hematopoiesis

Blood, its main functions. Plasma and formed elements. Microscopic, ultramicroscopic structure and functions of blood cells: leukocytes, erythrocytes, platelets. Morphological classification of leukocytes (granulocytes and agranulocytes). Blood count. Leukogram. Physiological regeneration of blood. Age-related changes in peripheral blood counts.

Hematopoiesis (hemopoiesis). Stem cells. Stages of blood cells development. Lymphoid and myeloid lineages. Lymphopoiesis: two-stage process, antigen-dependent nature of the final stage, the formation of effector immunocompetent cells. The concept of specific immunity. Cellular and humoral immune responses. The role of the microenvironment in the development of hematopoietic cells. Regulation of hematopoiesis.

4.4. Connective tissues

General characteristics of connective tissues proper, classification, sources of development, histogenesis.

Loose connective tissue, its composition and location in the human body. Extracellular matrix: structure, chemical composition, physical properties of fibers and the ground substance. Connective tissue cells: fibroblasts, myofibroblasts, fibrocytes, adipocytes (fat cells), macrophages (histiocytes), adventitial cells, pericytes, plasma and mast cells, pigment cells: their origin, structure, functions. The relationship between blood cells and loose connective tissue. Functioning of leukocytes in loose connective tissue. Interaction of cells in the processes of histogenesis, regeneration, participation in the non-specific and specific defenses. Phases of acute inflammation.

Dense connective tissue, its types, structure and functions. Tendon as an organ.

The structure of tendons, aponeuroses, ligaments.

Specialized connective tissues. Reticular connective tissue, structure, histophysiology and significance. Adipose tissue, its varieties, structure and significance. Pigment tissue, structural features and significance. Mucous connective tissue, structure.

Skeletal tissues, sources of development. General morphofunctional characteristics of cartilaginous tissues. Cartilage cells: chondroblasts, chondrocytes. Isogenic groups of cells. Extracellular matrix, territorial, interterritorial matrix. Growth patterns of cartilage. Perichondrium: structure, significance, appositional growth and cartilage regeneration. Types of cartilage: hyaline, elastic, fibrous. Morphofunctional characteristics and classification of bone tissues. Cellular composition: osteoblasts, osteocytes, osteoclasts. Intercellular substance, its structure and physico-chemical properties. The structure of the bone as an organ. Development, growth and bone remodeling.

4.5. Muscle tissues

General characteristics and classification of muscle tissues.

Striated muscle tissue. Skeletal muscle tissue. Muscle fiber: symplast, myosatellite cells, basement membrane. The structure of the symplast: sarcolemma, nuclei, sarcoplasm, general and special organelles. Microscopic and ultramicroscopic structure of myofibrils. Molecular bases and mechanisms of muscle contraction. Types of muscle fibers. Regeneration of skeletal muscle tissue. Skeletal muscle as an organ. Efferent and afferent innervation of the skeletal muscle.

Cardiac muscle tissue: sources of development. Cellular composition: contractile, conductive and secretory atrial cardiomyocytes. Morphology of intercalated discs. Possibilities of regeneration of cardiac muscle tissue.

Smooth muscle tissue: location and sources of development. The structure of a smooth muscle cell. Regeneration of smooth muscle tissue.

4.6. Nervous tissue

General characteristics of the nervous tissue. Irritability and conductivity as the main properties of nervous tissue. Embryonic development of nervous tissue. Differentiation of neuroblasts and glioblasts.

The main structural and functional elements of the nervous tissue, their interactions. Neurons. Classification of neurons, their structural and functional characteristics. Neuroglia. Types of neuroglial cells: oligodendrocytes, astrocytes, ependymal cells, microglial cells. Nerve fibers. Myelinated and unmyelinated nerve fibers. Nerve fiber response to damage and its regeneration. Receptor and effector nerve endings. Synapses: classification, structure, mechanisms of nerve impulse transmission. Neurotransmitters. The concept of reflex arcs.

5. SPECIAL HISTOLOGY

5.1. Cardiovascular system

Blood vessels: general morphofunctional characteristics, classification. Hemodynamic conditions and vessel wall. Arteries: histological structure, main types of arteries. Microcirculation. Arterioles: structure, role in the regulation of peripheral blood flow. Blood capillaries: classification, wall structure, localization, functions. Venules: morphofunctional characteristics. Arterio-venous anastomoses. Veins, their

classification. Features of the structure of the wall of veins of various localization. Lymphatic vessels: capillaries, intraorganic and extraorganic vessels, lymphatic ducts.

Heart, development in embryogenesis. Histological structure of the membranes of the heart wall (endocardium, myocardium, epicardium). Functional morphology of conducting cardiomyocytes. Neurohumoral cardiac regulation.

5.2. Lymphoid system

General characteristics of the lymphoid organs. Sources of their embryonic development.

Primary lymphoid organs. Bone marrow. Structure, tissue composition and functions of the red bone marrow. Features of bone marrow vascularization, structure of its blood capillaries. The bone marrow microenvironment. Yellow bone marrow. Bone marrow regeneration. Thymus: sources of development, functions. Cortex and medulla. Varieties of thymus stromal cells. Thymic corpuscles. Features of thymus blood supply. Blood-thymus barrier. Age-related and accidental thymic involution.

Secondary lymphoid organs. General characteristics: antigen-dependent nature of functional activity, the presence of T and B areas, different types of effector cells. Lymph nodes: development, structure. Cortex, paracortex and medulla (medullary cords). Features lymph circulation: afferent and efferent lymphatic vessels, sinuses. Spleen: structure of white and red pulp, features of the microvasculature, functions. Mucosa-associated lymphoid tissue. Functional morphology of the tonsils.

5.3. Endocrine glands

General characteristics, classification and functional morphology of the endocrine glands.

Epiphysis, structure, cellular composition, function. Pinealocytes and gliocytes.

Morphofunctional characteristics of the hypothalamus–pituitary complex. Hypothalamus. Neurosecretory cells of the hypothalamus. Hormonal functions of the hypothalamus.

Pituitary gland, embryonic development. Structure and functions of the adenohypophysis. Characteristics of chromophils and chromophobs of the anterior pituitary. Hypothalamic-hypophyseal portal circulation. The intermediate lobe of the pituitary and its features in humans. The structure and function of the neurohypophysis, its relationship with the hypothalamus. Vascularization and innervation of the pituitary gland.

Thyroid gland: sources of development, structure, functional significance. Characteristics of follicles, ultrastructure of follicular thyrocytes (T thyrocytes) and C-cells. Thyroid hormone synthesis and secretion.

Parathyroid glands: cellular composition, the role of parathyroid hormones in the regulation of mineral metabolism.

Adrenal gland: sources of development, structure, functional morphology of the cortex and medulla. Communication between the adrenal cortex and the pituitary gland (hypothalamo-pituitary-adrenal axis). Interaction between the adrenal medulla and the central nervous system. Adaptive stress response.

Diffuse endocrine system.

5.4. Nervous system and sense organs

General morphofunctional characteristics and sources of nervous system development. Peripheral nervous system. Microscopic structure of the nerve trunk, sensory and autonomic ganglia. Autonomic subdivision of the peripheral nervous system. General morphofunctional characteristics. Autonomic reflex arc.

Central nervous system. Spinal cord, morphofunctional characteristics. The structure of gray matter: types of neurons and their participation in the formation of reflex arcs, types of glial cells. Spinal cord nuclei. The structure of the white matter. Central canal of the spinal cord and cerebrospinal fluid. Ascending and descending spinal tracts.

