MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION

PENZA STATE UNIVERSITY

MEDICAL INSTITUTE

APPROVED

by director of the Medical Institute

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SUBJECT'S SYLLABUS

C1.1.17 HISTOLOGY, EMBRYOLOGY, CYTOLOGY

Program (specialty) – *31.05.01 – General Medicine*

Graduate's qualification (degree) – *Medical doctor*

Study format – *full-time*

Penza, 2016

1. Subject mastering goals

Main goals of mastering "Histology, Embryology, Cytology" subject are as follows: mastering the students' knowledge of the microscopic morphology and functional development of cell, tissue and organ systems of humans providing the relevant part of the theoretical foundation of training professional activities of a doctor.

2. Subject's place in MPEP's structure

Academic discipline "Histology, Embryology, Cytology" refers to the basic part of the block C.1. "Discipline". "Histology, Embryology, Cytology" is one of the basic disciplines, which is interconnected with the disciplines of biology, human anatomy.

Main provisions of histology, embryology, cytology are needed to explore such disciplines as: pathological anatomy, clinical pathological anatomy, pathophysiology, clinical pathophysiology, forensic medicine.

3. Student competences developed as a result of subject mastering "Histology, Embryology, Cytology"

According to the state curriculum for the course, the study is oriented at developing of the following competences and their elements:

Competence code	Name of competence	Structural elements of the competence (knowledge, skill, application as a final learner outcome)
1	2	3
GEC-1	abstract thinking, logical analysis and synthesis skills	to know: the laws of formal logic – the main points which should contain the report prepared for public speaking, how to submit material report.
		to be able to: to correct and logical build of the sentence in oral speech, to argue its own arguments in a dispute and refute the arguments of opponents.
		to apply: logical methods and techniques in the analysis of available information
GPC-9	know how to use medicines, medical products and technologies in solving professional problems	to know: macroscopic and microscopic parameters of the normal tissues and organs.
		to be able to: to find organs, tissues, cells and non-cellular structures on micro slide.
		to apply: to skill to identify organs, tissues, cells and non-cellular structures at the microscopic level.
SPC-5	be able to analyse patients complaints and medical history, results of medical examinations, laboratory tests, special equipment diagnostics and others so as to determine the presence or absence of pathologies, medical disorders and diseases	to know: macroscopic and microscopic parameters of normal tissues and organs.
		to be able to: to find organs, tissues, cells and non-cellular structures on micro slide
		to apply: to identify the organs, tissues, cells and non-cellular structure at the microscopic level.
SPC-20	be ready to analyse and submit for public assessment the medical data	to know: the basic techniques of working with information on paper and electronic

	founded on evidence-based medicine	media.
		to be able to: to choose from a large amount of information on the subject studied and to introduce its to.
		to apply: skills synthesis of information, interpretation of the results obtained on the basis of evidence-based medicine.

4. Structure and contents of subject "Histology, Embryology, Cytology"

4.1. Subject's structure

General workload of the subject totals 7 credit units, 252 hours.

№	Subject's sections and topics	Semester	Weeks of the semester	Types of learning, including students' out-of-class work and workload (in hours)									Current progress monitoring types*(by semester's weeks)*							
				Work in class				Out-of-class work												
				Total	Lecture	Practice	Laboratory exercises	Total	Preparing for class work	Papeprs, essay, etc.	Course work (project)	Preparing for the exams	Interview	Test marking	Spoken test	Check work marking	Marking of essays and other creative works	Check the workbook (album)	Course work (project)	Practical skills
1.	**Section 1. General cytology and embryology**	**2**	**1-6**	**24**	**2**	**18**		**11**	**11**											
1.1.	History of development and research methods in histology, cytology and embryology.	2	1	2	-	2		1	1				1					1		1
1.2.	Cytology: cell theory, cell types, symplast, syncytium intercellular substance cytolemma.	2	1	3	2	2		1	1				1					1		1
1.3	Cytology. Cytoplasm. Organelles and inclusions.	2	2	3	-	2		1	1				2					2		2
1.4	Cytology. Nucleus, cell division, cell cycle	2	2	4	-	2		1	1				2					2		2

