



Ministry of science and high education RF Ulyanovsk State University Faculty of Medicine named after Biktimirov T.Z., IMEiPC	Form	
F-Educational plan of the histology, embryology, cytology		



**APPROVED**  
 by the decision of the Academic Council of the USU Institute of Medicine,  
 Ecology and Physical Culture  
 June « 20 » 2020, № 10/220  
 \_\_\_\_\_ V.I. Midlenko  
*(signature, signature clarification)*  
 « 20 » of June 2020.

### EDUCATIONAL PLAN

Subject:	Histology, embryology, cytology
Faculty	Medical
Department	Morphology
Course	1,2

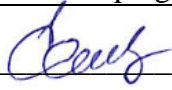

Speciality 31.05.01. «General medicine»  
(code of the speciality, full name)


Form of education- full-time education

Date of introducing in the instruction process at USU: « 1 » of September 2020.  
 The program was updated at the meeting of the department: № 1 of 1.09. 2021.  
 The program was updated at the meeting of the department: № \_\_\_ of \_\_\_ 20 \_\_\_.

Information about the authors:

Initials	Abbreviation of the department	Degree, scientific rank
Slesareva Elena Vasilievna	Morphology	Professor, MD, Associate Professor
Kuznetsova Tatyana Ivanovna	Morphology	Associate Professor, Ph.D.

AGREED	AGREED
Head of department Morphology, developing discipline	Head of the graduating Department Hospital therapy
 /Slesareva E.V./ <i>signature</i> «20» June 2020 yr.	 /Vise-Chripunova M.A./ <i>signature</i> «20» June 2020 yr.

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## 1. OBJECTIVES AND AIM OF DISCIPLINE:

The aim of mastering the discipline: Mastering the knowledge of the laws of the microscopic and ultramicroscopic structure of human body structures (cells, tissues, organs).

Tasks of mastering the discipline: Mastering knowledge about the ultramicroscopic structure of cells, the microscopic structure of tissues, the features of their development and functioning, age-related changes. This is necessary for the subsequent study of the essence of changes in tissue structures in diseases caused by exposure to various factors - external, internal and treatment.

## 2. PLACE OF THE SUBJECT IN THE STRUCTURE OF GEP:

Discipline "Histology, embryology, cytology" to professional cycle (B1 B12) GEP HE of specialty «General medicine». To study this discipline, a student must master such disciplines as "Embryonic development of body tissues", "Anatomy", "Physics", "Chemistry", "Biology", "Latin". Knowledge of the discipline "Histology, embryology, cytology" is necessary for the subsequent development of the following disciplines: "Normal physiology", "Pathological anatomy", "Physiology of visceral systems", "Propaedeutics of internal diseases. Introduction to the specialty ", " Pathophysiology, Clinical Pathophysiology. "


## 3. 3.LIST OF EXPECTED RESULTS OF INSTRUCTION ON THE SUBJECT (UNIT), CORELATED WITH PLANNED RESULTS OF COMPLETING THE PROGRAM

The study of the subject "Histology, embryology, cytology" within the completion of the educational program is directed towards the formation of the following general and professional competences in students:

Competence index. Content of a competence (or a part of it)	The proposed results of the course students are:
GPC 9	<p><u>To know</u>: the basic laws of the development and vital activity of the body based on the structural organization of cells, tissues and organs; histofunctional features of tissue elements, methods for their research. The structure, topography and development of cells, tissues, organs and systems of the body in interaction with their function in normal and pathological conditions.</p> <p><u>To be able to</u>: work with a magnifying technique (microscope); give a histophysiological assessment of the state of various cellular, tissue and organ structures;</p> <p><u>To own</u>: the skills of microscopy and analysis of histological, histochemical and embryological preparations and electronic micrographs; the skill of sketching histological preparations.</p>

## 4. VOLUME OF THE SUBJECT

### 4.1 Volume of the subject in credit points (total): 7 credit points

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#### 4.2 On types of academic workload (in hours):


Type of study	Number of hours (form of study: full-time)		
	Total according to plan	In semester	
		2	3
Contact work of students with a teacher in accordance with syllabus			
Contact lessons*:	144	72	72
Lectures*	36	18	18
Practical classes and seminars lab classes*	108	54	54
Self-study work	72	54	18
Concurrent control		Test, colloquium, summary, standings	Test, colloquium, summary, standings
Types of intermediate certification (exam, test)	36	credit	36 exam
Total hours for discipline	252	126	126

\*If it is necessary to use partially or exclusively remote educational technologies in the educational process, the table shows the number of hours of work of teaching staff with students for conducting classes in a remote format using e-learning.


#### 4.3. Contents of the discipline (module). Distribution of hours on themes and kinds of study: Number of hours – 252

The form of training: full time

Name of sections and themes	Total	Activity format				Form of current control
		Classroom studies			Self-study work	
		Lectures	pract.cl.	Inter-active classes		
Section 1. Cytology						
1. Methods of histological studies	12	-	-	-	12	Summary, test interview, test
2. The structure of the cytoplasm	12	-	-	-	12	Summary, test interview, test
3. The structure of the nucleus. Cell division	12	-	-	-	12	Summary, test interview, test
Section 2. Human Embriology						
4. The initial and embryonic	14	2	-	-	12	Summary, test interview, test

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periods of human embryogenesis.						
5. The structure of extra-germ organs.	14	2	-	-	12	Summary, test interview, test
<b>Section 3. General histology</b>						
6. Epithelial tissues and glands	8	2	6			Questions in the final lesson, standings, exam. Interview.
7. Blood and lymph	3	-	1	2	-	Questions in the final lesson, standings, exam. Interview.
8. Connective tissue	8	2	6		-	Questions in the final lesson, standings, exam. Interview.
9 Skeletal tissue	8	2	6		-	Questions in the final lesson, standings, exam. Interview.
10 The final lesson on topics 6-82	8	2	6		-	Questions in the final lesson, standings, exam. Interview.
<b>Section 4. Privat histology</b>						
14. Cardiovascular system	5	2	3		-	Questions in the final lesson, standings, exam.
15. Urinary system	3	-	3		-	Questions in the final lesson, standings, exam
16. The final lesson on topics 20-22	6		4	2		Interview, exam
17. Diagnosis of drugs	18	6	12		-	Questions in the final lesson, standings, exam
18. Digestive system	8	2	6		-	Questions in the final lesson, standings, exam
19. Hematopoietic organs	3	-	1	2	-	Questions in the final lesson, standings, exam
21. Final lesson on topics 15-18	3	-	3		-	Interview, exam

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20. Endocrine system	3	-	3		-	Questions in the final lesson, standings, exam
22. Respiratory system	8	2	6		-	Questions in the final lesson, standings, exam
23. Leather and its derivatives	8	2	6		-	Questions in the final lesson, standings, exam
24. The nervous system	14	2	-		12	Questions in the final lesson, standings, exam
25. Sense organs	3	-	1	2		Questions in the final lesson, standings, exam
26. The reproductive system	6	-	4	2		Questions in the final lesson, standings, exam
27. The final lesson on topics 15-18	3		3	2		Interview, exam
	216	36	108	12	72	

#### Interactive classes

№п/п	The name of the discipline section	Interactive forms of conducting classes	Duration (hour)
1.	Final lesson on topics 6-8	Work in small groups in solving situational problems, training in determining histological preparations	2
2	(Epithelial and connective tissue)	Work in small groups in solving situational problems, training in determining histological preparations	2
3	Final lesson on topics 10-12 (Skeletal, muscle and nerve tissue)	Training in the determination of histological preparations, the business game "Doctor-Histologist"	2
4	Diagnosis of drugs by general histology	Work in small groups in solving situational problems, training in determining histological preparations	2
5	Final lesson on topics 15-18 (Digestive and endocrine	Work in small groups in solving situational problems, training in	2

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	systems)	determining histological preparations	
6	Final lesson on topics 20-22 (Sense organs and nervous system)	Training in the determination of histological preparations, the business game "Doctor-Histologist"	2
ИТОГО			12

## 5. COURSE CONTENT

### Section 1.

#### CYTOLOGY

##### Topic 1

##### METHODS OF HISTOLOGICAL RESEARCH

Taking material for histological examination. Preparation of material for histological examination: fixation, wiring, pouring, preparation of histological sections, staining, conclusion of sections. Taking material for diagnostic cytological examination. Preparation of material for cytological examination. Cytochemical and histochemical research methods. Immunohistochemical research methods. Light microscopy.

##### Topic 2 CONSTRUCTION OF CYTOPLASMA


The concept of a cell as an elementary living system, the basis of the structure and function of eukaryotic organisms. The concept of non-cellular structures. The main provisions of cell theory at the present stage of development of science.

Biological membrane as a structural basis of cell activity, its molecular organization and basic functions. The cell membrane (cytolemma), the supersubmembrane and submembrane components, their structural-chemical and functional characteristics. Mechanisms of transport of substances, reception, adhesion. Participation in the formation of intercellular compounds.

Different types of intercellular compounds (contacts), their functional and structural characteristics. Simple joints, tight junctions, gap junctions (nexus), synaptic junctions, desmosomes, finger-shaped junctions.

The main components of the cytoplasm are organelles, inclusions, hyaloplasm (matrix). Organelles - definition, classification.

Organelles having a membrane structure. Endoplasmic reticulum - the structure and functions of the granular and non-granular endoplasmic reticulum, their importance in the synthesis of substances, structural features in connection with various cell metabolism. Golgi complex - structure, functions, role in the secretion processes in glandular cells, importance in the interaction of membrane structures. Lysosomes - structure, major enzymes, role in intracellular digestion; primary and secondary lysosomes, hetero- and autophagosomes; the value of lysosomes in cells that perform protective functions in the body. Peroxisomes - structure, enzyme composition, functions. Mitochondria - structure, basic enzyme composition, functions; an idea of autonomous protein synthesis in mitochondria, reproduction of mitochondria; structural features of mitochondria in cells with different levels of bioenergy.

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Organelles that do not have a membrane structure Ribosomes - structure, chemical composition, functions. The concept of polyribosomes. The role of free ribosomes and membrane-related endoplasmic reticulum. Centrioli - the structure, functions in the interphase and during cell division. The concept of the cytoskeleton of cells. The fibrillar structures of the cytoplasm: microtubules, microfilaments and microfibrils. Their chemical composition and functional characteristics.

Special organelles. Microvilli. Flickering cilia. Flagella. Tono-fibrils. Myofibrils. Neurofibrils. Their structure and importance for the vital functions of cells and the body.

Inclusions. Definition Classification. Significance in the life of cells and the body. The structure and chemical composition of various types of inclusions.

Hyaloplasm. Definition Physico-chemical properties, an idea of the chemical composition. Importance in metabolism and maintaining the integrity of the cytoplasmic structures of the cell.

### **Topic 3. STRUCTURE OF THE NUCLEUS. DIVISION OF CELLS.**

The importance of the nucleus in the life of the cell and in the transfer of genetic information in a number of generations of cells. The shape, size, number of nuclei in cells with different specializations. Nuclear-cytoplasmic relationships as an indicator of the functional state of the cell. The main components of the nucleus: the nuclear membrane, chromatin, nucleolus, karyoplasm (nucleoplasm).

The shell of the core. Structure. The participation of the nuclear membrane in the metabolism between the nucleus and the cytoplasm. The role of pore complexes. Interactions of the nuclear membrane with the membrane system of the cytoplasm of the cell.

Chromatin. The concept of chromatin. Its molecular chemical organization and role in the life of cells. Euchromatin (diffuse) and heterochromatin (condensed). Sex chromatin.

The nucleolus. Structure. The role of nucleoli in the synthesis of rRNA and the formation of ribosomes. Participation of the nucleolar organizers of chromosomes in the formation of the nucleolus. Functional lability of nucleoli.

Synthetic processes in the cell. Interactions of the structural components of the cell in the synthesis of proteins and non-protein substances. The concept of secretion and its types.

Life (cell) cycle. Life cycle definitions. Characterization of its stages (reproduction, growth and differentiation, active functioning, aging and cell death). Features of the life cycle of cells of various types of tissues.

Reproduction of cells and cell structures. Reproductive cycle. Definition and biological significance. Periods (interphase and mitosis). Characterization of the main processes of the reproductive cycle of cells.

Mitosis. The biological essence. Phases of mitosis. Transformations of the structural components of the cell during each of the phases.

Meiosis. Its features and biological significance.

Intracellular regeneration. General morphofunctional characteristic. Biological significance. Cell adaptation. Its importance for maintaining the life of cells in altered living conditions.


## **Section 2**

### **HUMAN EMBRYOLOGY**

#### **Topic 4: INITIAL AND EMBRIOLOGIC PERIODS OF EMBRIOGENESIS.**

Progenesis. General characteristics of gametogenesis, especially the course of the main stages of spermatogenesis and oogenesis. The structure and functions of male and female germ cells. Their laying, migration and development in the genital rollers.