Brain: general morphofunctional characteristics of its divisions. Cytoarchitectonic and myeloarchitectonic maps of the cerebral cortex. Cerebellum: structure and functional characteristics. Neuronal organization of the cerebellar cortex. Input and output pathways of the cerebellum. The structure of the brain and spinal cord meninges.

Sense organs. General morphofunctional characteristics of the sense organs. Cytophysiology of receptor cells. The organ of vision: structure, sources of development. Dioptric eye structures: cornea, lens, vitreous body. The accommodation apparatus of the eye: the structure of the ciliary body and iris. The neural composition of the retina. Yellow and blind spots of the retina. The photoreceptors mechanism. Sources of development and structure of the olfactory organ, cytophysiology of reception. The organ of equilibrium. Structure, sources of development, functions. The organ of hearing. Structure and functional role of the cochlear canal. Organ of Corti. Histophysiology of hearing.

5.5. Digestive system

General characteristics. Sources of development. The overall plan of the structure of the digestive tube wall: mucosa, submucosa, muscularis externa and outer (serosa or adventitia) layer.

Oral cavity. The general morphofunctional characteristics, development. Oral mucosa. Types of oral mucosa. Minor salivary glands development and structure. Lips: characteristics of labial mucosa, vermilion border and cutaneous lip. Buccal mucosa: maxillary, mandibular zones and linea alba. Hard and soft palate. Features of oral and nasal surfaces of soft palate. Histological structure of gingiva. Gingival sulcus. Epithelial attachment. Tongue: functions, sources of development. Tongue: structure and topographic features of the mucous membrane. Structure of the lingual tonsil. Structure of the taste bud. Mechanisms of taste reception.

Esophagus: development and structure. The anomalies of structure. Age-related changes. Stomach. Morphofunctional characteristics. Development. Anomalies. Structure of different parts. Classification and characteristics of gastric glands, their cellular structure, functions. Regeneration of the gastric epithelium.

Small intestine. Development, anomalies. General morphofunctional characteristics. Villus-crypt system. Large intestine. Development and histophysiology. Appendix. Neurohumoral mechanisms of regulation of secretory activity and motor activity of the digestive tract wall. Process of digestion and absorption. Structural peculiarities of the anal canal zones.

Liver. General morphofunctional characteristic. Development. Structural organization of the liver. Ultrastructure of the hepatocyte.

Liver lobules: the classical hepatic lobule, the portal lobule, the liver acinus. Gall bladder, structure and functions.

Pancreas. General morphofunctional characteristics. Development, structure of the exocrine and endocrine portions. Pancreatic acinus. Age-related changes.

5.6. Integumentary system

Morphofunctional characteristics and sources of development of the skin. The cellular structure and histophysiology of the epidermis. Process of keratinization and the regeneration of the epidermis. Histophysiology of dermis. Sensory apparatus of the skin. Skin appendages (hair, glands, nails).

5.7. Respiratory system

Respiratory system. Morphofunctional characteristics. Functions of conducting and respiratory portions. Histological structure of the nasal respiratory and olfactory mucosa. The conducting portion of the respiratory system. Structure and functions of larynx, trachea and bronchi.

Respiratory portion of lungs. Acinus. Structure of alveolar wall. Surfactant. The blood-air barrier. Blood circulation, lymphatic drainage and innervation of the lungs.

5.8. Urinary and genital systems

Morphofunctional characteristics of the urinary system. Kidney: development, structure (cortex and medulla). Renal corpuscle. Filtration membrane. The nephron as the structural and functional unit of the kidney. Types of nephrons and features of their blood supply. Histophysiology of urine formation. Endocrine function of kidney.

Major and minor renal calyces, renal pelvis, ureter, urinary bladder, male (female) urethra. The structure of the wall of the renal calyx and pelvis. The structure of the ureters. The structure of the urinary bladder. Features of the structure of the male and female urethra.

Male reproductive system. Morphofunctional characteristics and sources of testis development. Spermatogenesis and its regulation. Sertoli cells. Leydig cells. The blood-testis barrier. Genital ducts. Prostate, seminal vesicles, bulbourethral glands. Structure and function.

Female reproductive system. Development, structure, functions of the ovaries. Ovarian cycle and its hormonal regulation. Atretic follicles. Significance of atresia. Oviduct, uterus, vagina: structure and functions. Menstrual cycle, its regulation.

6. DENTOALVEOLAR SYSTEM

6.1. Glands of the oral cavity

Major salivary glands. The principles of the structural organization of the major salivary glands. The structure of the secretory units and excretory ducts. Endocrine function of the salivary glands. Structural features of the parotid, submandibular and sublingual glands, comparative characteristics of their secretory portions. The composition and functions of saliva.

6.2. Tooth structure

The general plan of the structural organization of the teeth. Functions of the teeth. Enamel. Prismatic and nonprismatic enamel. The shape and structure of the enamel rods. Interrod enamel. Enamel lamellae, spindles and tufts. Metabolism and nutrition of enamel. Enamel cuticle, pellicle, plaque and their role in the entry of inorganic substances inside enamel.

Dentin: dentinal tubules and mineralized extracellular matrix. Predentin. Mantle and circumpulpal dentin. Intertubular and peritubular dentin. The contents of the dentinal tubule. Interglobular dentin. Tomes' granular layer. The concept of primary, secondary and tertiary dentin. Sclerotic dentin. Dead tracts. Dentin sensitivity.

General characteristics and functions of the pulp. Microscopic structure of pulp, blood supply and innervation. Denticles. Differences between the coronal pulp and radicular pulp, pulp of temporary and pulp of permanent teeth. Regeneration and age characteristics of the pulp. The reaction of the dentin-pulpal complex on the injury. Reparative dentin. Age-related changes in dentin and pulp.

6.3. Periodontium

Periodontium. General structural and functional characteristics of components: cementum, periodontal ligament, alveolar bone and gingiva. Cementum: cellular and acellular. Periodontal ligament (PDL): cells, classification of the major groups of collagen fibers, ground substance. Epithelial cell rests of Malassez. Cementicles. Blood supply and innervation. Receptor function of PDL.

Dental alveoli: interradicular and interdental septum. Histological structure of the alveolar bone. The physiological and reparative remodelling of the walls of the dental alveoli.

Morphofunctional state of periodontium at different ages. The clinical significance of gingival fluid in maintaining the normal state of periodontal tissues. Changes in periodontium during tooth movement. Histological aspects of intraosseous dental implants.

6.4. Tooth development

Formation of vestibular lamina and dental lamina. Formation of the tooth germ. The enamel organ, the dental papilla and the dental follicle: their structure, development and derivatives. The morphogenesis of the tooth crown: odontoblasts and ameloblasts, the sources of their formation. Amelogenesis: formation of rods, mineralization of enamel. Possible disturbances of amelogenesis. Enamel hypoplasia. Enamelogenesis imperfecta, dental fluorosis. Dentinogenesis. Development of single-rooted and multi-rooted teeth. Cementogenesis: cementoblasts, the formation of extracellular matrix, its mineralization. Resorption of cementum, hypercementosis. The development of the periodontal ligament. Congenital anomalies of the teeth. Abnormalities of the teeth number. Odontogenic cysts. The role of functional factors in the development of dentition anomalies. Tooth eruption. Anomalies of tooth eruption.

6.5. Morphogenesis of the face and oral cavity

Formation of the oral fossa (stomodeum). Branchial (pharyngeal) apparatus, its structure and derivatives. Development of the face and oral cavity. The development

of the upper and lower jaw. Secondary palate development. Formation of the nasal cavity. The development of the tongue.

Congenital malformations of the face and neck. External risk factors for the occurrence of birth defects. Endogenous factors as the cause of malformations. Congenital dento-maxillofacial anomalies. Birth defects associated with abnormal development of the branchial arches. Prevention of congenital abnormalities.

ACADEMIC DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	Number of hours		Self-studies	Form of control
		lectures	laboratory		
1	<p>Introduction. Histology as a science.</p> <p>Objects and methods of research in histology and cytology. The main steps of histological slides preparation. Rules of working with a light microscope</p> <ol style="list-style-type: none"> 1. Methodological and applied value of histology, cytology and embryology, their connection with other medical and biological sciences. 2. Types and techniques for preparation of histology slides. 3. Principles and methods of tissue fixing in histology. Preparation of histology slides. Principles and methods of histological staining. The concept of basophilia and oxyphilia. 4. Methods for studying the chemical composition of cells and tissues. 5. Instruments and research methods in light and electron microscopy. 	-	2	-	Interviews, computer tests.
2	<p>Cytology.</p> <p>Fundamentals of cytology</p> <ol style="list-style-type: none"> 1. The concept of a cell as a basic unit of living things. Cell theory. Extracellular matrix. 2. Biological membranes. Plasmalemma and its derivatives. Types of cell junctions. Methods by which substances pass through the cell 	-	2	3	Interviews, computer tests.

	membrane. 3. Morphofunctional classification of intracellular structures. The concept of organelles and inclusions. 4. Classification of organelles based on their structure: membranous and non-membranous organelles. Their structure, function. Classification of inclusions. 5. Cell nucleus. Function and structure of the nucleus in interphase. 6. Cell division: mitosis, endoreduplication. Cell cycle.					
3.	Embryology.	1	4	4	4	
	Fundamentals of human embryology 1. Characteristics of mature human gametes. 2. Fertilization. Cleavage of zygote. Formation of blastocyst. 3. Events of second week of human development. 4. Gastrulation: formation of germ layers. 5. Differentiation of germ layers and their derivatives. 6. Extraembryonic membranes. 7. The concept of placentation. 8. Critical periods in human development.	1	-	-		Interviews, computer tests.
	Fundamentals of human embryology. Developmental periods. Fertilization. Cleavage 1. Concept of embryogenesis. Connections between phylogeny and ontogeny. 2. Developmental periods. 3. Gametogenesis. Morphological and functional characteristics of mature human gametes. Fertilization and zygote formation. Cleavage and formation of the blastocyst.	-	2	2	2	Interviews, computer tests.
	Gastrulation. Mechanisms of organogenesis and histogenesis 1. Completion of implantation of blastocyst. Implantation sites. 2. Gastrulation. Histiotrophic and hemotrophic nutrition. 3. Organogenesis and histogenesis. Differentiation of germ layers and their derivatives. 4. Extraembryonic membranes: sources of development and functions.	-	2	2	2	Interviews, computer tests.

	5. Placenta. Structure and function. 6. Critical periods in human development.					
4.	General histology	7	28	36		
4.1.	Introduction to tissues General principles of structural organization of tissues: cells, extracellular matrix 1. Definition of the concept of "tissue". Classification of tissues. 2. General principles of the structural organization of tissues: cells, extracellular matrix. 3. The concept of syncytia and postcellular structures. 4. Cell-differon organization of the tissues.	-	2	-		Interviews, computer tests, filling flash cards.
4.2.	Epithelial tissues General characteristics of tissues. Epithelial tissues 1. Definition of the tissue. 2. Structural and functional elements of tissues. 3. Classification of tissues. Regenerative capacity. 4. General morphofunctional characteristics of epithelial tissues, classification. 5. Surface epithelium. 6. Glandular epithelium.	1	2	4		
	The structure of the surface epithelium. Morphology of the glandular epithelium 1. Definition of the tissue. Classification of tissues. 2. Morphofunctional characteristics of epithelial tissues. Regenerative capacity. 3. Developmental sources of epithelia. Classification and types of epithelial tissues. 4. Micro- and ultramicroscopic characteristics of simple epithelia. Intercellular junctions. 5. Stratified epithelia. 6. Histophysiology of glandular epithelium. Characteristics of secretory cells. 7. Glandulocytes secretory cycle, its phases. Types of exocrine secretion.	-	2	4		Interviews, computer tests, filling flash cards.

	8. Classification of exocrine glands. The regeneration of glandular epithelium.				
4.3.	Blood and hematopoiesis The structure and functions of blood cells. Hematopoiesis 1. Blood as a tissue, source of development, functions. 2. Blood cells: structural features and functions. 3. Blood count and leukogram. 4. Embryonic and postembryonic hematopoiesis. 5. Stem hematopoietic cell. 6. Erythropoiesis. 7. Granulopoiesis. 8. Monocytopoiesis. 9. Thrombopoiesis. 10. Lymphopoiesis in the central and the peripheral lymphoid organs. T-and B-lymphocytes.	2	8	10	
	General morphology of blood and lymph. Structure and functions of blood cells 1. Blood and lymph as types of vascular connective tissues. 2. Functions of the blood. 3. The blood plasma as a variety of extracellular matrix. 4. Blood cells: size, structural features, functions, lifespan. 5. Blood count, leukogram.	-	2	2	Interviews, computer tests, filling flash cards.
	Hematopoiesis 1. Stem hematopoietic cell. 2. Embryonic hematopoiesis: in the yolk sac, in the liver, in the red bone marrow, in the spleen. 3. Erythropoiesis. 4. Granulopoiesis. 5. Monocytopoiesis. Mononuclear phagocyte system. 6. Thrombopoiesis. 7. Lymphopoiesis in the central and the peripheral lymphoid organs. T-and B-lymphocytes.	-	2	2	Interviews, computer tests, filling flash cards.
	General principles of development and structural organization of body tissues	-	2	2	Interviews, computer tests, filling flash cards.

	<p>1. Histogenesis and possibilities of physiological regeneration of epithelial tissues.</p> <p>2. Features of embryonic and postembryonic hematopoiesis.</p> <p>3. Blood count, clinical significance of blood test indicators. Leukogram of an adult, left shift in the blood testing.</p> <p>4. Cellular and humoral immunity. Cooperative interactions between macrophages, T-and B-lymphocytes.</p> <p>Final class on the topics: «Cytology», «Embryology», «Epithelial tissues», «Blood and hematopoiesis»</p>	-	2	Colloquium. Computer tests. Diagnostics of histological preparations.
4.4.	<p>Connective tissues</p> <p>Histophysiology of connective tissues</p> <p>Characteristics of connective tissue proper. Specialized connective tissues</p> <p>1. General morphofunctional characteristics of connective tissues, their origin, classification.</p> <p>2. Histogenesis, structure and functions of loose connective tissue.</p> <p>3. Relationship between blood cells and loose connective tissue cells.</p> <p>4. Structure and functions of dense connective tissues.</p> <p>5. Specialized connective tissues.</p>	-	8	8
	<p>General principles of connective tissue organization. Connective tissue proper: loose and dense</p> <p>1. Classification, sources of development, and general morphofunctional characteristics of connective tissues.</p> <p>2. Histogenesis, structure and functions of loose connective tissue.</p> <p>3. Relationship between blood cells and loose connective tissue cells.</p> <p>4. Structure and functions of dense connective tissues.</p>	1	-	Interviews, computer tests, filling flash cards, visual laboratory class.
	<p>Specialized connective tissues</p> <p>1. The structure and functions of specialized connective tissues.</p> <p>2. Reticular tissue: structural features, localization.</p> <p>3. Pigment tissue: structural features, localization.</p> <p>4. White and brown adipose tissue: structural features, localization.</p> <p>5. Reaction of connective tissues to damage: inflammation, reparative regeneration.</p>	-	2	2
		-	2	Interviews, computer testing, filling flash cards.