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Embryogenesis I week of development. Fertilization, biological significance and the main stages. Crusting: its characteristic, chronology, duration. The structure of the embryo at various stages of fragmentation: morula, blastocyst. Embryoblast and trophoblast.

2 week of development. Gastrulation (Phase I). Embryoblast rearrangement processes: the formation of epiblast and hypoblast, primary and secondary yolk bladder, amniotic bladder. The beginning of the formation of germ layers. The formation of amniotic legs. Differentiation of trophoblast.

3rd week of development. Gastrulation (2nd phase). Primary streak and the formation of 3 germ layers. The formation of chords, neural tubes. The formation of the intestinal tube. Beginning of mesoderm segmentation. Differentiation of hematopoietic islets and the formation of blood vessels in the wall of the yolk bladder and amniotic leg. The development of allantois.

4th week of development. Mesoderm segmentation. The closure of the neural tube. Change in the shape of the embryo and its connection with the yolk bladder. The formation of the head, middle and hindgut.

### **Topic 5 EXTRAEMBRYONIC ORGANS**

The concept of the mother-fetus system. Preimplantation preparation of the endometrium. Implantation: general characteristics, main stages, duration. Trophoblast differentiation: cytotrophoblast and syncytiotrophoblast.

Chorion formation. Features of the villous chorion in different periods of pregnancy. Human placenta: structure, functions. Amnion. Yolk sac (secondary), allantois, their structure and functional significance. The structure of the umbilical cord.

General characteristics and features of histo-, organo- and systemogenesis in humans. Critical periods of the development of the human embryo (P.G. Svetlov).

### **Section 3**

#### **GENERAL HISTOLOGY**

### **Topic 6. EPITHELIAL TISSUES AND GLANDS**

General morphological and functional characteristics of epithelial tissues in connection with their borderline location in the body. The basement membrane. Special organelles of epithelial tissue cells. Cellular bonds in epithelial tissues. Histogenesis of epithelial tissues. Morphofunctional and genetic classification.

The structure and differential composition of various types of single-layer and multilayer epithelial tissues. Histophysiological and reparative regeneration of epithelial tissues. The location of cambial cells in various epithelium.


Secretory function of epithelial tissues. Histophysiology of the secretory process. The structural features of secretory cells depending on the phases of the secretory cycle and the properties of the secreted secretion. The cytological characteristic of the types of secretion: holocrine, apocrine and merocrine. Structural features of exo- and endocrine glands. Classification of exocrine glands in connection with their structure, chemical composition of the secretion and type of secretion.

### **Topic 7. BLOOD AND LYMPH.**

The amount and composition of blood, the main functions. Blood shaped elements.

Red blood cells: quantity, shape, size, structure, function. The concept of anisocytosis and poikilocytosis. White blood cell count. Classification of leukocytes (granulocytes and agranulocytes). The shape, size and structure of various types of white blood cells, their functions. Hemogram. Leukocyte formula. The concept of leukocytosis and leukopenia. The



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number and morphological and functional characteristics of platelets. The concept of physiological blood regeneration (see. Blood formation). The composition of the lymph and the idea of lymph formation.

### **Topic 8. CONNECTIVE TISSUE**

Morphofunctional characteristic of connective tissues. Classification. Contribution of domestic scientists to the study of connective tissue.

Fibrous connective tissue. Classification. Loose fibrous connective tissue. Cells of loose fibrous connective tissue. Fibroblasts, their origin, structure, varieties and potentials of further differentiation; intracellular and extracellular stages of fibrogenesis. Macrophages, their origin, structure, role in the protective reactions of the body, the concept of a mononuclear macrophage system. Adipocytes (fat cells) of white and brown adipose tissue, their origin, structure and significance. Pericytes, their origin, structure and functional characteristics. Plasma cells, their origin, structure, role in immunity. Tissue basophils (mast cells), their origin, structure, participation in the regulation of the state of connective tissue and in the exchange of biogenic amines (monoamines). Pigment cells, their origin, structure, function.

Intercellular substance. General characteristics and structure. The main substance, its physico-chemical properties and significance. Collagen and elastic fibers, their role, structure and chemical composition. Reticular fibers. An idea of the different types of collagen and their localization in the body. The origin of the intercellular substance. Age-related changes. The relationship of blood and loose fibrous connective tissue. The functioning of leukocytes in loose fibrous connective tissue. The interaction of connective tissue cells and leukocytes in the processes of histogenesis, regeneration and protective reactions of the body.

Dense fibrous connective tissue, its varieties, structure and functions. Specialized connective tissue. Reticular tissue, structure, histophysiology and significance. Adipose tissue, its varieties, structure and significance. Pigment tissue, origin, structure. Mucous tissue, structure.

### **Topic 9. SKELETAL TISSUE**


Morphofunctional characteristic of skeletal tissue. Classification. Cartilage tissue. General morphological and functional characteristic. Chondroblast cartilage cells, chondrocytes and chondroclasts. Isogenic blood types. Types of cartilage tissue (hyaline, elastic, fibrous). Histochemical characteristics and structure of the intercellular substance of various types of cartilage tissue. Chondrogenesis and age-related changes in cartilage.

Bone tissue. General morphological and functional characteristic. Classification. Bone tissue: osteocytes, osteoblasts, osteoclasts. Their cyto-functional characteristic. Intercellular substance of bone tissue, its physico-chemical properties and structure. Reticulofibrotic bone tissue. Lamellar (fine fiber) bone tissue. Their localization in the body and morphofunctional features. Histogenesis of bone tissue. Change with age.

General morphological and functional characteristics of the organs of the musculoskeletal system. Bones. The structure of tubular and flat bones. Periosteum (periosteum and endosteum), its structure, role in nutrition, growth and bone regeneration. Vessels and nerves of bone. Bone development (direct and indirect osteogenesis). Bone remodeling in ontogenesis. Factors affecting bone growth.

Cartilage. The structure of hyaline, elastic and fibrous cartilage. Perichondrium, its significance in trophism and cartilage regeneration. The development and growth of cartilage.

Joints. The structure of the joints (diarthrosis). Articular cartilage - structure, growth and nutrition. Articular cartilage regeneration. Joint bag and synovial membrane. The structure of

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symphyses (intervertebral discs) and other types of bone joints (syndesmosis, synchondrosis, synostosis).

### **Topic 10. MUSCULAR TISSUE**

Morphofunctional characteristic of muscle tissue. Classification.

Smooth muscle tissue. Histogenesis, structure and morphofunctional features. Smooth myocyte: structure, organization and histochemical characteristics of its contractile apparatus, the mechanism of the contraction process. Regeneration of smooth muscle tissue. Age-related changes.

Striated muscle tissue. Skeletal muscle tissue (somatic type). Histogenesis. Muscle fiber as a structural unit of tissue. The structure of muscle fiber: the basement membrane, sarcolemma, nuclei, organelles. Organization and histochemical characteristics of the contractile apparatus. Sacromer as a structural unit of myofibrils. The mechanism of muscle contraction. Histochemical and functional features of muscle fibers of various types. Mion. Skeletal muscle tissue regeneration, the importance of myosatellite.

Cardiac muscle tissue (coelomic type). Histogenesis. Classification. Features of the structure and function of contractile and conductive cardiomyocytes of cardiac muscle tissue. Structural and functional features of atrial secretory cardiomyocytes. Morphological and functional characteristics of insertion discs. Possibilities of regeneration of cardiac muscle tissue.

### **Topic 11. NERVOUS TISSUE**

Morphofunctional characteristic of nerve tissue. Histogenesis.

Neurocytes (neurons). Classification of neurocytes: morphological and functional. The structure of the pericarion (body of neurocytes), axon and dendrites. The idea of the chromatophilic substance (tigroid substance) of neurocytes. The role of plasmolemma of neurocytes in the reception and in conducting a nerve impulse. Transport processes in the cytoplasm of neurons. The concept of neurotransmitters and neuropeptides. Neurosecretory cells. Their morphofunctional characteristic.

Neuroglia. General morphofunctional characteristic. Classification. Macro-glia, types of gliocytes: ependymocytes, astrocytes and varieties of oligodendroglia. Their structure, significance and topography. Microglia, origin, structure, function.

Nerve fibers. General morphofunctional characteristic. Classification. The structure of myelin and non-myelin nerve fibers. The process of myelination fiber-con. The mechanism of conducting excitation along nerve fibers in connection with the peculiarities of their structure. Degeneration and regeneration of nerve fibers.

Nerve endings. General morphofunctional characteristic. Receptor endings, their origin, classification and structure. Effector endings, their origin, structure and mechanism of work. The concept of synapses. Interneuronal electrical and chemical synapses, their structure and mechanisms of transmission of excitation. Classification of synapses.


Reflex arcs as a morphological substrate of the reflex activity of the nervous system. The structure of simple and complex reflex arcs.

## **Section 4.**

### **PRIVATE HISTOLOGY**

### **Topic 12. CARDIOVASCULAR AND LYMPHATIC SYSTEM**

Morphofunctional characteristic of the cardiovascular system. Embryonic development of the cardiovascular system.

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Blood vessels. General principles of structure, tissue composition and histochemical features of the walls of blood vessels. Classification of blood vessels. Dependence of the structure of blood vessels on hemodynamic conditions. Vascularization of vessels (vessels of vessels). Innervation of blood vessels. Postnatal changes in the vascular wall. Vascular regeneration.

Arteries. Classification. Features of the structure and function of arteries of various types: muscle, muscular-elastic and elastic. Organ features artery.

The vessels of the microvasculature. Structure, hemodynamic conditions, importance in metabolism and blood deposition. Arterioles, their role in blood circulation. Structure. The importance of endothelio-myocytic contacts in the histophysiology of arterioles. Hemocapillary. Classification, function and structure. Morphological foundations of the process of permeability of capillaries and regulation of their functions. Organ features of capillaries. Veins. Functional value and structure. Arterio-venular anastomoses. Importance for blood circulation. Classification. The structure of arterio-venular anastomoses of various types.

Veins. The structure of the vein wall due to hemodynamic conditions. Classification. The structural features of the veins of various types (muscle and non-muscular). The structure of venous valves. Organ features of the veins.

Lymphatic vessels. Structure and classification. The structure of the lymphatic capillaries and various types of lymphatic vessels. The participation of lymphatic capillaries in the microcirculation system.

A heart. General morphofunctional characteristic. Embryonic development. The structure of the wall of the heart, its membranes, their tissue composition. Heart valves. Conductive system of the heart. Cytophysiology of myocardial cardiomyocytes. The endocrine function of the heart in connection with the cytophysiological features of atrial cardiomyocytes. The conduction system of the heart, its morphological and functional characteristics, its significance in the work of the heart. The structure of the pericardium. Vessels of the heart. Innervation of the heart. The heart of the newborn. Perestroika and development of the heart after birth. Age-related changes in the heart.


### **Topic 13. URINARY SYSTEM**

Morphological and functional characteristics of the urinary system. Embryonic development. The kidneys. Cortical and medulla of the kidney. Nephron - as a morphofunctional unit of the kidney, its structure. Types of nephrons. Vascularization of the kidney. The structure of vascular glomeruli and renal bodies. Histophysiology of nephrons and collecting tubules. The concept and structure of the countercurrent system of the kidney. Morpho-functional basis for the regulation of urine formation. The endocrine apparatus of the kidney is the juxtaglomerular complex and interstitial cells. Their structure and function. Innervation of the kidney. Regenerative potency. Features of the kidney in the newborn. Subsequent age-related changes in the kidney.

Urinary tract. The structure of the wall of the renal calyx and pelvis. Morphological and functional characteristics of the ureters, bladder and urethra. Structural features of the male and female urethra.

### **Topic 14. DIGESTIVE SYSTEM**

Morphological and functional characteristics of the digestive system. The structure of the walls of the digestive canal. The mucous membrane, the submucosa, the muscle membrane, the outer membrane, their tissue composition. The concept of the mucous membrane, its structure and significance. Innervation and vascularization of the digestive canal.

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Oral cavity. Embryonic development. The structure of the mucous membrane in connection with the function and characteristics of the conditions in the oral cavity. The structure of the lips, cheeks, hard and soft palate, tongue, gums, tonsils; their blood supply and innervation.

Large salivary glands. Exo and endocrine functions. Embryonic development. Structure. Blood supply and innervation.

Tongue. Structure. Features of the structure of the mucous membrane on the upper and lower surfaces of the organ. Papillae of the tongue and their types. Blood supply and innervation.

Teeth. Structure. Enamel, dentin and cement - structure, value and chemical composition. Tooth pulp - structure and meaning. Periodontium - structure and significance. Blood supply and innervation of the tooth. Change of teeth. Age-related changes.

Throat and esophagus. General morphofunctional characteristic. Embryonic development. The structure and tissue composition of the wall of the pharynx and esophagus in its various departments. Glands of the esophagus, their histophysiology. Features of the structure of the esophagus in newborns and in various age periods after birth.