	<p>Morphofunctional characteristics of skeletal tissues. Cartilage and bone tissue</p> <ol style="list-style-type: none"> General morphofunctional characteristics and classification of skeletal tissues. The structure of cartilaginous tissues (cells, extracellular matrix). Sources of development, growth, regeneration and age-related changes in cartilage. The structure and functions of the perichondrium. The structure of woven bone tissue. The structure of lamellar (fine-fibrous) bone tissue. Histological structure of the compact and spongy bone. The role of the periosteum and its structure. Development of bone tissue in the embryo. Direct and indirect osteogenesis. Growth of long bones in length. 	1	-	
	<p>Skeletal tissues. Morphofunctional characteristics of cartilage: classification, cells and extracellular matrix, growth, histogenesis, regeneration</p> <ol style="list-style-type: none"> General morphofunctional characteristics and classification of skeletal tissues. Structure of cartilaginous tissues (cells, extracellular matrix). Sources of development, growth, regeneration and age-related changes of cartilage. Perichondrium: structure and functions. 	-	2	Interviews, computer tests, filling flash cards.
	<p>Morphofunctional characteristics of bone tissues: classification, cells and extracellular matrix, growth, histogenesis, regeneration</p> <ol style="list-style-type: none"> Structure of woven (immature) bone tissue - cells, extracellular matrix. Structure of lamellar (mature) bone tissue. Compact and spongy (cancellous) bone. Periosteum: structure and functions. Development of bone tissue. Intramembranous ossification. Endochondral ossification. Growth of long bones. Bone remodeling. 	-	2	Interviews, computer tests, filling flash cards.
4.5.	Muscle tissues	1	4	4

	<p>General morphofunctional characteristics of muscle tissues</p> <ol style="list-style-type: none"> 1. Classification of muscle tissues, sources of development, general morphofunctional characteristics. 2. Smooth muscle tissues: morphological and functional characteristics of structural elements, regeneration. 3. Striated cardiac muscle tissue. The structure of contractile (typical) and conducting (atypical) cardiomyocytes. Regenerative capacity. 4. Skeletal muscle tissue: histogenesis, morphofunctional characteristics of muscle fibers, histophysiology of contraction, regeneration. 5. Structure of skeletal muscle as an organ. 	1	-	
	<p>Morphofunctional characteristics of smooth muscle tissue</p> <ol style="list-style-type: none"> 1. Classification of muscle tissues, origin, general morphofunctional characteristics. 2. Smooth muscle tissue: morphological and functional characteristics of structural elements. Histophysiology of muscle contraction, regeneration. 	-	2	Interviews, computer tests, filling flash cards.
	<p>Morphofunctional characteristics of striated muscle tissues</p> <ol style="list-style-type: none"> 1. Cardiac muscle tissue. Contractile (typical) and conducting (atypical) cardiomyocytes. The possibilities of regeneration. 2. Striated skeletal muscle tissue: histogenesis, morphofunctional characteristics of the structural elements, histophysiology of contraction, regeneration. 3. Structure of skeletal muscle as an organ. 	-	2	Interviews, computer tests, filling flash cards.
4.6.	<p>Nervous tissue</p>	1	4	10
	<p>Histophysiology of nervous tissue</p> <ol style="list-style-type: none"> 1. General morphofunctional characteristics, sources of development of the nervous tissue. 2. Neurons: classification, structural and functional characteristics. 3. Neuroglia: classification, origin, morphofunctional characteristics. 4. Nerve fibers: classification, structure of unmyelinated and myelinated nerve fibers. Degeneration and regeneration of nerve fibers. 	1	-	

	<p>5. Nerve endings: classification, general morphofunctional characteristics. Receptor and effector nerve endings: classification, structure. Interneuronal synapses: classification, structure, mechanisms of nerve impulse transmission.</p> <p>General morphofunctional characteristics, sources of development</p> <ol style="list-style-type: none"> 1. Nervous tissue: general morphofunctional characteristics, sources of development. 2. Neurons. 3. Neuroglia. 4. Structure of unmyelinated and myelinated nerve fibers. Degeneration and regeneration of nerve fibers. 5. Nerve endings: classification, general morphofunctional characteristics; a. receptor and effector nerve endings: classification, structure; b. interneuronal synapses: classification, structure, mechanisms of nerve impulse transmission. 			Interviews, computer tests, filling flash cards.
	<p>Final class on the topics: «Connective tissues», «Muscle tissues», «Nervous tissue»</p>		2	Colloquium. Computer test, diagnostics of histological preparations. Credit.
5.	Special histology	14	72	37
5.1	Cardiovascular system	2	4	5
	<p>Histophysiology of the cardiovascular system</p> <ol style="list-style-type: none"> 1. General morphofunctional characteristics of the cardiovascular system. 2. Classification of blood vessels. The general plan of the structure of the vessel wall. 3. Arteries. Classification. Dependence of the artery wall structure on haemodynamic conditions. 4. Veins. Classification. Influence of haemodynamic conditions on the vein wall structure. 5. Microcirculation. The structure and functions of the arterioles, venules and capillaries. Arterio-venous anastomoses. 	2	-	-

	<p>6. Heart. Sources of development. The structure of the layers of heart wall.</p> <p>7. Cardiac conduction system. Comparative characteristics of typical, conducting, and secretory cardiomyocytes.</p> <p>Microscopic structure of blood vessels and the heart wall</p> <p>1. General morphofunctional characteristics of the cardiovascular system.</p> <p>2. Classification of blood vessels. General plan of structure their walls, source of development.</p> <p>3. Arteries. Classification. Dependence of the artery wall structure on haemodynamic conditions.</p> <p>4. Veins. Classification. Influence of haemodynamic conditions on the vein wall structure.</p> <p>5. Microcirculation. The structure and functions of the arterioles, venules and capillaries. Arterio-venous anastomoses.</p> <p>6. Lymphatic vessels. Classification. Structure.</p> <p>7. Heart. Sources of development. The structure of the layers of heart wall.</p> <p>8. Cardiac conduction system. Comparative characteristics of typical, conducting, and secretory cardiomyocytes.</p> <p>9. Vascularization, innervation and regeneration of blood vessels and the heart. Age-related changes.</p>		Interviews, computer tests, filling flash cards, visual laboratory class.
<p>5.2.</p> <p>Lymphoid system</p> <p>Primary and secondary lymphoid organs</p> <p>1. General characteristics of the lymphoid organs, sources of their embryonic development.</p> <p>2. Primary lymphoid organs. Bone marrow, structure and functions.</p> <p>3. Primary lymphoid organs. Thymus, structure and functions.</p> <p>4. Secondary lymphoid organs. Distribution of T and B zones in spleen, lymph nodes and tonsils.</p> <p>5. Morphological manifestations of cellular and humoral immune responses.</p> <p>Primary lymphoid organs. Red bone marrow. Thymus</p> <p>1. General morphofunctional characteristics of the organs of the</p>	<p>-</p> <p>4</p> <p>5</p> <p>1</p> <p>8</p> <p>5</p> <p>1</p> <p>-</p> <p>-</p> <p>-</p> <p>4</p> <p>2</p> <p>-</p>		Interviews, computer tests, filling flash cards,

	<p>lymphoid system.</p> <ol style="list-style-type: none"> 2. The concept of primary and secondary organs of the lymphoid system. 3. Red bone marrow. Development, structure, functions. 4. Age-related changes in the red bone marrow. 5. Thymus. Development, structure, function. 6. Blood-thymic barrier. Age-related and accidental thymic involution. 7. Endocrine function of the thymus. <p>Secondary lymphoid organs. Lymph node. Spleen. Tonsil</p> <ol style="list-style-type: none"> 1. General principles of the structural organization of the secondary organs of the lymphoid system. 2. Lymph nodes. Development, structure, functions, age-related changes. 3. T and B zones of lymph nodes, their dynamics during the immune response. 4. Spleen. Development, structure, functions. Features of blood circulation. 5. T and B zones of the spleen. Age-related changes in the spleen. 6. Lymphoid tissue associated with mucous membranes (MALT). Development, structure, functions of the tonsils. 		visual laboratory class.
5.3.	<p>Endocrine glands</p> <p>Histophysiology of the endocrine system</p> <ol style="list-style-type: none"> 1. The concept of neuroendocrine regulation in the body. 2. Endocrine system (organs and hormone-producing cells). 3. Pituitary gland. Sources of development. Structure, features blood supply and histophysiology. Hypothalamic-pituitary relationships. Feedback regulation mechanisms of endocrine signaling. 4. Epiphysis: development, structure, function. 5. Thyroid and parathyroid glands: development, structure, histophysiology and functional significance. 6. Adrenal gland. Sources of development, structure, histophysiology of the cortex and medulla. 	- 4 3	Interviews, computer tests, filling flash cards, visual laboratory class.
		1 4 5	

	<p>Microscopic structure of the pituitary gland, epiphysis, thyroid and parathyroid glands, adrenal gland</p> <ol style="list-style-type: none"> 1. Endocrine system (organs and cells with endocrine functions). The concept of neuroendocrine regulation in the body, target organs. 2. Hypothalamus, microscopic structure, functions. Hypothalamic-pituitary relationships. 3. Pituitary. Sources of its development. Structure, blood supply and histophysiology. 4. Epiphysis: sources of development, microscopic structure, functions. 5. Thyroid and parathyroid glands, development, structure, significance for the body. Histophysiology of the secretory cycle. 6. Adrenal gland. Sources of development, microscopic structure of the cortex and medulla. Hypothalamo-pituitary-adrenal axis. 7. Age-related changes in the adrenal glands. 	-	4	5	Interviews, computer tests, filling flash cards, visual laboratory class.
5.4.	<p>Nervous system and sense organs</p>	2	16	6	Interviews, computer tests, filling flash cards, visual laboratory class.
	<p>Peripheral nervous system. Microscopic structure of the nerve, sensory and autonomic ganglia</p> <ol style="list-style-type: none"> 1. General morphofunctional characteristics of the nervous system. Sources of development. Classification. 2. Reflex arcs. 3. Microscopic structure of the nerve trunk and sensory ganglia. 4. Autonomic nervous system. General morphofunctional characteristics, divisions. Composition of the central and peripheral reflex arcs. 5. Cellular composition of the autonomic ganglia. 	-	4	1	Interviews, computer tests, filling flash cards, visual laboratory class.
	<p>Central nervous system. Microscopic structure of the spinal cord, cerebellar cortex and cerebral cortex</p> <ol style="list-style-type: none"> 1. Spinal cord. Morphofunctional characteristics. Structure of gray and white matter. 2. Cerebrum, morphological types of neurons of the cerebral cortex. 3. Cyto- and myeloarchitectonics maps of the cerebral cortex. Granular and agranular cortex. 4. Cerebellum. Histological structure of the cerebellar cortex. 	-	4	1	Interviews, computer tests, filling flash cards, visual laboratory class.

	<p>5. Neuronal organization of the cerebellar cortex.</p> <p>6. Histological structure of the meninges of the brain and spinal cord.</p> <p>7. Blood-brain barrier and blood-cerebrospinal fluid barrier, structure and functional significance.</p>			
	<p>Histophysiology of the sense organs</p> <p>1. The structure of the sensory system.</p> <p>2. Cytophysiology of receptor cells.</p> <p>3. Organ of vision.</p> <p>4. Organ of hearing.</p> <p>5. Organ of balance (equilibrium).</p>	2	-	
	<p>Sense organs. Microscopic structure of the eyeball and inner ear</p> <p>1. Classification of the sense organs. The concept of analyzers and their main departments.</p> <p>2. Morphofunctional characteristics of sensory cells.</p> <p>3. Sources of development of the eyeball.</p> <p>4. Microscopic structure of the cornea, lens, vitreous body.</p> <p>5. Microscopic structure of the ciliary body and iris.</p> <p>6. Microscopic structure of the retina.</p> <p>7. Microscopic structure of the vestibular labyrinth.</p> <p>8. Microscopic structure of the cochlear labyrinth. Spiral (Corti) organ. Histophysiology of hearing.</p> <p>9. Sources of development, microscopic structure of the organ of taste, cytophysiology of reception.</p> <p>10. Sources of development, microscopic structure of the olfactory organ, cytophysiology of reception.</p>	-	4	1
	<p>Final class on the topic: «Histophysiology of the regulatory systems of the body»</p> <p>1. Neuroendocrine regulation in the body.</p> <p>2. Reflex action of the nervous system.</p> <p>3. Structure and functional significance of hypothalamic neurosecretory system.</p> <p>4. Negative feedback systems in hormonal control.</p> <p>5. Hypothalamo-pituitary-adrenal axis and nervous regulation of</p>	-	4	3
				<p>Colloquium. Computer test, filling flash cards. Oral examination.</p>

	adrenal medulla. 6. Participation of the adrenal glands in the adaptation reactions of the organism under stress.				
5.5.	Digestive system Histophysiology of the digestive system 1. Functions of the digestive system, stages of absorption of nutrients. 2. Embryonic sources of development of the digestive system. 3. General plan of the structure of the wall of digestive tract. 4. Comparative characteristics of the mucous membrane of various parts of the digestive canal. 5. Development, structure, functions of the esophagus and stomach. 6. Morphofunctional characteristics of the small and large intestine. Microscopic structure of the oral mucosa. Lip, gingiva, cheek, palate, tongue 1. Masticatory and lining oral mucosa. 2. Structure of the lips. Labial glands. 3. Microscopic structure of the gingiva. 4. Structure of the cheek mucosa. Buccal glands. 5. Hard palate. Features of the microscopic structure of various zones. 6. Features of the microscopic structure of the mucous membrane of the soft palate. 7. Tongue. Microscopic structure, functional significance. The structure of the lingual tonsil. The structure of the taste bud. Mechanism of taste perception. 8. Sources of development of the organs of the oral cavity. 9. Age-related features of the structure of the oral mucosa.	3	16	8	
	Microscopic structure of the wall of the pharynx, esophagus, stomach 1. General plan of the structure of the wall of digestive tract. 2. Features of the microscopic structure of the pharyngeal wall. 3. Microscopic structure of the esophageal wall. 4. Microscopic structure of the stomach wall.	2	-	-	interviews, computer tests, filling flash cards, visual laboratory class.
		-	4	2	
		-	4	2	Interviews, computer tests, filling flash cards, visual laboratory class.