Stomach. General morphofunctional characteristic. Embryonic development. The structure of the mucous membrane in various parts of the body. Cytophysiological characteristics of integument epithelium. The localization, structure and cellular composition of the glands in different parts of the stomach. Cytophysiology of exo- and endocrine glands. Regeneration of the epithelium and epithelium of the glands of the stomach. Blood supply and innervation of the stomach. Age-related features of the structure of the stomach.

Small intestine. General morphofunctional characteristic. Embryonic development. The structure of the wall, its tissue composition. The crypt-villus system as a structurally functional unit. Types of epithelial cells of villi and crypts, their structure and cyto-physiology. Histophysiology of the process of parietal digestion and absorption. The role of mucus and microvilli of enterocytes in parietal digestion. Regeneration of the epithelium of the small intestine. Blood supply and innervation of the wall of the small intestine. Age-related changes in the wall of the small intestine.


Colon. General morphofunctional characteristic. Embryonic development. The structure of the wall of the colon, its tissue composition. Features of the structure of the mucous membrane in connection with the function. Types of cells of its epithelium, their cytophysiological characteristic. Blood supply. Innervation.

Appendix. Features of its structure and significance.

Rectum. The structure of the wall in the pelvic and anal parts of the rectum due to their functional features.

Pancreas. General morphofunctional characteristic. Embryonic development. The structure of exocrine and endocrine departments. Cytophysiological characteristics of acinar cells. Types of insular cells and their morphological and functional characteristics. Acinoinsular cells, their structural and functional features. Innervation. Regeneration. Features of histophysiology in different periods of childhood. Changes in the gland during aging.

Liver. General morphofunctional characteristic. Embryonic development. Features of blood supply. The structure of the lobule as a structurally functional unit of the liver. Representations of the portal lobule and acinus. The structure of intralobular sinusoidal vessels, the cytophysiology of their cellular elements. Hepatocytes, their structure and functions. The structure of the bile canaliculi (cholangiol) and interlobular bile ducts. Innervation. Regeneration. Features of the structure of the liver of newborns. Morphological and functional characteristics of the liver of young children and the aging organism. Gall bladder and biliary tract. Development. Structure.

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### **Topic 15. HEMATOPOIETIC AND LYMPHOID ORGANS**

Morphological and functional characteristics of the hematopoietic system and immune defense. The main sources and stages of the formation of hematopoietic organs in phylogenesis of vertebrates. Mesoblastic, hepatolienal and medullary-lymphatic stages of the formation of the blood system in ontogenesis in humans.

Central organs of blood formation and immunogenesis.

Bone marrow. General morphofunctional characteristic. The structure, tissue composition and function of the red bone marrow. Features of vascularization and the structure of geocapillaries. Yellow marrow. Bone marrow development in the prenatal period. Features in children and age-related changes. The possibility of damaging effects on bone marrow radiation due to its morphological and functional features. Bone marrow regeneration.

Thymus. General morphofunctional characteristic. Embryonic development. Role in lymphocytopoiesis. The structure and tissue composition of the cortical and medulla. Vascularization. The structure and significance of the blood-thymus barrier. Temporary (accentual) and age-related involution of the thymus.

Peripheral organs of hematopoiesis and immunogenesis

Lymph nodes in the wall of the airways and digestive tract (single and multiple). Their structure, cellular composition and significance.

The lymph nodes. General morphofunctional characteristic. Embryonic development. The structure and fabric composition. Cortical and medulla, paracortical zone. Their morphological and functional characteristics, cellular composition. T and B zones. The system of sines. Vascularization. The role of blood vessels in the development and histophysiology of lymph nodes. Innervation. Regeneration of the lymph nodes. Age-related changes. Features in newborns.

Hemolymphatic nodes. Structure and functional value.

Spleen. General morphofunctional characteristic. Embryonic development. The structure and fabric composition. White and red pulps, their morphofunctional characteristics and cellular composition, T and B zones. Blood supply to the spleen. Structural and functional features of venous sinuses. Innervation. Regenerative capabilities of the spleen. Features in newborns. Age-related changes.

Hemocytopoiesis and immunocytopoiesis

The development of blood as tissue (embryonic hematopoiesis). Postembryonic hematopoiesis and immunocytopoiesis. The unitary theory of hematopoiesis of A.A. Maksimov and its modern interpretation. Characterization of stem and semi-stem cells (pluripotent precursors), unipotent precursors. Stem cell circulation in the body. The concept of colony forming units (CFU) of blood cells. Characterization of blast forms of blood cells. Morphologically identifiable stages of the development of blood cells are differentiating (maturing) cells and differentiated (mature) cells.


### **Topic 16. ENDOCRINE SYSTEM**

Morphological and functional characteristics of the endocrine system. Central and peripheral links of the endocrine system. The concept of hormones, target cells and their receptors for hormones. The relationship of the endocrine and nervous systems.

Hypothalamic-pituitary neurosecretory system.

Hypothalamus. General morphofunctional characteristic. Embryonic development. Large and small cell nuclei of the hypothalamus and their morphological and functional features.



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Adenohypophysotropic zone of the hypothalamus. Liberins and statins. Ways of regulation of the glands of the endocrine system by the hypothalamus. Regulation of the functions of the hypothalamus by the nervous and endocrine systems.

Pituitary. General morphofunctional characteristic. Embryonic development. The structure of the adenohypophysis and neurohypophysis. Cytofunctional characteristic of adenocytes of the anterior pituitary gland. Hypothalamoadenohypophysial circulation, its role in the interaction of the hypothalamus and pituitary gland. Cytofunctional characteristic of adenocytes of the middle pituitary gland. The structure and function of the neurohypophysis, its connection with the hypothalamus. Vascularization and innervation of the pituitary gland. The pituitary gland of the newborn and its restructuring at the stages of ontogenesis.

Epiphysis. General morphofunctional characteristic. Embryonic development. Structure, cellular composition. Communication with other endocrine glands. Innervation. Age-related changes.

Thyroid. General morphofunctional characteristic. Embryonic development. Structure. Follicles as morphological and functional units, wall structure and colloid composition of follicles. Thyrocytes, their hormones and phases of the secretory cycle. The role of thyrocyte hormones. Restructuring of follicles in connection with various functional activity. C cells. Sources of development, localization and function. Thyroid vascularization and innervation. Thyroid epithelium proliferation in newborns and ontogenesis.

Parathyroid glands. General morphofunctional characteristic. Embryonic development. The structure and cellular composition. Hormone. A role in the regulation of mineral metabolism. Vascularization, innervation and regulation mechanisms of the parathyroid glands. The structure of the parathyroid glands in newborns and age-related changes.

Adrenal glands. General morphofunctional character.

### **Topic 17. RESPIRATORY SYSTEM**

Morphological and functional characteristics of the respiratory system. Airborne puti and respiratory department. Embryonic development. The concept of non-respiratory functions of the respiratory apparatus - metabolic, immune defense, etc. and their structural support.


Extrapulmonary airways. The structural features of the wall of the airways: nasal cavity, larynx, trachea and main bronchi. Tissue composition and histo-functional characteristic of their shells. The cellular composition of the epithelium of the mucous membrane.

Lungs. Intrapulmonary airways: bronchi and bronchioles, the dependence of the wall structure and cellular composition of the mucosal epithelium on their caliber.

Acinus as a morphofunctional unit of the lung. Structural components of acinus. The structure of the wall of the alveoli. Types of pneumocytes, their cytofunctional characteristics. Structural and chemical organization and function of the surfactant-alveolar complex. The structure of the interalveolar septa. Aero-hematic barrier and its importance in gas exchange. Macrophages of the lung. Blood supply to the lung. Innervation. The structure of the lungs of newborns (live and stillborn). Lung development in the postnatal period. Age-related changes in the lung during aging. Regenerative potentials of the respiratory system. Pleura. Morphofunctional characteristic.

### **Topic 18. SKIN AND ITS DERIVATIVES**

Leather. Morphofunctional characteristic. Embryonic development. Fabric composition. Epidermis. Layers of the epidermis. Their cellular composition. Structural features of the epidermis of thick and thin skin. The concept of the process of keratinization. Structural and biochemical changes in cells during keratinization. Cellular renewal of the epidermis and the idea of

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its core organization. The local system of immune surveillance of the epidermis, its composition and significance. Pigment cells of the epidermis, their origin, structure and role. Tactile cells. Basal lamina, dermal-epidermal junction. Dermis. Papillary and reticular layers, their tissue composition. Vascularization of the skin. Innervation of the skin. Regeneration. Hair. Development, structure, growth and change of hair. Nails The development, structure and growth of nails.

### **Topic 19. NERVOUS SYSTEM**

Morphofunctional characteristic of the nervous system. Embryonic development. Peripheral nervous system. Nerve. Structure. Fabric composition. Damage response: regeneration. Sensitive nerve nodes: (spinal and cranial). Functions Structure. Fabric composition. Cytofunctional characteristic of neurocytes.

Central nervous system. Features the structure of gray and white matter. The concept of nerve centers. The structure of the meninges. Spinal cord. General morphological and functional characteristics. Embryonic development. The structure of gray matter. Its neural composition and types of gliocytes. Spinal cord nuclei, their structure and functional characteristics .. Own reflex apparatus of the spinal cord. The composition of the front and rear roots. The structure of white matter. Morphofunctional characteristics of the pathways. Cerebellum. General morphofunctional characteristic. The structure and neural composition of the cerebellar cortex. Afferent and efferent nerve fibers. Inter-neuronal connections in the cerebellar cortex. Cerebellar Glyocytes.

Cortex of the cerebral hemispheres. General morphological and functional characteristics. Cytoarchitectonics: neural composition and plates (layers) of the cortex of the large hemispheres. Interneuronal communications. The idea of the modular organization of the cortex. Mioarchitectonics: radial and tangential nerve fibers. Glyocytes. Structural features of the cortex in the motor zones and in the central departments of the analyzers. The blood-brain barrier, its structure and significance.

Autonomic (vegetative) nervous system. General morphological and functional characteristics. The structure and neural composition of the ganglia of the autonomic nervous system (extra- and intramural). The structure of the nuclei of the central parts of the autonomic nervous system. Pre- and postganglionic nerve fibers. Structural features of reflex arcs of the autonomic nervous system. Age-related changes in the organs of the nervous system.


### **Topic 20. SENSORY ORGANS**

Characterization of sensory organs in the light of the doctrine of analyzers (sensory systems). The classification of the senses. The general principle of cellular organization (receptor and supporting).

Organ of vision. General morphofunctional characteristic. Embryonic development. The general plan of the structure of the eyeball. Shells, their departments and derivatives, weave composition. The main functional devices: diopter, accommodative and receptor. The structure and role of the constituent cornea, lens, vitreous, iris, retina. Neural composition and retinal gliocytes, their morphofunctional characteristic. Structural features of the central fossa of the optic disc. The concept of a visual analyzer. Retinal pigment epithelium, structure and significance. Features of blood supply to the eyeball. Hematophthalmic barrier, its composition and significance. Age-related changes. Auxiliary organs of the eye (eyelids, lacrimal apparatus).

Olfactory organ. General morphofunctional characteristic. Sources and the course of embryonic development. The structure and cellular composition of the olfactory lining: receptor, supporting and basal cells. Histophysiology of the organ of smell. Age-related changes.



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Organ of taste. General morphological and functional characteristics and the course of embryonic development. The structure and cellular composition of taste buds: taste, supporting and basal cells. The innervation of taste buds. Histophysiology of the organ of taste.

The organs of hearing and balance. General morphofunctional characteristic. Sources and the course of embryonic development. Outer ear: the structure of the skin of the external auditory meatus, the structure of the eardrum. Middle ear: characteristic of the epithelium of the tympanum and auditory tube. Inner ear: bony and membranous labyrinths. The vestibular part of the membranous labyrinth: elliptical and spherical sacs and semicircular canals. Their receptor departments: the structure and cellular composition of the spot and ampullar scallops. Innervation. Histophysiology of the vestibular labyrinth. The cochlear part of the membranous labyrinth: the structure of the cochlear canal, the structure and cellular composition of the spiral organ, its innervation. Histophysiology of sound perception. The concept of an auditory analyzer. Age-related changes.

### **Topic 21. REPRODUCTIVE SYSTEM**

Morphofunctional characteristics of the genital system. Embryonic development. Primary gonocytes, initial localization, migration paths to the germ of the gonad. The histologically indifferent stage of gonad development and histogenetic processes at this stage. Factors of sexual differentiation. The tissue composition of the organs of the genital system.

Male genital organs. Histogenetic processes in the germ of the gonad leading to the development of the testis. Development of the vas deferens.

Testicle. General morphofunctional characteristic. Curved seminiferous tubules, wall structure. Spermatogenesis. The cytological characteristic of its main phases. The role of Sustentocytes in spermatogenesis. Testicular endocrine function: male sex hormone and the glandulocytes synthesizing it, their cytochemical features, participation in the regulation of spermatogenesis. Hematotesticular barrier. Histophysiology of direct canaliculi, tubules of the network and efferent tubules of the testis. Regulation of generative and endocrine testicular function. Features of the testicle of the newborn, before puberty, during puberty and with aging.