	<p>5. Microscopic structure of the gastric mucosa in its various regions.</p> <p>6. Cellular composition of the gastric glands. Possibilities of regeneration of the gastric epithelium.</p>				
	<p>Microscopic structure of the wall of the small and large intestines</p> <ol style="list-style-type: none"> 1. Morphofunctional characteristics of the small intestine. Sources of its development. 2. Microscopic structure of the small intestine wall in different divisions. 3. Histophysiology of the crypt-villus system. Regeneration of the epithelium of the small intestine. 4. Functions and microscopic structure of the colon wall. 5. Structure of the wall and functional features of the appendix. 6. Features of the structure of the wall of the rectum. The structure of the wall of the anal canal. 	-	4	2	Interviews, computer tests, filling flash cards, visual laboratory class.
	<p>Histophysiology of liver and pancreas</p> <ol style="list-style-type: none"> 1. Structural features of the major salivary glands. 2. Histophysiology of the liver. 3. The structure of the exocrine pancreas. 4. The structure of the endocrine pancreas. 	1	-	-	
	<p>Microscopic structure of the liver and pancreas. Final control in the section «Digestive system»</p> <ol style="list-style-type: none"> 1. Functions of the liver, sources of its development in embryogenesis. 2. The structure of the classic hepatic lobule, portal lobule, hepatic acinus. 3. Microvasculature of the liver. 4. Age features of the structure of the liver and mechanisms of its regeneration. 5. Histological structure of the wall of the bile ducts and gallbladder. 6. Functions of the exocrine and endocrine parts of the pancreas; development of the pancreas in embryogenesis. 7. The structure of the exocrine pancreas. 8. The structure of the endocrine pancreas. 	-	4	2	Colloquium, computer test, filling flash cards. Oral examination.

5.6.	<p>Integumentary system</p> <p>Microscopic structure of the skin and its derivatives</p> <ol style="list-style-type: none"> 1. Morphofunctional characteristics of the skin and the sources of its development. 2. Cellular composition and histophysiology of the epidermis. The process of keratinization and regeneration of the epidermis. 3. Histophysiology of the dermis. 4. Features of the tissue organization of the papillary and reticular layers of the dermis. 5. Blood supply and innervation of the skin. Features of the skin receptor apparatus. 6. Histophysiology and topography of sweat and sebaceous glands, sources of their development. 7. Development, structure and types of hair. 	-	4	2	Interviews, computer tests, filling flash cards, visual laboratory class.
5.7.	<p>Respiratory system</p> <p>Histophysiology of the respiratory system</p> <ol style="list-style-type: none"> 1. General morphofunctional characteristics of the respiratory system. 2. The main stages of the embryonic development of the respiratory system in human ontogenesis. 3. Comparative morphofunctional characteristics of the upper respiratory airways. 4. Microscopic structure of the walls of bronchi and bronchioles. 5. The structure of the respiratory zone of the lung. Acinus. Cellular composition of the wall of the pulmonary alveolus. 6. The concept of the blood-air barrier. The role of the pulmonary surfactant. 	2	4	2	
	<p>Respiratory system. The microscopic structure of the conducting and respiratory portions</p> <ol style="list-style-type: none"> 1. Morphofunctional characteristics of the respiratory system: conducting and respiratory zones. 2. Sources of development of the respiratory system in embryogenesis. 3. Features of the microscopic structure of the mucous membranes of 	-	4	2	Interviews, computer tests, filling flash cards, visual laboratory class.

	<p>the nasal cavity, nasopharynx and larynx.</p> <ol style="list-style-type: none"> 4. Microscopic structure of the tracheal wall. 5. Microscopic structure of the walls of bronchi and bronchioles. 6. The structure of the respiratory zone of the respiratory system: respiratory bronchioles, alveolar ducts, alveolar sacs, alveoli. 7. The concept of the blood-air barrier. 8. The role of the pulmonary surfactant. 9. Extracellular and intracellular surfactant. 				
5.8.	Urinary and genital systems	3	16	4	
	<p>Histophysiology of the urinary system</p> <ol style="list-style-type: none"> 1. Sources and stages of embryonic development of the kidney. 2. Structure of the kidney: cortex and medulla. Cortical and juxtamedullary nephrons. 3. The mechanism of urination. 4. Endocrine function of the kidney. Hormonal regulation of urine formation. 5. Blood supply to the kidney. Features of blood circulation in the juxtamedullary nephrons. 	1	-	-	
	<p>Microscopic structure of the kidney, ureter, bladder</p> <ol style="list-style-type: none"> 1. Sources and stages of embryonic development of the kidney. 2. Structure of the kidney: cortex and medulla. Cortical and juxtamedullary nephrons. 3. Histophysiology of the renal corpuscle, filtration membrane. 4. Histophysiology of proximal, thin, distal tubules of nephron and collecting ducts. 5. The mechanism of urine formation. 6. Blood supply to the kidney. Features of blood circulation of juxtamedullary nephrons. 7. Endocrine function of the kidneys. Juxtglomerular apparatus. Hormonal regulation of urine formation. 8. The structure of the wall of the ureter and urinary bladder. 	-	4	1	Interviews, computer tests, filling flash cards, visual laboratory class.
	<p>Histophysiology of the reproductive systems</p> <ol style="list-style-type: none"> 1. Development of the organs of the male reproductive system, its components. 	2	-	-	

	<ol style="list-style-type: none"> 2. Spermatogenesis. 3. Comparative characteristics of genital ducts. 4. Accessory glands of the male reproductive system. 5. Structure and functions of the female reproductive system. 6. Ovary, ovarian cycle. 7. Fallopian tube (oviduct). 8. Uterus, uterine cycle. 9. Histophysiology of the menstrual cycle. 10. The structure of the vagina. 			
	<p>Microscopic structure of the male reproductive system organs: testis, genital ducts, prostate</p> <ol style="list-style-type: none"> 1. Morphofunctional characteristics of the male reproductive system and the sources of its development. 2. Microscopic structure of the testis. 3. Sperm production and testosterone secretion by the testis. Age-related changes in the testis. 4. Spermatogenesis, its stages. 5. Microscopic structure of the epididymis and other genital ducts. 6. Microscopic structure and functions of the prostate, seminal vesicles, bulbourethral glands. 	-	4	1
	<p>Microscopic structure of the organs of the female reproductive system: ovary, uterus</p> <ol style="list-style-type: none"> 1. Morphofunctional characteristics of the female reproductive system and the sources of its development. 2. Microscopic structure of the ovary. Types of follicles, follicular atresia, structure of the atretic follicle. 3. Oogenesis, its stages. Difference between oogenesis and spermatogenesis. 4. Ovulation. Corpus luteum, its growth and development, functional significance. 5. Corpus albicans. 6. Endocrine function of the ovaries, its regulation. Age-related changes. 7. Microscopic structure of the fallopian tube wall. 	-	4	1

Interviews, computer tests, filling flash cards, visual laboratory class.

Interviews, computer tests, filling flash cards, visual laboratory class.

	8. Microscopic structure of the uterine wall. Cyclic and age-related changes. 9. Menstrual cycle, its regulation. 10. Microscopic structure of the vaginal wall. Cyclic changes.				
	Final class on the topics: «Integumentary system», «Respiratory system», «Urinary system», «Male reproductive system», «Female reproductive system»	-	4	1	Colloquium, computer test, filling flash cards. Credit.
6.	Dentoalveolar system		36	54	
6.1	Glands of the oral cavity		7	6	
	The principles of the structural organization of the salivary glands. Microscopic structure of the parotid, submandibular and sublingual glands 1. Principles of structural organization of the major salivary glands. 2. Structure of the secretory units and excretory ducts 3. Structural features of the parotid, submandibular and sublingual gland. 4. Comparative characteristics of the secretory portions of the parotid, submandibular and sublingual glands.	-	4	3	Interviews, computer tests, filling flash cards.
	Glands of the oral cavity. Microscopic structure of minor salivary glands 1. Composition and functions of saliva. Saliva as an object of research and diagnostics. 2. Endocrine function of the salivary glands. 3. Topography and structural features of minor salivary glands. 4. Age-related changes in the salivary glands.		3	3	Interviews, computer tests, filling flash cards.
6.2	Tooth structure		7	7	
	General plan of the structural organization of the tooth. Microscopic structure of enamel. Metabolism, nutrition, age-related changes in enamel 1. General plan of the structural organization of the tooth. Functions	-	4	4	Interviews, computer tests, filling flash cards.

	<p>of the teeth.</p> <ol style="list-style-type: none"> 2. General characteristics of enamel, its functions. 3. Structure of enamel: enamel rod, interrod enamel. 4. Optical phenomenon on longitudinal ground sections of tooth (Hunter-Schreger bands). 5. Incremental growth lines in enamel. 6. Enamel lamellae, tufts, spindles. Dentino-enamel junction. 7. Remineralization and demineralization of enamel. 8. Surface coatings of enamel (perikymata, cuticle, pellicle, dental plaque, calculus), their composition and functions. <p>Microscopic structure of dentin. Blood supply, innervation, physiological and reparative regeneration of dentin</p> <ol style="list-style-type: none"> 1. Types of dentine (according to topography, pattern and degree of mineralization). Physical properties and chemical composition of dentin. 2. Microscopic structure of the dentin. 3. Dentinal fluid. 4. Predentin, mantle dentin and circumpulpal dentin. 5. Primary, secondary and tertiary dentin. 6. Denticles. Pathological changes in dentin. 		
6.3	<p>Periodontium</p> <p>Microscopic structure of the tooth pulp. Functions, blood supply, innervation, age-related changes in the pulp. Periodontium. Cementum: cellular and acellular</p> <ol style="list-style-type: none"> 1. General characteristics and functions of the pulp. 2. Microscopic structure of the pulp, blood supply and innervation. 3. Differences between the coronal and root pulp. 4. Differences between the pulp of deciduous and permanent teeth. 5. Regeneration and age-related changes in the pulp. Denticles. 6. Structural organization of the tooth supporting apparatus. 7. General characteristics and functions of cementum. Acellular and cellular cementum. 8. Participation of cementum in reparative processes. Hypercementosis, its types. 	3	Interviews, computer tests, filling flash cards.
		7	Interviews, computer tests, filling flash cards.
		8	
		4	5

	<p>Microscopic structure of the periodontal ligament, blood supply and innervation. Alveolar bone. Histologic changes during tooth movement. Histological aspects of endosseous dental implantation</p> <ol style="list-style-type: none"> 1. Microscopic structure of the periodontal ligament. Dentoalveolar and gingival groups of fibers. Blood supply and innervation. 2. Epithelial rests in the periodontal ligament. 3. Physiological and reparative rearrangement of the desmodont. 4. The value of gingival fluid to maintain the normal state of periodontal tissues. 5. The role of periodontium in orthodontic tooth movement. 6. Alveolar bone: alveolar bone proper and supporting bone. 7. Histological changes in periodontal tissues during tooth movement. 8. Histological aspects of endosseous implantation of teeth. 		Interviews, computer tests, filling flash cards.
6.4	Tooth development	7	8
	<p>Development of the tooth in embryogenesis. Formation of the tooth germ. Morphogenesis of the tooth crown. Organogenesis of the roots of teeth. Tooth eruption. Congenital anomalies in the tooth development.</p> <ol style="list-style-type: none"> 1. Sources of development of tooth tissues. 2. Stages of tooth development: initiation, bud, cap, and bell stages. 3. Histogenesis of dentin and enamel. 4. Development of dental pulp and periodontium. 5. Mechanisms of eruption of deciduous and permanent teeth. 6. Anomalies of the tooth structure and malformations of the teeth. 7. Clinical manifestations of violations of the early stages of tooth development. 8. Violations of dentinogenesis and enamelogenesis associated with insufficiency of alimentary factors and general diseases. 		Interviews, computer tests, filling flash cards. Essays.
	Final class on the topic «Structure and development of tooth and its supporting tissues»	3	5
6.5	Morphogenesis of the face and oral cavity	8	25

	<p>Pharyngeal apparatus, its structures and derivatives</p> <ol style="list-style-type: none"> 1. Formation of the stomodeum. 2. Development of the face and oral cavity, upper and lower jaws 3. The development of the palate, the formation of the nasal and oral cavities. 4. Tongue and thyroid development. 5. Structures of the pharyngeal apparatus. 6. Derivatives of pharyngeal arches, pouches, and clefts. 	4	5	Interviews, computer tests, filling flash cards. Essays.
	<p>Congenital malformations of the face and neck. Prevention of congenital pathology</p> <ol style="list-style-type: none"> 1. The significance of external risk factors for the occurrence of congenital malformations. 2. Endogenous factors as the cause of malformations. 3. Congenital dentomaxillofacial anomalies. Influence of defects of the maxillofacial region on the development and health of children. 4. Anomalies in the development of the face: macrostomia, microstomia, cleft lip, cleft palate. Congenital neck cysts. 5. Congenital malformations associated with anomalies in the development of pharyngeal arches. 	3	15	Interviews, computer tests, filling flash cards. Essays.
	<p>Final class on the topic «Morphogenesis of the face and oral cavity, congenital disorders of the face and neck»</p>	1	5	Colloquium. Computer tests, filling flash cards. Oral examination.
		22	144	134

INFORMATION AND INSTRUCTIONAL UNIT

LITERATURE

Basic (relevant):

1. Melnyk, N. Histology, cytology and embriology : textbook : учебник для англоязыч. студентов. – Киев : Книга плюс, 2017. – 416 р..
2. Kuznetsov, S. L. Histology, cytology and embryology (a course of lectures) : учеб. пособие для студентов мед. вузов / ed. by E. V. Babchenko. – 2nd ed. – Moscow : Medical Informational Agency, 2019. – 240 p.
3. Студеникина, Т. М. Гистология, цитология, эмбриология = Histology, cytology, embryology : учеб. пособие / под ред. Т. М. Студеникиной. – Минск : Новое знание, 2022. – 326 с.

Additional:

4. Eroschenko, V. P. Atlas of histology with functional correlations. – 13th ed. – Philadelphia : Wolters Kluwer, 2017. – 593 p.
5. Moore, K. L., Persaud, T. V. N., Torchia, M. G. The Developing Human : Clinically Oriented Embryology. – Elsevier Health Sciences, 2020. – 503p.
6. Mescher, A. L. Junqueira's basic histology : text and atlas. – McGraw-Hill, 2013.

METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE

The time allotted for independent work can be used by students for:

- preparation for lectures and laboratory classes;
- preparation for colloquiums, tests and oral examination in the academic discipline;
- study of topics (issues) submitted for independent study;
- problem solving;
- performing research and creative tasks;
- preparation of thematic reports, essays and presentations;
- performing practical tasks;
- taking notes of educational literature;
- preparation of reports;
- compiling a review of scientific literature on a given topic;
- design of information and demonstration materials (stands, posters, graphs, tables, newspapers, etc.);
- production of mock-ups, laboratory and teaching aids;
- compiling a thematic selection of literary sources and Internet sources;
- compiling tests for students to organize mutual control.

LIST OF AVAILABLE DIAGNOSTIC TOOLS

The following forms are used for competences assessment:

Oral form:

interviews;
colloquiums;
conference reports;
examinations;
identification of histology slides.

Written form:

filling out flash cards;
essays;
publication of articles, abstracts.

Oral-written form:

credits;

Technical form:

computer tests.

LIST OF AVAILABLE TEACHING METHODS

Traditional method (lecture, laboratory practicals);

Active (interactive) methods:

Problem-Based Learning (PBL);

Team-Based Learning (TBL);

Case-Based Learning (CBL);

Research-Based Learning (RBL);

Simulation-based learning.

LIST OF PRACTICAL SKILLS

1. Identification of structures on the histological preparations with using a light microscope.

LIST OF LECTURES**1st semester**

1. Fundamentals of human embryology.
2. General characteristics of tissues. Epithelial tissues.
3. Structure and function of blood cells. Hematopoiesis.
4. Histophysiology of connective tissues.
5. Characteristics of connective tissue proper. Specialized connective tissues.
6. Morphofunctional characteristics of skeletal tissues. Cartilage and bone tissues.
7. General morphofunctional characteristics of muscle tissues.
8. Histophysiology of nervous tissue.

2nd semester

1. Histophysiology of the cardiovascular system.
2. Primary and secondary lymphoid organs.

3. Histophysiology of the endocrine system.
4. Histophysiology of the sense organs.
5. Histophysiology of the digestive system.
6. Histophysiology of the liver and pancreas.
7. Histophysiology of the respiratory system.
8. Histophysiology of the urinary system.
9. Histophysiology of the reproductive systems.

LIST OF LABORATORY STUDIES

1st semester

1. Objects and methods of research modern histology. The main stages of histological slides preparation. Rules of working with a light microscope.
2. Fundamentals of cytology.
3. Fundamentals of the human embryology. Developmental periods. Fertilization. Cleavage.
4. Gastrulation. Mechanisms of organogenesis and histogenesis
5. Introduction to tissues.
6. General principles of structural organization of tissues: cells, extracellular matrix. Epithelial tissues. The structure of the surface epithelium. Morphology of the glandular epithelium.
7. General morphology of blood and lymph. Structure and functions of blood cells.
8. Hematopoiesis.
9. General principles of development and structural organization of body tissues.
10. Final class on the topics: «Cytology», «Embryology», «Epithelial tissues», «Blood and hematopoiesis».
11. General principles of connective tissue organization. Connective tissue proper: loose and dense.
12. Specialized connective tissues.
13. Skeletal tissues. Morphofunctional characteristics of cartilage: classification, cells and extracellular matrix, growth, histogenesis, regeneration.
14. Skeletal tissues. Morphofunctional characteristics of bone tissues: classification, cells and extracellular matrix, growth, histogenesis, regeneration.
15. Muscle tissues. Morphofunctional characteristics of smooth muscle tissue.
16. Muscle tissues. Morphofunctional characteristics of striated muscle tissues.
17. Nervous tissue. General morphofunctional characteristics, sources of development.
18. Final class on the topics: «Connective tissues», «Muscle tissues», «Nervous tissue»

2nd semester

1. Microscopic structure of blood vessels and the heart wall.
2. Primary lymphoid organs. Red bone marrow Thymus.
3. Secondary lymphoid organs. Lymph node. Spleen. Tonsil.

4. Microscopic structure of the pituitary gland, epiphysis, thyroid and parathyroid glands, adrenal gland.
5. Peripheral nervous system. Microscopic structure of the nerve, sensory and autonomic ganglia.
6. Central nervous system Microscopic structure of the spinal cord, cerebellum and cerebral hemisphere.
7. Sense organs. Microscopic structure of the eyeball and inner ear.
8. Final class on the topic: «Histophysiology of the regulatory systems of the body».
9. Microscopic structure of the oral mucosa. Lip, gingiva, cheek, palate, tongue.
10. Microscopic structure of the wall of the pharynx, esophagus, stomach.
11. Microscopic structure of the wall of the small and large intestines.
12. Microscopic structure of the liver and pancreas. Final control in the section «Digestive system».
13. Microscopic structure of the skin and its derivatives.
14. Respiratory system. The microscopic structure of the conducting and respiratory portions.
15. Microscopic structure of the kidney, ureter, bladder.
16. Microscopic structure of the male reproductive system organs: testis, genital ducts, prostate.
17. Microscopic structure of the organs of the female reproductive system: ovary, uterus.
18. Final class on the topics: «Integumentary system», «Respiratory system», «Urinary system», «Male reproductive system», «Female reproductive system».

3rd semester

1. The principles of the structural organization of the salivary glands. Microscopic structure of the parotid, submandibular and sublingual glands.
2. Glands of the oral cavity. Composition and functions of saliva.
3. General plan of the structural organization of the tooth. Microscopic structure of the enamel. Metabolism, nutrition, age-related changes in enamel.
4. Microscopic structure of the dentin. Blood supply, innervation, physiological and reparative regeneration of the dentin.
5. Microscopic structure of the tooth pulp. Functions, blood supply, innervation, age-related changes in the pulp. Periodontium. Cementum: cellular and acellular.
6. Microscopic structure of the periodontal ligament, blood supply and innervation. Alveolar bone. Histologic changes during tooth movement. Histological aspects of endosseous dental implantation.
7. Development of the tooth in embryogenesis. Formation of the tooth germ. Morphogenesis of the tooth crown. Organogenesis of the roots of teeth. Tooth eruption. Congenital anomalies in the tooth development.
8. Final class on the topic «Structure and development of tooth and its supporting tissues».

9. Morphogenesis of the face and oral cavity. Pharyngeal apparatus, its structures and derivatives.

10. Congenital malformations of the face and neck. Prevention of congenital pathology.

11. Final class on the topic «Morphogenesis of the face and oral cavity, congenital disorders of face and neck».

**PROTOCOL OF THE CURRICULUM APPROVAL
BY OTHER DEPARTMENTS**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department, which designed the curriculum (date, protocol #)
1. Human anatomy	Human morphology	no	Protocol # 10 from 15.05.23
2. Topographic anatomy and operative surgery	Human morphology	no	Protocol # 10 from 15.05.23

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Curriculum content, composition and the accompanying documents comply with the established requirements.

Dean of the Medical Faculty for International Students of the educational institution «Belarusian State Medical University»

26.06. 2023

O.S.Ishutin

Methodologist of the educational institution «Belarusian State Medical University»

26.06. 2023

S.V.Zaturanova