The possibility of a damaging effect on the testicles of physico-chemical factors - radiation, alcohol, temperature, etc. in connection with their morpho-functional features.

The vas deferens. The epididymis. Vas deferens. Seed puffs. Ejaculation channel. Prostate. Their structure and functions. Age-related changes. Penis. Structure, vascularization, innervation.

Female genitals. Histogenetic processes in the germ of the gonad leading to the development of the ovary. Embryonic development of the oviducts and uterus.

Ovary. General morphofunctional characteristic. Structural features of the cortical and medulla. Ovogenesis Differences of ovogenesis from spermatogenesis. The structure and development of follicles. Ovulation. The concept of the ovarian cycle and its regulation. The development, structure and functions of the corpus luteum during the ovarian cycle and during pregnancy. Atresia of the follicles. Ovarian endocrine function: female sex hormones and their cellular elements. Features of the ovary of newborns before puberty, during puberty and aging. Vascularization and innervation. Morpho-functional basis of the sensitivity of the ovaries to the effects of radiation, alcohol and other factors.


The fallopian tubes. Structure and function. Uterus. General morphofunctional characteristic. The structure of the uterine wall in its various departments. The menstrual cycle and its phases. Features of the structure of the endometrium in various phases of the cycle. The relationship of cyclic changes in the endometrium and ovary. Reconstruction of the uterus during

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pregnancy and after childbirth. Vascularization and uterine innervation. Features of the uterus of newborns, girls before puberty, during puberty, in adults

## 6. Topics of practical classes and seminars


	<b>Section 3 General Histology</b>
<b>Topic 1.</b>	<p><b>Epithelial tissue. Single layer epithelium.</b> Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. The concept of fabric.</li> <li>2. Classification of tissues.</li> <li>3. General morphological and functional characteristics and classification of epithelial tissues.</li> <li>4. Histogenesis of epithelial tissues.</li> <li>5. Intercellular communication in epithelial tissues.</li> <li>6. Special organelles of epithelial tissue cells.</li> <li>7. The basement membrane.</li> <li>8. The structure of single-layer and multi-row epithelium.</li> </ol> <p>To study under a microscope: the structure of a single-layered squamous epithelium of the peritoneum (mesothelium); single-layer cubic epithelium of the renal tubules, single-layer prismatic epithelium of the small intestine and multilinear ciliary epithelium of the trachea.</p>
<b>Topic 2.</b>	<p><b>Epithelial tissue. Stratified and glandular epithelium.</b> Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. Embryogenesis, structure and functions of stratified epithelium.</li> <li>3. Classification and structure of exocrine glands.</li> <li>4. Secretory cycle.</li> <li>5. Features of the structure of secretory cells depending on the phases of the secretory cycle.</li> <li>6. Types of secretion.</li> </ol> <p>To study under a microscope: the structural organization of the stratified squamous non-keratinized epithelium of the cornea of the eye, the structural organization of the stratified squamous keratinized epithelium of the skin (epidermis), the structural organization of the transitional epithelium of the bladder ..</p>
<b>Topic 3.</b>	<p><b>Actually connective tissue. Loose fibrous unformed connective tissue.</b> Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. General characteristics and classification of connective tissue.</li> <li>2. The structure and function of cellular elements of loose fibrous unformed connective tissue.</li> <li>3. General characteristics and structure of the intercellular substance of loose fibrous unformed connective tissue.</li> <li>4. The role of loose fibrous connective tissue cells in the processes of regeneration, restoration and protective reactions of the body.</li> </ol> <p>To study under a microscope: the structure of cellular elements and structures of the intercellular substance of loose connective tissue, the accumulation of paint in histiocytes of loose connective tissue.</p>
<b>Topic 4.</b>	<p><b>Blood and lymph.</b> Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. The concept of musculoskeletal tissue.</li> </ol>

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	<ol style="list-style-type: none"> <li>2. Tissues of the internal environment.</li> <li>3. Blood and lymph. Their composition and main functions.</li> <li>4. The structure of blood cells, their functions.</li> <li>5. Morphological classification of leukocytes.</li> <li>6. Hemogram and white blood cell count.</li> <li>7. Features of the blood of the fetus, newborn, postnatal dynamics.</li> </ol> <p>To study under a microscope: the formed elements of blood in a smear of human blood, the structural organization of blood reticulocytes, human platelets.</p>
<b>Topic 5.</b>	<p><b>Dense fibrous connective tissue. Connective tissue with special properties.</b></p> <ol style="list-style-type: none"> <li>1. The structure and functions of dense unformed and dense decorated connective tissue.</li> <li>2. The structure and function of connective tissue with special. properties.</li> </ol> <p>To study under a microscope: the structural organization of loose and dense unformed connective tissue of the skin of the finger; the structure of the transverse section of the tendon, the structure of the reticular tissue in the lymph node, the structure of the adipose tissue of the omentum and the structure of the mucous tissue of the umbilical cord.</p>
<b>Topic 6.</b>	<p><b>Final lesson on topics 1-5.</b></p> <p>Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. Morphofunctional classification of tissues. Evolutionary and genetic principles of tissue classification.</li> <li>2. Classification and general characteristics of epithelial tissues.</li> <li>3. Single-layer epithelium: origin, structure, localization.</li> <li>4. Stratified epithelium: origin, structure, localization. Regeneration of the integument epithelium.</li> <li>5. Iron epithelium: secretory cycle, types of secretion, classification and general plan of the structure of exocrine glands.</li> <li>6. Blood: composition, structure and function of the formed elements, leukocyte formula. Age-related changes in blood.</li> <li>7. The development of blood as tissue.</li> <li>8. Postembryonic hematopoiesis and physiological blood regeneration (erythro-, granulo-, lympho- and monocytopenesis).</li> <li>9. Classification of connective tissue. The structure and functions of cellular elements of loose fibrous unformed connective tissue. Their role in the protective reactions of the body and in the process of regeneration.</li> <li>10. General characteristics and structure of the intercellular substance of loose fibrous unformed connective tissue.</li> <li>11. The structure and function of dense unformed and decorated connective tissue.</li> <li>12. The structure and function of connective tissues with special properties.</li> </ol> <p>List of micropreparations for diagnosis.</p> <ol style="list-style-type: none"> <li>1. Multiple ciliary epithelium of the trachea.</li> <li>2. Stratified squamous epithelium of the cornea of the eye.</li> <li>3. Stratified squamous keratinized epithelium of the skin of the finger.</li> <li>4. Transitional epithelium of the mucous membrane of the bladder.</li> <li>5. A smear of human blood.</li> <li>6. Cross section of a tendon.</li> </ol>
<b>Topic 7</b>	<p><b>Skeletal tissue. Cartilage tissue.</b></p> <p>Questions to the topic.</p>

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	<ol style="list-style-type: none"> <li>1. Morphological and functional characteristics and classification of cartilage.</li> <li>2. The structure and function of cartilage cells.</li> <li>3. Histochemical characteristics and structure of the intercellular substance of cartilage.</li> <li>4. The structure of hyaline, fibrous and elastic cartilage.</li> </ol> <p>To study under a microscope: the structural organization of hyaline cartilage of the rib, the structural organization of elastic cartilage of the auricle, the structural organization of the fibrous cartilage of the intervertebral disc.</p>
<b>Topic 8</b>	<b>Skeletal tissue. Bone tissue</b> Questions to the topic. <ol style="list-style-type: none"> <li>1. Morphological and functional characteristics and classification of bone tissue.</li> <li>2. The general plan of the structure of coarse-fibrous and lamellar bone tissue.</li> <li>3. The structure of the tubular bone.</li> <li>4. Regeneration and age-related bone remodeling.</li> </ol> <p>To study under a microscope: the structure of the preparation of bone development at the site of cartilage, the structure of the preparation of development of bone at the site of connective tissue of the lower jaw, the structural organization of the diaphysis of the tubular bone.</p>
<b>Topic 9.</b>	<b>Skeletal muscle tissue.</b> Questions to the topic. <ol style="list-style-type: none"> <li>1. Morphological and functional characteristics and classification of muscle tissue.</li> <li>2. The structure of muscle fiber.</li> <li>3. Blood supply, innervation and age-related muscle changes.</li> </ol> <p>Examine under a microscope: the structural organization of striated muscle tissue</p>
<b>Topic 10</b>	<b>Cardiac and smooth muscle tissue.</b> Questions to the topic: <ol style="list-style-type: none"> <li>1. The structure, functional features and regeneration of striated cardiac muscle tissue.</li> <li>2. Classification, structure, functional features of smooth muscle tissue.</li> </ol> <p>To study under a microscope: the structural organization of cardiac muscle tissue, the structural organization of smooth muscle tissue of the bladder.</p>
<b>Topic 11.</b>	<b>Nerve tissue.</b> Questions to the topic. <ol style="list-style-type: none"> <li>1. General morphological and functional characteristics of the nervous tissue.</li> <li>2. Classification, structure and functional features of neurocytes and neuroglia.</li> <li>3. Regeneration of nerve tissue.</li> </ol> <p>Examine under a microscope: a tigroid in the nerve cells of the spinal cord, neurons of the cerebral cortex.</p>
<b>Topic 12.</b>	<b>Nerve tissue.</b> Questions to the topic. <ol style="list-style-type: none"> <li>1. Morphofunctional characteristic, classification of nerve fibers.</li> <li>2. The structure of myelin and non-myelin nerve fibers.</li> <li>3. Degeneration and regeneration of nerve fibers.</li> <li>4. Morphological and functional characteristics of nerve endings.</li> <li>5. The concept of synapses, their classification and structure.</li> </ol> <p>To study under a microscope: the structure of myelin and non-myelin nerve fibers, the structure of free and non-free nerve endings in the dense connective tissue of the finger skin</p>
<b>Topic 13.</b>	<b>Questions on the topics of the section Final lesson on topics 7-12.</b> <ol style="list-style-type: none"> <li>1. Cartilage tissue: morphological and functional characteristics, classification,</li> </ol>


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	<p>structure, functions, blood supply, age-related changes.</p> <ol style="list-style-type: none"> <li>2. The structure of hyaline, elastic and fibrous cartilage.</li> <li>3. Bone tissue: morphological and functional characteristics and classification.</li> <li>4. The structure of coarse-fibrous and lamellar bone tissue.</li> <li>5. The structure of the diaphysis of the tubular bone.</li> <li>6. Regeneration and age-related bone remodeling.</li> <li>7. Smooth muscle tissue: classification, structure, functional features.</li> <li>8. Skeletal muscle tissue: the structure and function of striated skeletal muscle fiber. The process of contraction of muscle fibers.</li> <li>9. The structure of the muscle as an organ. Skeletal muscle tissue regeneration.</li> <li>10. The structure of cardiac muscle tissue.</li> <li>11. Morphological and functional characteristics of nerve tissue: classification, structure and function of neurons and neuroglia.</li> <li>12. The structure and regeneration of nerve fibers.</li> <li>13. Nerve endings: classification and structure.</li> </ol> <p>SLIDES</p> <ol style="list-style-type: none"> <li>1. Hyaline cartilage.</li> <li>2. Elastic cartilage.</li> <li>3. Fibrous cartilage.</li> <li>4. A cross section of the diaphysis of the tubular bone.</li> <li>5. Cross-striped muscle tissue of the tongue.</li> <li>6. Myelin nerve fibers of the sciatic nerve.</li> </ol>
	<p><b>Section 4 Private Histology</b></p>
<p><b>Topic 14.</b></p>	<p><b>The cardiovascular system. The structure of arteries and veins.</b></p> <p>Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. General morphological and functional characteristics, sources and course of embryonic development of the organs of the vascular system.</li> <li>2. General principles of structure, tissue composition, dependence of the structure of blood vessels on hemodynamic conditions, vascular regeneration.</li> <li>3. Arteries: structural features and functions of arteries of various types.</li> <li>4. Veins: structural features of various types of veins.</li> </ol> <p>To study under a microscope: the structural organization of the cross-section of an elastic type artery (aorta), muscle type artery, vein with a strong development of muscle elements (femoral vein).</p>
<p><b>Topic 15.</b></p>	<p><b>The cardiovascular system. Microcirculatory bed. A heart.</b></p> <p>Questions to the topic.</p> <ol style="list-style-type: none"> <li>1. The vessels of the microvasculature.</li> <li>2. The structure and role in the blood circulation of arterioles.</li> <li>3. Classification, function and structure of hemocapillaries.</li> <li>4. The structure of the wall of venules.</li> <li>5. The structure and classification of lymphatic vessels.</li> <li>6. The heart. Fetal sources.</li> <li>7. Features of the structure of the wall of the heart and its membranes, heart valves, the conductive system.</li> <li>8. Vascularization and innervation of the heart.</li> </ol> <p>To study under a microscope: the structural organization of the microvasculature of the mesentery, the structural organization of the transverse section of the heart wall, the structural organization of the conduction system of the heart</p>

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<b>Topic 16.</b>	<b>Urinary system.</b> Questions to the topic. 1. General morphological and functional characteristics. 2. The kidneys. Cortical and medulla. 3. Nephron: types, histophysiology. 4. Morphofunctional basis for the regulation of the process of urination. Juxtglomerular complex. 5. Vascularization, innervation, regenerative capabilities of the kidney. 6. Urinary tract, the structure of the walls of the renal calyces, cups and pelvis. Morphological and functional characteristics of the ureter, bladder, urethra. To study under a microscope: the structural organization of the cortical and medulla of the kidney, the structural organization of the cross section of the wall of the ureter and bladder.
<b>Topic 17.</b>	<b>Final lesson on topics 14-16.</b> Questions to the topic: 1. The kidneys. Cortical and medulla. 2. Nephron. Types. Histophysiology. 3. Juxtglomerular apparatus of the kidneys. 4. Urinary tract, the structure of the walls of the renal cups and pelvis. 5. The structure of the ureter, bladder, urethra. 6. The structure of the arteries of the elastic type. 7. The structure of the arteries of the mixed and muscle type. 8. The structure and functions of arterioles and capillaries. 9. Arteriovenular anastomoses. 10. The structure of the veins of the muscleless and muscular type. 11. Embryogenesis of the heart. 12. The structure of the endocardium. 13. The structure of the myocardium. <b>SLIDES</b> 1. The kidney. 2. The bladder 3. Arterioles, capillaries, venules 4. Ureter 5. Elastic type artery 6. Muscular vein 7. The wall of the ventricle of the heart. Purkinje fibers.
<b>Topic 18.</b>	<b>Diagnosis of slides by general histology.</b> 1. Multiple ciliary epithelium of the trachea. 2. Stratified squamous epithelium of the cornea of the eye. 3. Stratified squamous keratinized epithelium of the skin of the finger. 4. Transitional epithelium of the mucous membrane of the bladder. 5. A smear of human blood. 6. Cross section of a tendon. 7. Hyaline cartilage. 8. Elastic cartilage. 9. Fibrous cartilage. 10. A cross section of the diaphysis of the tubular bone. 11. The striated muscle tissue of the tongue.




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	12. Myelin nerve fibers of the sciatic nerve.
<b>Topic 19.</b>	<b>Digestive system. Anterior digestive tube.</b> Questions to the topic. 1. The general plan of the microscopic structure of the digestive tube. 2. The oral cavity. Lips, cheeks, hard and soft palate, tongue, gums, tonsils; their structure, blood supply and innervation. 3. Language. Structure. Features of the structure of the mucous membrane on the upper and lower surfaces. Papillae of the tongue. Blood supply and innervation. 4. Large salivary glands: parotid, submandibular, sublingual. The structure of the end departments and excretory ducts. To study under a microscope: the structural organization of the palatine tonsils, the structural features of the tongue, the structural organization of the serous and mixed salivary glands.
<b>Topic 20.</b>	<b>Digestive system. Anterior digestive tube.</b> Questions to the topic. 1. The teeth. Structure, embryonic sources, blood supply, innervation, age-related changes. 2. Throat and esophagus. Function, wall structure, embryonic sources, structure of various sections of the esophagus wall. To study under a microscope: the structural organization of the bookmark of the enamel organ, the preparation for the development of dentin and tooth enamel, the structural organization of the cross section of the esophagus.
<b>Topic 21.</b>	<b>Digestive system. The middle and posterior sections of the digestive tube.</b> Questions to the topic. 1. The stomach. Morphofunctional characteristic, embryonic sources. Wall structure, blood supply and innervation. 2. The structure of the mucous membrane in various parts of the stomach, its glands and their cellular composition. 3. The small and large intestine. Fetal sources. Morphological and functional characteristics, wall structure. Features of the structure of the mucous membrane in various departments. 4. Blood supply and innervation. To study under a microscope: the features of the transition of the esophagus into the stomach, the structural organization of the wall of the fundus of the stomach, the structural organization of the wall of the pyloric stomach, the structural organization of the wall of the duodenum, the structural organization of the wall of the jejunum and colon.
<b>Topic 22.</b>	<b>Digestive system. Digestive glands.</b> Questions to the topic. 1. The pancreas. Morphofunctional characteristics, embryonic sources: structure of the endocrine and exocrine departments. Cytophysiological characteristic of their secretory cells, blood supply, innervation, regeneration. 2. The liver. Morphofunctional characteristic, embryonic sources. Features of blood supply, lobule structure. Intralobular hemocapillaries. The structure and function of hepatocytes. Regenerative potency of the liver. To study under a microscope: the structural organization of the exocrine and endocrine parts of the pancreas, compare the structural organization of the liver of a pig and the human liver.



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<b>Topic 23.</b>	<b>Hematopoietic and immune defense organs.</b> Questions to the topic. 1. General morphological and functional characteristics and embryonic sources. 2. Structure, function, age-related features, regeneration of red bone marrow. 3. Thymus. Structure, tissue composition, vascularization, regeneration, age-related changes. Examine under a microscope: the structural organization of the thymus, spleen, smear of red bone marrow.
<b>Topic 24.</b>	<b>Hematopoietic and immune defense organs.</b> Questions to the topic. 1. Lymph nodes and lymphatic follicles of the digestive tract. Structure, tissue composition, vascularization, regeneration, age-related changes. 2. The spleen. Structure, tissue composition, blood supply, innervation, regeneration, age-related changes. Examine under a microscope: the structural organization of the lymph node, spleen.
<b>Topic 25</b>	<b>Endocrine system.</b> Questions to the topic. 1. General morphological and functional characteristics of the endocrine system. The concept of hormones. 2. Classification of endocrine glands. The concept of target cells and hormone receptors. 3. Characterization of the hypothalamic-pituitary neurosecretory system. Adenohypophysial zone of the hypothalamus. Liberins and statins. 4. The pituitary gland. The structure, tissue and cellular composition of the adenohypophysis. Hypothalamic-adenohypophysial circulation. 5. The structure and function of the neurohypophysis. 6. Epiphysis. Embryonic sources, structure, cellular composition, connection with other endocrine glands. To study under a microscope: the structural organization of the pituitary, pineal gland,
<b>Topic 26.</b>	<b>Endocrine system.</b> Questions to the topic. 1. Thyroid gland, Embryonic sources, structural features, functions, cellular composition, hormones, vascularization and innervation. 2. The parathyroid glands. Embryonic sources, structural features, functions, cellular composition, hormones, vascularization and innervation. 3. The adrenal glands. Embryonic sources, structural features, functions, cellular composition, hormones, vascularization and innervation. Examine under a microscope: the structural organization of the thyroid gland, parathyroid gland, adrenal gland.
<b>Topic 27.</b>	<b>Final lesson on topics 19-26.</b> 1. The relationship of the nervous and endocrine systems, the classification of endocrine glands. 2. The development and structure of the hypothalamus, its hormones. 3. The development of the pituitary gland. The structure and function of the adenohypophysis. 4. Development of the pituitary gland, structure and function of the middle and posterior pituitary gland. Vascularization of the pituitary gland. 5. Development, structure and function of the pineal gland.

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6. The development, structure and function of the thyroid gland.
7. Adrenal glands. Development, structure and function of the adrenal cortex.
8. Adrenal glands. Development, structure and function of the adrenal medulla.
9. The general plan of the structure of the digestive canal.
10. Embryonic development and structure of the lips, cheeks, hard and soft palate, tongue, gums, tonsils; their blood supply and innervation.
11. The structure of the tongue. Features of the structure of the mucous membrane on the upper and lower surfaces. Papillae of the tongue.
12. Embryonic development and structure of the tooth.
13. Large salivary glands. Embryonic development, structure, exo- and endocrine functions. Blood supply and innervation.
14. The esophagus. Embryonic development, structure, histophysiology of the glands of the esophagus.
15. The stomach. The structure of the stomach and mucous membrane. Localization, structure and cellular composition of the glands in various parts of the stomach. Cytophysiology of exo- and endocrine glands. Blood supply and innervation. Thymus. Development, structure.
16. Red bone marrow. Development, structure, vascularization, age-related changes, regeneration.
17. The structure and function of the lymph node
18. The spleen. Development, structure of the white pulp. Vascularization.
19. The small intestine. General morphological and functional characteristics, wall structure. The structure of the mucous membrane in various departments. Blood supply and innervation.
20. The large intestine. The structure of the wall and mucous membrane.
21. The rectum. The structure of the wall in the pelvic and anal parts due to their functional features.
22. The pancreas. Embryonic development, the structure of the exo- and endocrine department, the cytophysiology of their cellular composition. Blood supply and innervation.
23. The liver. Embryonic development. Features of the structure, blood supply and innervation. The structure and function of hepatocytes.

List of micropreparations for diagnosis.


1. Thymus.
2. The pituitary gland.
3. The thyroid gland.
4. The parathyroid gland.
5. Adrenal glands.
7. Tooth development (enamel organ).
8. The development of dentin and enamel.
9. Larynx (filiform papillae).
10. The parotid gland.
11. The hyoid gland.
12. The pancreas.
13. The esophagus.
14. The transition of the esophagus into the stomach.
15. The human liver.

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	16. The bottom of the stomach. 17. The pyloric part of the stomach. 18. The duodenum. 19. The small intestine. 20. The large intestine. 21. The liver of a pig. 22. Lymph node. 23. The spleen. 24. Thymus.
<b>Topic 28.</b>	<b>Respiratory system.</b> Questions to the topic. 1. General morphological and functional characteristics. 2. The structure of the wall of the airways: nasal cavity, larynx, trachea, main bronchi, bronchi and bronchioles. 3. Respiratory department of the lung. 4. Acinus, alveolar wall structure, histofunctional characteristic of pneumocytes, structure of interalveolar septa. 5. Blood supply and innervation of the lung. To study under a microscope: the structural organization of the wall of the trachea, bronchi of different caliber and lung parenchyma.
<b>Topic 29.</b>	<b>Skin and its derivatives.</b> Questions to the topic. 1. Morphofunctional characteristics and embryonic skin sources. 2. Tissue composition of the skin, vascularization and innervation, regeneration, age-related skin changes. 3. The structure of the epidermis and dermis. 4. The glands of the skin. 5. Appendages of the skin: hair, nails. To study under a microscope: the structural organization of the skin and its glands, the structural organization of the skin with hair.
<b>Topic 30.</b>	<b>Nervous system.</b> Questions to the topic. 1. Nerve: structure, response to damage and regeneration. 2. Sensitive nerve nodes. 3. Sources of development, structure. 4. The spinal cord. 5. Morphofunctional characteristics, development. 6. The structure of gray and white matter. 7. Characterization of the conductive paths. To study under a microscope: the structural organization of the cross section of the nerve, the structural organization of the spinal sensitive ganglion, the structure of the transverse section of the spinal cord.
<b>Topic 31.</b>	<b>Nervous system.</b> Questions to the topic. 1. The brain. 2. Morphological and functional characteristics, embryogenesis. 3. Gray and white matter. 4. The microscopic structure of the departments of the brain stem.

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	<p>5. The structure and function of the cerebellum and cerebral cortex.          6. The autonomic nervous system.          7. Age-related changes in the nervous system.          To study under a microscope: the structural organization of the cerebellar cortex, the structural organization of the cerebral cortex.</p>
<b>Topic 32.</b>	<p><b>The sensory organs. The structure of the organ of vision and smell.</b>          Questions to the topic.          General characteristics and classification of the senses.          Receptor cells and reception mechanisms.          Morphofunctional characteristic, embryogenesis, structure and histophysiology of the organ of vision.          Morphological and functional characteristics, embryogenesis, structure and histophysiology of the organ of smell.          STUDY UNDER THE MICROSCOPE: STRUCTURAL ORGANIZATION OF THE CORNEAL EYE, STRUCTURAL ORGANIZATION OF THE REAR WALL OF THE EYE</p>
<b>Topic 33.</b>	<p><b>The organs of hearing and taste.</b>          1. Morphological and functional characteristics, embryogenesis, structure and histophysiology of the organ of hearing and balance.          2. Morphological and functional characteristics, embryogenesis, structure and histophysiology of the taste organ.          To study under a microscope: the structural organization of the organ of Corti, the structural organization of taste buds in the leaf-shaped papillae of the tongue.</p>
<b>Topic 34.</b>	<p><b>Final lesson on topics 28-33.</b>  <b>Questions to the topic.</b>          1. The development of the nervous system.          2. The structure and functions of the spinal node.          3. The spinal cord. Morphofunctional characteristic.          4. The structure and function of the cerebellum.          5. Cyto- and myeloarchitectonics of the cerebral cortex.          6. The structure and functions of the autonomic nervous system.          7. The classification of the senses. Characterization of their receptor cells.          8. Embryogenesis and the general plan of the structure of the organ of vision.          9. The structure of the cornea of the eye and sclera.          10. The structure of the lens and vitreous body of the eye.          11. The structure of the choroid of the eye.          12. The structure of the iris.          13. The structure of the ciliary body.          14. The structure and functions of the retina ..          15. Embryogenesis and the structure of the organ of smell.          16. The structure of the organ of taste.          17. Embryogenesis of the organ of hearing and balance.          18. The structure of the organ of equilibrium.          19. The structure and function of the organ of hearing.          20. The structure of the wall of the airways. The cellular composition of the epithelium of the mucous membrane.          21. The lungs. The structure of the respiratory department of the wall of the alveoli, the cytophysiological characteristic of pneumocytes.</p>

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	<p>22. Skin, tissue composition, vascularization, innervation, regeneration. The structure of the epidermis and dermis. Skin glands, skin appendages.</p> <p>List of micropreparations for diagnosis.</p> <ol style="list-style-type: none"> <li>1. Nerve (cross section).</li> <li>2. The spinal node.</li> <li>3. The spinal cord (transverse section).</li> <li>4. Cortex of the cerebral hemispheres.</li> <li>5. The cerebellum.</li> <li>6. The back wall of the eye.</li> <li>7. The cornea of the eye.</li> <li>8. Corti's organ.</li> <li>9. Taste buds. Leaf-shaped slice papillae of the tongue.</li> <li>10. The skin of the palmar surface of the finger.</li> <li>11. Skin with hair.</li> <li>12. Trachea</li> <li>13. The lung.</li> </ol>
<b>Topic 35. Diagnosis of drugs by embryology and general histology</b>	
<b>Topic 36.</b>	<b>Diagnostics of drugs by private histology</b>

**7. LABORATORY CLASSES** - This type of work is not provided by syllabus

**8. SUBJECT OF COURSE, CONTROL WORKS** - This type of work is not provided by syllabus

**Sample topics of abstracts:**

1. Methods of microscopy of histological preparations.
2. Research methods for fixed cells and tissues.
3. Research methods for living cells and tissues.
4. Research methods for the chemical composition and metabolism of cells and tissues.
5. Fractionation of cell contents.
6. Quantitative methods of morphological studies.
7. Methods of image analysis of cellular and tissue structures.
8. Modern ideas about the cell as a single integrative system.
9. Reproduction of cells.
10. Pathology of mitosis.
11. The initial and embryonic periods of embryogenesis.
12. Extra germinal organs.

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13. Histophysiology of the male reproductive system.

14. Histophysiology of the female reproductive system.

**Requirements for abstracts:** the abstract should reflect the goals and objectives, as well as disclose the issue under study, combining capacity and conciseness. The volume of the abstract is 10-15 sheets of typewritten text, 12 sheets - introduction, 10-12 - the main material, 1-2 - the conclusion.

## 9. LIST OF QUESTIONS FOR THE EXAM (OFF)

### Exemplary questions for offset in "Histology, embryology, cytology"

#### CYTOLOGY.


1. The main stages of development and the current state of cell theory.
2. Structural organization of eukaryotic cells.
3. General organization of the nucleus of animal cells.
4. The structure and function of the cell surface and endoplasmic membrane.
5. The structure and function of the endoplasmic reticulum.
6. The structure and function of the Golgi complex.
7. The structure and function of mitochondria.
8. The structure and function of lysosomes and peroxisomes.
9. The structure and function of microtubules and centrioles.
10. The structure and function of cilia and flagella.
11. The structure and function of microfilaments and microfibrils.
12. Classification and characterization of inclusions of the cytoplasm.
13. Cell response to damage.
14. The concept of the vital and mitotic cycles of the cell.
15. Characterization of interphase.
16. Mitosis. Characterization of the phases of mitosis.
17. Amitosis. Endomitosis

#### EMBRYOLOGY.

1. The structure and function of male and female germ cells.
2. Classification of eggs.
3. Fertilization and its phases.
4. Characterization of the egg, cleavage and blastocysts of a person.
5. Implantation of a human blastocyst.
6. Gastrulation of the human embryo.
7. The formation, structure and function of extra-embryonic organs in humans.
8. Classification and structure of the placenta.
9. The structure of the chorion.
10. Embryonic histogenesis.

#### GENERAL HISTOLOGY.

1. Morphofunctional classification of tissues. Evolutionary and genetic principles of tissue classification.
2. Classification and general characteristics of epithelial tissues.
3. Single-layer epithelium: origin, structure, localization.
4. Stratified epithelium: origin, structure, localization. Regeneration of integument epithelium.
5. Glandular epithelium: secretory cycle, types of secretion, classification and general plan of the structure of exocrine glands.

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6. Blood: composition, structure and function of the formed elements, leukocyte formula. Age-related changes in blood.

7. The development of blood as tissue.

8. Postembryonic hematopoiesis and physiological blood regeneration (erythro-, granulo-, lympho- and monocytopenesis).

9. Classification of connective tissues, structure and functions of cellular elements of loose fibrous unformed tissue. Their role in the protective reactions of the body and in the processes of regeneration.

10. General characteristics and structure of the intercellular substance of loose fibrous non-formed connective tissue.

11. The structure and function of dense unformed and decorated connective tissue.

12. The structure and function of connective tissues with special properties.

13. Cartilage tissue: morphological and functional characteristics, classification, structure, function, blood supply, age-related changes.

14. The structure of hyaline, fibrous and elastic cartilage.

15. Bone tissue: morphological and functional characteristics and classification, Structure of coarse-fibrous and lamellar bone tissue.

16. The structure of the diaphysis of the tubular bone. Regeneration and age-related bone remodeling.

17. Direct and indirect osteogenesis.

18. Smooth muscle tissue: histogenesis, structure, functional features, regeneration.

19. Skeletal muscle tissue: structure and function of striated muscle fiber. The process of contraction of muscle fibers.

20. The structure of the muscle as an organ. Skeletal muscle tissue regeneration.

21. Histogenesis and structure of cardiac muscle tissue.

22. The development of nerve tissue.

23. Morphological and functional characteristics of nerve tissue: classification, structure and function of neurocytes and neuroglia.

24. The structure of bezmyelinovy and myelin nerve fibers. Regeneration of nerve fiber-con.

25. Nerve endings: classification and structure of receptor and efferent endings. Classification, structure and function of synapses.

### **Sample questions for the exam in "Histology, embryology, cytology"**

#### **Cytology**

1. The main provisions of the cellular theory of Schleiden-Schwann. The contribution of Purkinje, Schleiden, Schwann, Virchow and others to the doctrine of the cell. The importance of cell theory for the development of biology and medicine.

2. Plasmolemma: structure, chemical composition, function. Structural and functional characteristics of various types of intercellular compounds.


3. Organelles of the cytoplasm. Classification. Structural and functional characteristics of organelles involved in the biosynthesis of substances in the cell: EPS, Golgi complex, ribosomes.

4. Structural and functional characteristics of cytoplasmic organelles involved in intracellular digestion, protective and neutralizing reactions.

5. Organelles of the cytoplasm. Structural and functional characteristics of mitochondria.

6. Structural, chemical and functional characteristics of the organelles that make up the cytoskeleton of cells. The structure and significance of centrioles, cilia and flagella.



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7. The main provisions of cell theory. Cell definition. Cytoplasmic inclusions: concept, classification, chemical and morphological and functional characteristics.

8. Cell nucleus: Functions, structure, chemical composition. The interaction of the nucleus and cytoplasm in the process of protein biosynthesis in the cell.

9. The value of the nucleus in the life of the cell. The main components of the kernel: their structure and functions.

10. The concept of the life cycle of cells, its stages and morphological and functional characteristics. The biological nature and phases of mitosis.

General histology

11. Morphological and functional characteristics and classification of epithelial tissues. Sources of their development.

12. Features of the structure of cells of epithelial tissues (epithelial cells): polarization, special organelles, intercellular compounds. The structure and role of the basal membrane.

13. Morphological and functional characteristics of single-layer and multi-row (pseudo-state-layer) epithelium: sources of development, varieties, structure, physiological regeneration.

14. Stratified epithelium: classification, source of development structure, localization, physiological regeneration of the epidermis.

15. Stratified epithelium. Structure, localization, physiological regeneration of multilayered squamous non-keratinizing and transitional epithelium.

16. Morphological and functional characteristics of the glandular epithelium. Cytophysiological characteristic of the secretory process. Types of secretion. The structure and classification of glands.

17. The concept of the blood system. Blood as a kind of tissue of the internal environment. Uniform elements of blood. Postcellular blood structures. Red blood cells: size, shape, structure, chemical composition, function, life expectancy. Features of the structure and chemical composition of reticulocytes. Blood platelets (platelets).

18. The concept of the blood system. Classification of white blood cells. Leukocyte formula. Granular leukocytes: varieties, sizes, structure, functions, life expectancy.

19. Classification of leukocytes. Non-granular white blood cells (agranulocytes): varieties, sizes, structure, functions, life expectancy.

20. The concept of the blood system. Fetal hematopoiesis.

21. The concept of the blood system. Postembryonic hematopoiesis.

22. Morpho-functional characteristics and classification of connective tissues. Cellular elements of loose unformed fibrous connective tissue, their structure and functions.

23. The intercellular substance of the fibrous connective tissue: structure and significance. The role of fibroblasts in the formation of intercellular substance.

24. Dense unformed and dense decorated fibrous connective tissue: structure and function.

25. Connective tissues with special properties: classification, structure, functions.


26. Morphological and functional characteristics and classification of cartilage. Their histogenesis, structure, function and regeneration.

27. Morphological and functional characteristics and classification of bone tissue. Structural features and localization of coarse-fibrous and lamellar bone tissues. The structure of the diaphysis of the tubular bone.

28. Classification of bone tissue. Direct osteogenesis.

29. Classification of bone tissue. Indirect osteogenesis.

30. Morpho-functional characteristics and classification of muscle tissue. Smooth muscle tissue: a source of development, structure, functional features and regeneration.

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31. Morpho-functional characteristics and classification of muscle tissue. Bounded skeletal muscle tissue: histogenesis, structure, histochemical characterization, functional features and regeneration.

32. Histological and submicroscopic structure of striated (striated) muscle fiber. Histophysiology of muscle contraction.

33. Streaked cardiac muscle tissue: histogenesis, structure, functional features and regenerative properties.

34. Morpho-functional characteristics of nerve tissue. Sources of development. Neurocytes: structure, morphological and functional classification.

35. Nerve fiber: structure, functional features of myelin and myelination of nerve fibers. Regeneration of nerve fibers.

36. Morpho-functional characteristics and classification of nervous tissue. Neuroglia: classification, structure and significance of various types of gliocytes.

37. Nerve endings: concept, classification, structure, functional significance.

38. Synapses: concept, classification, structure and mechanisms of transmission of a nerve impulse

Private histology

39. Morphological and functional characteristics of the nervous system. Nerves and cerebrospinal ganglia: embryonic source, function, structure. Nerve regeneration.

40. Morphofunctional characteristic of the spinal cord: development, structure of gray and white matter, their functional significance.

41. The trunk of the brain. Sources of development. The principle of organization of gray and white matter. Medulla oblongata: structure and functions.

42. The brain. Morphofunctional characteristic of the cerebral cortex. Myeloarchitectonics.

43. Cerebellum: structure, functional characteristic, neural composition of the cortex. Interneuronal communications.

44. Autonomous (autonomic) nervous system: morphological and functional characteristics, departments. The structure of extra- and intramural ganglia. The nuclei of the central departments of the autonomic nervous system.

45. Morphological and functional characteristics of the vascular system. The development of blood vessels. Arteria: classification, structure, function, age-related changes. The relationship of the structure of arteries and hemodynamic conditions.

46. Morphological and functional characteristics of the vascular system. Veins: classification, structure, functions. The relationship of the structure of veins with hemodynamic conditions.

47. Morphological and functional characteristics of the vessels of the microvasculature. Arterioles, venules, arterio-venular anastomoses.


48. Microcirculatory bed. The structure and classification of capillaries. Arterio-venular anastomoses.

49. Morphological and functional characteristics of the heart: sources of development, the structure of the membranes of the wall and heart valves, vascularization and regeneration.

50. Heart. Source of development. The structure of the conduction system of the heart.

51. General morphological and functional characteristics of the senses. The concept of analyzers. The classification of the senses. The organ of smell and taste.

52. Vision organ: development, morphofunctional characteristic. The structure of the receptor apparatus of the eye.

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53. Morphological and functional characteristics and development of the organ of vision. The structure of structures that make up the diopter and accommodation apparatuses of the eye.

54. Hearing organ: development, morphological and functional characteristics. The structure of the inner ear. Cytophysiology of receptor cells of the inner ear.

55. Morpho-functional characteristics of the central organs of blood formation and immunogenesis. Bone marrow structure: stromal cells, hematopoietic cells, features of blood supply.

56. Morpho-functional characteristics of the central organs of blood formation and immunogenesis. Thymus (thymus gland): structure, functional features, endocrine function, age and case involution.

57. Morphological and functional characteristics of peripheral organs of blood formation and immunogenesis. Lymph nodes: structure and functional zones and their cellular composition. Lymphocytopoiesis.

58. Spleen: structure, features of blood supply, functional zones of white pulp and their cellular composition, red pulp and its participation in the utilization of hemoglobin.

59. Morphological and functional characteristics of the endocrine system. Neurosecretory departments of the hypothalamus. Connection of the hypothalamus with the adeno- and neurohypophysis.

60. Morphological and functional characteristics of the endocrine system. Pituitary gland: sources of development, structure, cellular composition, functional characteristic, regeneration. The connection of the pituitary gland with the hypothalamus and its significance.

61. The thyroid gland: sources of development, cellular composition, functional characteristics. Features of the secretory process in thyrocytes and its regulation.

62. Morphological and functional characteristics of the parathyroid gland: sources of development, structure, cellular composition, functional significance. The participation of the thyroid gland in the regulation of calcium homeostasis.

63. Adrenal glands: sources of development, structure, tissue and cellular composition, functional characteristics, features of regeneration. Regulation of adrenal gland function.

64. The oral cavity. The structure of the lips, tongue and tonsils.

65. The oral cavity. The development and structure of teeth.

66. The oral cavity. Development and structure of large salivary glands.

67. The digestive canal. The general plan of the wall structure, innervation and vascularization.

68. Morphological and functional characteristics of the esophagus.

69. Stomach: structural features, histophysiology of glands, innervation and vascularization.

70. Small intestine: structural features of the wall, histophysiology of crypts and villi, regeneration.

71. General morphological and functional characteristics of the colon and rectum.

72. Pancreas: development, structure of exo- and endocrine parts. Age-related changes and regeneration.


73. The liver. Development. The structure of the classic hepatic lobule. Features of blood supply to the liver.

74. The liver. Structural and functional characteristics of hepatocytes. Features of liver regeneration. Bile ducts, gall bladder.

75. Respiratory system. Development, structure of the larynx, trachea.

76. The lungs. Development, structure of the air and respiratory departments.

77. Leather. Structure, regeneration, keratinization process. Sweat and sebaceous glands

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78. Derivative skin: hair structure. Nails

79. Mammary glands: sources of development, structure, endocrine regulation. Features of the glands during lactation.

80. General morphological and functional characteristics of the urinary system. The main stages of development. Kidneys: structure, blood supply, age-related changes and regeneration.

81. Nephron as a structurally functional unit of the kidney. Cytological and cytophysiological characteristics of the nephron divisions in connection with the main mechanisms of urine formation.

82. Morphological and functional characteristics of the endocrine apparatus of the kidney.

83. Embryonic development of the urinary system. The structure of the ureter and urinary bladder.

84. Sources and course of embryonic development of the male reproductive system. Testis: structure, generative and endocrine functions.

85. Morphological and functional characteristics of the male reproductive system. The appendage of the testis, vas deferens, ejaculatory canal, seminal vesicles, prostate.

86. Ovary: structure, functions. Ovogenesis Endocrine ovarian function. Age-related changes in the ovary.

87. The female reproductive system. Ovarian-menstrual cycle.

88. Embryonic development of the female reproductive system. The structure of the oviduct (fallopian tubes) and uterus.

Embryology

89. Periods and main stages of embryogenesis in humans. The concept of progenesis. Human sex cells, their structural and genetic characteristics.

90. The concept of fertilization. Characterization of human fertilization: morphology, necessary conditions. The concept of zygotes.

91. The concept of crushing. Characterization of crushing in humans. The structure of the human embryo at the implantation stage.

92. The concept of gastrulation. Characterization of gastrulation in humans. The idea of critical periods of development.


93. Extra germinal organs of a person. Amnion, yolk sac, allantois: formation, structure and significance. The formation of the trunk fold.

94. The placenta: appearance in evolution and significance. Human placenta: type, structure, functions. The structure and significance of the placental barrier.


95. Human placenta: development, maternal and fetal components. The structure and value of the umbilical cord.

## 10. SELF-STUDY WORK OF STUDENTS

№	Name of the section / subject	Types of SSW	Total number of hours	Current control
Section 1. Cytology.				
1.	Methods of histological studies	Abstract writing on the topics: Methods of microscopy of histological preparations. Research methods for fixed cells and tissues. Methods for the study of living cells and tissues. Research methods for the chemical composition and metabolism of cells and tissues.	12	Referat


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		Fractionation of cell contents. Quantitative methods. Methods of image analysis of cellular and tissue structures.		
2.	The structure of the cytoplasm	<p>Study material on the following topics: The concept of a cell as an elementary living system, The concept of non-cellular structures. The main provisions of cellular theory.</p> <p>Biological membrane, its molecular organization and basic functions. Mechanisms of transport of substances, reception, adhesion. Participation in the formation of intercellular compounds. Different types of intercellular compounds (contacts), their functional and structural characteristics. Simple joints, tight junctions, gap junctions (nexus), synaptic junctions, desmosomes, finger junctions.</p> <p>The main components of the cytoplasm are organelles, inclusions, hyaloplasm (matrix). Endoplasmic reticulum - the structure and functions of the granular and non-granular endoplasmic reticulum. Golgi complex - structure, functions, role in the secretion processes. Lysosomes - structure, major enzymes, role in intracellular digestion. Peroxisomes - structure, enzyme composition, functions. Mitochondria - structure, basic enzyme composition, functions.</p> <p>Ribosomes - structure, chemical composition, functions. The concept of polyribosomes. Centrioli - structure, functions in the interphase and during cell division. The concept of the cytoskeleton of cells. The fibrillar structures of the cytoplasm: microtubules, microfilaments and microfibrils.</p> <p>Microvilli. Cilia. Flagella. Tonofibrils. Myofibrils. Neurofibrils. Their structure and importance for the life of cells and the body.</p> <p>Inclusions. Definition Classification.</p>	12	Questions in the final lesson, standings, exam
3.	The structure of the core. Cell division	<p>Development of educational material on the following topics: The significance of the nucleus in the life of the cell and in the transfer of genetic information. The shape, size, number of nuclei in cells with different specializations. The main components of the nucleus: the nuclear membrane, chromatin, nucleolus, karyoplasm (nucleoplasm).</p> <p>The shell of the core. Structure. The participation of the nuclear membrane in the</p>	12	Questions in the final lesson, standings, exam

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		<p>metabolism between the nucleus and the cytoplasm.</p> <p>The concept of chromatin. Its molecular chemical organization and role in the life of cells. Euchromatin (diffuse) and heterochromatin (condensed). Sex chromatin.</p> <p>The nucleolus. Structure. The role of nucleoli in the synthesis of rRNA and the formation of ribosomes.</p> <p>Life (cell) cycle. Life cycle definitions. Characterization of its stages (reproduction, growth and differentiation, active functioning, aging and cell death).</p> <p>Reproduction of cells and cell structures. Reproductive cycle. Definition and biological significance. Periods (interphase and mitosis). Characterization of the main processes of the reproductive cycle of cells.</p> <p>Mitosis. The biological essence. Phases of mitosis. Transformation of the structural components of the cell during each of the phases. Meiosis. Its features and biological significance.</p> <p>Intracellular regeneration. General morphofunctional characteristic. Biological significance. Cell adaptation. Its importance for maintaining the life of cells in altered living conditions.</p>		
<b>Section 2. Human Embryology</b>				
4.	The initial and embryonic periods of human embryogenesis .	Study material on the topics: progenesis. General characteristics of gametogenesis, especially the course of the main stages of spermatogenesis and oogenesis. Egg classification according to yolk content. Types of crushing and their characteristics. Types of blastula structure. Possible mechanisms of gastrulation, their characteristics.	12	Questions in the final lesson, standings, exam
5	The structure of extra-germ organs.	Development of training material on the topics: Bookmark extra-germ organs. The structure and functions of the amnion, chorion, yolk sac, allantois. Human placenta, type, development, structure, functions.	12	Questions in the final lesson, standings, exam
<b>Section 3. Private histology</b>				
6.	Reproductive system	Study material on topics: Embryonic development. Primary gonocytes, initial localization, migration paths to the germ of the gonad. Factors of sexual differentiation. Tissue composition of the organs of the reproductive	12	Questions in the final lesson, standings, exam



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	<p>system. Male genital organs. Histogenetic processes in the germ of the gonad leading to the development of the testis. Development of the vas deferens.</p> <p>Testicle. Curved seminiferous tubules, wall structure. Spermatogenesis. Hematotesticular barrier. Histophysiology of direct tubules, tubules of the network and efferent tubules of the testis. Regulation of generative and endocrine testicular function. Features of the testicle of the newborn, before puberty, during puberty and with aging.</p> <p>The possibility of a damaging effect on the testicles of physico-chemical factors - radiation, alcohol, temperature, etc. in connection with their morphological and functional features.</p> <p>Female genitals. Histogenetic processes in the germ of the gonad leading to the development of the ovary. Embryonic development of the oviducts and uterus.</p> <p>Ovary. General morphofunctional characteristic. Ovogenesis Differences of ovogenesis from spermatogenesis. The structure and development of follicles. Ovulation. The concept of the ovarian cycle and its regulation. Ovarian endocrine function. Features of the ovary of newborns before puberty, puberty and aging. Vascularization and innervation. Morpho-functional basis of the sensitivity of the ovaries to radiation, alcohol and other factors.</p>		
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## 11. EDUCATIONAL-METHODICAL AND INFORMATION SUPPORT OF DISCIPLINE


### a) List of recommended literature:

#### Core reading:

1. Histology, embryology, cytology [Electronic resource]: textbook / Yu. I. Afanasyev, N. A. Yurina, E. F. Kotovsky and others; under the editorship of Yu. I. Afanasyev, N.A. Yurina. - 6th ed., Revised. and add. - M.: GEOTAR-Media, 2016. - <http://www.studmedlib.ru/book/ISBN9785970436639.html>
2. Boychuk N.V., Histology, embryology, cytology [Electronic resource]: textbook / N.V. Boychuk, R. R. Islamov, E. G. Ulumbekov, Yu. A. Chelyshev; under the editorship of E. G. Ulumbekova, Yu. A. Chelysheva - M.: GEOTAR-Media, 2016. - 944 p. - Access mode: <http://www.studmedlib.ru/book/ISBN9785970437827.html>

#### Supplementary reading:



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1. Колесников Л.Л., Terminologia Embryologica. Международные термины по эмбриологии человека с официальным списком русских эквивалентов / Колесников Л.Л., Шевлюк Н.Н., Ерофеева Л.М. - М. : ГЭОТАР-Медиа, 2014. - ISBN 978-5-9704-3080-4 - Текст : электронный // ЭБС "Консультант студента" : [сайт]. - URL : <http://www.studentlibrary.ru/book/ISBN9785970430804.html>

2. Kurnosova, N. A. Training toolkit "Cytology" / N. A. Kurnosova, N. A. Mischeeva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2016. - 120 с. : ил. - Текст на англ. яз. - Библиогр.: с. 118.

3.

### Educational-methodical literature

1. Guidelines to laboratory work on histology : methodological recommendations for students of the discipline histology, embryology program 060101 "Medical care". P. 1 : Basic tissue types / T. I. Kuznetsova, O. F. Denisova, E. V. Slesareva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : UISU, 2016. - 14 с.

2. Kuznetsova, T. I.

Guidelines to laboratory work at "Embryonic development of organs and tissues" : methodological recommendations / T. I. Kuznetsova, O. F. Denisova, E. V. Slesareva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2017. - 12 с

#### AGREED:

*И.И. Шибанова* *О.Ф. Денисова* *Е.В. Слесарева* *И.И. Шибанова*  
 Position of scientific library employee      full name      signature      date

#### Software:


name
СПС Консультант Плюс Student Consultant+
НЭБ РФ. National Digital Library RF
ЭБС IPRBooks
АИБС "МегаПро"
ОС MicrosoftWindows
«МойОфис Стандартный»

#### c) Professional databases, information and reference systems:

##### 1. Electronic library systems:

1.1. IPRbooks: electronic library system: website / group of companies IPR Media. - Saratov, [2020]. - URL: <http://www.iprbookshop.ru>. - Access mode: for registered. users. - Text: electronic.

1.2. YURAYT: electronic library system: website / LLC Electronic publishing house

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URAYT. - Moscow, [2020]. - URL: <https://www.biblio-online.ru>. - Access mode: for registered. users. - Text: electronic.

1.3. Student advisor: electronic library system: website / Polytekhhresurs LLC. - Moscow, [2020]. - URL: [http://www.studentlibrary.ru/catalogue/switch\\_kit/x2019-128.html](http://www.studentlibrary.ru/catalogue/switch_kit/x2019-128.html). - Access mode: for registered. users. - Text: electronic.

1.4. Lan: electronic library system: website / EBS Lan. - St. Petersburg, [2020]. - URL: <https://e.lanbook.com>. - Access mode: for registered. users. - Text: electronic.

1.5. Znanium.com: electronic library system: website / Znanium LLC. - Moscow, [2020]. - URL: <http://znanium.com>. - Access mode: for registered. users. - Text: electronic.

1.6. Clinical Collection: collection for medical universities, clinics, medical libraries // EBSCOhost: [portal]. - URL: <http://web.a.ebscohost.com/ehost/search/advanced?vid=1&sid=e3ddfb99-a1a7-46dd-a6eb-2185f3e0876a%40sessionmgr4008>. - Access mode: for authorization. users. - Text: electronic.

**2. ConsultantPlus** [Electronic resource]: reference legal system. / LLC "Consultant Plus" - Electron. Dan. - Moscow: ConsultantPlus, [2020].

### **3. Databases of periodicals:**

3.1. Database of periodicals: electronic journals / LLC IVIS. - Moscow, [2020]. - URL: <https://dlib.eastview.com/browse/udb/12>. - Access mode: for authorization. users. - Text: electronic.

3.2. eLIBRARY.RU: scientific electronic library: site / Scientific Electronic Library LLC. - Moscow, [2020]. - URL: <http://elibrary.ru>. - Access mode: for authorization. users. - Text: electronic

3.3. "Grebennikon": electronic library / ID Grebennikov. - Moscow, [2020]. - URL: <https://id2.action-media.ru/Personal/Products>. - Access mode: for authorization. users. - Text: electronic.

**4. National Electronic Library:** Electronic Library: Federal State Information System: website / Ministry of Culture of the Russian Federation; RSL. - Moscow, [2020]. - URL: <https://neb.rf>. - Access mode: for users of the scientific library. - Text: electronic.


**5. SMART Imagebase** // EBSCOhost: [portal]. - URL: <https://ebsco.smartimagebase.com/?TOKEN=EBSCO-1a2ff8c55aa76d8229047223a7d6dc9c&custid=s6895741>. - Access mode: for authorization. users. - Image: electronic.

### **6. Federal information and educational portals:**

6.1. Single window of access to educational resources: federal portal / founder of FGAOU DPO TsRGOP and IT. - URL: <http://window.edu.ru/>. - Text: electronic.

6.2. Russian education: federal portal / founder of FGAOU DPO TsRGOP and IT. - URL: <http://www.edu.ru>. - Text: electronic.

### **7. Educational resources of UISU:**

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7.1. Electronic library of ULSU: module ABIS Mega-PRO / LLC "Data Express". - URL: <http://lib.ulsu.ru/MegaPro/Web>. - Access mode: for users of the scientific library. - Text: electronic.

7.2. ULSU educational portal. - URL: <http://edu.ulsu.ru>. - Access mode: for register. users. - Text: electronic.

**AGREED:**





Position of information technology Department employee      full name      signature      date

**12. EDUCATIONAL AND METHODOLOGICAL AND INFORMATION SUPPORT OF DISCIPLINE**

Classrooms for conducting practical classes, for conducting current control and intermediate certification are equipped with specialized furniture, educational board, and there are also

- microscopes - 25 pcs student;
- micropreparations according to general histology - 21 sets;
- micropreparations for private histology - 21 sets;
- research microscope -1.

Classrooms equipped with table lighting (2), histological laboratory (building of the medical faculty, 2 Ark. Livchak St.)

The lecture halls are equipped with specialized furniture, a training board, and there are also multimedia equipment for working with a large audience.


**13. SPECIAL CONDITIONS FOR STUDENTS WITH DISABILITIES**

If necessary, students from among persons with disabilities (at the request of the student) may be offered one of the following options for perceiving information, taking into account their individual psychophysical characteristics:


for persons with visual impairment: in print in large print; in the form of an electronic document; in the form of an audio file (translation of training materials into audio format); in printed form in Braille; individual consultations with the involvement of a translator; individual tasks and consultations;


for persons with hearing impairment: in print; in the form of an electronic document; video materials with subtitles; individual consultations involving an interpreter; individual tasks and consultations;


for persons with disorders of the musculoskeletal system: in print; in the form of an electronic document; in the form of an audio file; individual tasks and consultations.

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If it is necessary to use partly distance educational technologies in the educational process, the organization of work with students with disabilities and disabled people is provided in the electronic information and educational environment, taking into account their individual psychophysical characteristics.


Developer  Professor, MD, Associate Professor Slesareva E. V.

Developer  Associate Professor, Ph.D. \_\_\_\_\_ Kuznetsova T. I.

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**LIST OF CHANGES of  
Educational plan of discipline « Histology, embryology, cytology »  
Speciality 31.05.01. «General medicine»**

<b>№</b>	<b>Content of the change or a link to the attached text of the</b>	<b>Full name of the head of the Department developing the discipline</b>	<b>Signature</b>	<b>Date</b>
1	Introduction of changes to item A) Recommended Literature item 11 "Educational, methodological and information support of the discipline" with the design of Appendix 1	Slesareva E.V.		01.09.2021
2	Introduction of changes to item C) Professional databases, information and reference systems item 11 "Educational, methodological and information support of the discipline" with the design of Appendix 2	Slesareva E.V.		01.09.2021

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## Appendix 1

### Educational, methodological and information support of the discipline

#### a) List of recommended literature:

##### Core reading:

1. Danilov, R. K. Histology, Embryology, Cytology : Textbook / R. K. Danilov, T. G. Borovaya - Москва : ГЭОТАР-Медиа, . - 480 с. - <https://www.studentlibrary.ru/book/ISBN9785970463857.html>
2. Kurnosova N. A. **Training toolkit "Cytology"**/ N. A. Kurnosova, N. A. Micheeva; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2017. - Загл. с экрана; На англ. яз. - Электрон. текстовые дан. (1 файл : 31,9 МБ). - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/905>


##### Supplementary reading:

1. Колесников, Л. Л. Terminologia Embryologica. Международные термины по эмбриологии человека с официальным списком русских эквивалентов / Колесников Л. Л. , Шевлюк Н. Н. , Ерофеева Л. М. - Москва : ГЭОТАР-Медиа, 2014. - 422 с. - <https://www.studentlibrary.ru/book/ISBN9785970430804.html>
2. Зиматкин, С. М. Гистология, цитология и эмбриология. Атлас учебных препаратов = Histology, Cytology, Embryology. Atlas of practice preparations : учебное пособие / С. М. Зиматкин. — Минск : Вышэйшая школа, 2017. — 88 с. — URL: <https://www.iprbookshop.ru/90766.html>
3. Vasilieva, L. S. Lecture notes on sections «Cytology» and «General histology». Study guidance : учебно-методическое пособие / L. S. Vasilieva, O. A. Makarova, A. S. Dadueva. — Иркутск : ИГМУ, 2017. — 52 с. — URL: <https://e.lanbook.com/book/158739>
4. Summary of the course “Histology, cytology, embryology”: Methodological recommendations for students of discipline Histology, cytology, embriology . Part 1 / Т. I. **Kuznetsova**, O. F. Denisova, E. V. Slesareva. - Ulyanovsk : ULSU, 2018. - Загл. с экрана; На англ. яз. - Электрон. текстовые дан. (1 файл : 1,77 МБ). - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/1223>
5. Summary of the course “Histology, cytology, embryology”. Part 2 / Т. I. **Kuznetsova**, O. F. Denisova, E. V. Slesareva; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2019. - Текст на англ. яз.; Загл. с экрана. - Электрон. текстовые дан. (1 файл : 3,13 МБ). - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/4337>

##### Educational-methodical literature

1. **Kuznetsova Т. I.** Guidelines to laboratory work on histology: methodological recommendations for students of the discipline histology, embryology program 060101 "Medical care". Р. 1 : Basic tissue types / Т. I. Kuznetsova, O. F. Denisova, E. V. Slesareva; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2016. - На англ. яз.; Загл. с экрана. - Электрон. текстовые дан. (1 файл : 92,5 КБ). - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/281>




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2. Denisova O. F. Guidelines to laboratory work at histology : methodological recommendations. Part 2 : Histological structure of organs / O. F. Denisova, T. I. Kuznetsova, E. V. Slesareva; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2017. - На англ. яз.; Загл. с экрана. - Электрон. текстовые дан. (1 файл : 190 КБ). - Текст : электронный.  
<http://lib.ulsu.ru/MegaPro/Download/MObject/409>

**AGREED:**

*И.И. Бибикова* / *И.И. Бибикова* / *И.И. Бибикова* / 30.08.2021  
 Position of scientific library employee      full name      signature      date

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## Appendix 2

### Professed data base, directory and search systems:

#### 1. Electronic library systems:

1.1. IPRbooks: electronic library system: website / group of companies IPR Media. - Saratov, [2021]. - URL: <http://www.iprbookshop.ru>. - Access mode: for registered. users. - Text: electronic.

1.2. YURAYT: electronic library system: website / LLC Electronic publishing house URAYT. - Moscow, [2021]. - URL: <https://www.biblio-online.ru>. - Access mode: for registered. users. - Text: electronic.

1.3. Student advisor: electronic library system: website / Polytekhresurs LLC. - Moscow, [2021]. - URL: [http://www.studentlibrary.ru/catalogue/switch\\_kit/x2019-128.html](http://www.studentlibrary.ru/catalogue/switch_kit/x2019-128.html). - Access mode: for registered. users. - Text: electronic.

1.4. Lan: electronic library system: website / EBS Lan. - St. Petersburg, [2021]. - URL: <https://e.lanbook.com>. - Access mode: for registered. users. - Text: electronic.

1.5. Znaniy.com: electronic library system: website / Znaniy LLC. - Moscow, [2021]. - URL: <http://znaniy.com>. - Access mode: for registered. users. - Text: electronic.

1.6. Clinical Collection: collection for medical universities, clinics, medical libraries // EBSCOhost: [portal]. - URL: <http://web.a.ebscohost.com/ehost/search/advanced?vid=1&sid=e3ddfb99-a1a7-46dd-a6eb-2185f3e0876a%40sessionmgr4008>. - Access mode: for authorization. users. - Text: electronic.

**2. ConsultantPlus** [Electronic resource]: reference legal system. / LLC "Consultant Plus" - Electron. Dan. - Moscow: ConsultantPlus, [2021].

#### 3. Databases of periodicals:

3.1. Database of periodicals: electronic journals / LLC IVIS. - Moscow, [2021]. - URL: <https://dlib.eastview.com/browse/udb/12>. - Access mode: for authorization. users. - Text: electronic.


3.2. eLIBRARY.RU: scientific electronic library: site / Scientific Electronic Library LLC. - Moscow, [2021]. - URL: <http://elibrary.ru>. - Access mode: for authorization. users. - Text: electronic.

3.3. "Grebennikon": electronic library / ID Grebennikov. - Moscow, [2021]. - URL: <https://id2.action-media.ru/Personal/Products>. - Access mode: for authorization. users. - Text: electronic.

**4. National Electronic Library:** Electronic Library: Federal State Information System: website / Ministry of Culture of the Russian Federation; RSL. - Moscow, [2021]. - URL: <https://neb.rf>. - Access mode: for users of the scientific library. - Text: electronic.

**5. SMART Imagebase** // EBSCOhost: [portal]. - URL: <https://ebsco.smartimagebase.com/?TOKEN=EBSCO-1a2ff8c55aa76d8229047223a7d6dc9c&custid=s6895741>. - Access mode: for authorization. users. - Image: electronic.

#### 6. Federal information and educational portals:

Ministry of science and high education RF Ulyanovsk State University Faculty of Medicine named after Biktimirov T.Z., IMEiPC	Form	
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6.1. Single window of access to educational resources: federal portal / founder of FGAOU DPO TsRGOP and IT. - URL: <http://window.edu.ru/>. - Text: electronic.

6.2. Russian education: federal portal / founder of FGAOU DPO TsRGOP and IT. - URL: <http://www.edu.ru>. - Text: electronic.

**7. Educational resources of UISU:**

7.1. Electronic library of UISU: module ABIS Mega-PRO / LLC "Data Express". - URL: <http://lib.ulsu.ru/MegaPro/Web>. - Access mode: for users of the scientific library. - Text: electronic.

**Soft copy programs:**

Forensic Atlas. Ed. Corresponding Member RAMS, prof. Pigolkina Yu.I. .. - M.: "GEOTAR-Media" - 2010. - 376 p.: Ill.

Local electronic edition. Forensic Medicine. Pigolkin Yu.I., Romodanovsky P.O., Barinov E.Kh. GBOU VPO First MG MU them. I.M.Sechenova of the Ministry of Health of the Russian Federation, Moscow, 2013

**AGREED:**

 /  /  / 21.06.21  
 Position of information technology Department employee    full name    signature    date