1.5	Embryology: gametes, fertilization.	2	3	3	-	2		1	1				3					3		3
1.6	Embryology: cleavage, gastrulation.	2	3	2	-	2		1	1				3					3		3
1.7	Embryology: histogenesis, organogenesis, provisory organs	2	4	3	-	2		1	1				4					4		4
1.8	Self-study to control lesson	2	4	2	-	2		1	1					4		4		4		4
1.9	Control lesson with diagnostics micro slides and electronograms № 1	2	5	2	-	2		2	2				5					5		5
2.	**Section 2. General histology. Private histology**	**2**	**5-17**	**59**	**15**	**50**		**34**	**34**											
2.1	Epithelial tissue.	2	5	4	1	2		1	1				5					5		5
2.2	Blood. Lymph. Plasma. Erythrocytes. Platelets.	2	6	4	2	2		2	2				6					6		6
2.3	Blood. Leukocytes. WBC.	2	6	2	-	2		1	1				6					6		6
2.4	Hematopoiesis.	2	7	2	-	2		1	1				7					7		7
2.5	Connective tissue. Fibrous connective tissue. Connective tissue with special properties.	2	7	4	2	2		1	1				7					7		7
2.6	Connective tissue. Skeletal tissue. Development and structure of cartilage.	2	8	2	-	2		2	2				8					8		8
2.7	Connective tissue. Skeletal tissue. Direct and indirect osteogenesis. The structure of the bone tissue.	2	8	2	-	2		1	1				8					8		8
2.8	Muscle tissue. Striated skeletal muscle tissue.	2	9	3	2	2		1	1				9					9		9
2.9	Muscle tissue. Striated cardiac muscle, smooth muscle tissue.	2	9	3	-	2		1	1				9					9		9
2.10	Nervous tissue. Neurocytes. Neuroglia.	2	10	3	-	2		1	1				10					10		10

2.11	Nervous tissue. Nerve fibers. Nerve endings. Synapses. Reflex arcs.	2	10	2	2	2		2	2				10					10		10
2.12	Self-study to control lesson	2	11	2	-	2		1	1					11		11		11		11
2.13	Control lesson with diagnostics micro slides and electronograms № 2	2	11	2	-	2		2	2				11					11		11
2.14	The structure of organs of the nervous system. CNS.	2	12	3	2	2		2	2				12					12		12
2.15	The structure of organs of the nervous system. PNS.	2	12	2	-	2		1	1				12					12		12
2.16	The structure of organs of the nervous system. The autonomic nervous system.	2	13	2	-	2		1	1				13					13		13
2.17	The sense organs. The structure of the organs of sight and smell.	2	13	3	2	2		2	2				13					13		13
2.18	The sense organs. Structure of the organs of hearing, balance, and taste	2	14	2	-	2		2	2				14					14		14
2.19	The structure of organs of the cardiovascular system.	2	14	2	2	2		2	2				14					14		14
2.20	The structure of organs of the cardiovascular system.	2	15	2	-	2		1	1				15					15		15
2.21	The structure of central organs of the hematopoiesis and immunogenesis.	2	15	2	-	2		1	1				15					15		15
2.22	The structure of peripheral organs of the hematopoiesis and immunogenesis.	2	16	2	-	2		1	1				16					16		16
2.23	Self-study to control lesson	2	16	2	-	2		1	1					16		16		16		16
2.24	Control lesson with diagnostics micro slides and electronograms № 3	2	17	2	-	2		2	2				17					17		17
2.25	Concluding session of the semester	2	17	2	-	2		1	1				17					17		17

3.	**Section 3. Private histology**	**3**	**1-19**	**57**	**19**	**38**		**15**	**15**										
3.1.	The structure of organs of the digestive system. General morphofunctional characteristic. Features mucous membrane of parts of the digestive tube.	3	1	2	-	2		0,5	0,5				1					1		1
3.2	The structure of organs of the digestive system. Anterior part.	3	2	3	1	2		0,5	0,5				2					2		2
3.3	The structure of organs of the digestive system. Middle and rear section.	3	3	4	2	2		1	1				3					3		3
3.4	The structure of organs of the digestive system. Liver. Pancreas. Gallbladder.	3	4	4	2	2		1	1				4					4		4
3.5	Self-study to control lesson	3	5	2	-	2		0,5	0,5					5		5		5		5
3.6	Control lesson with diagnostics micro slides and electronograms № 4	3	6	2	-	2		0,5	0,5				6					6		6
3.7	The skin. Derivatives of the skin.	3	7	4	2	2		1	1				7					7		7
3.8	The structure of organs of the respiratory system.	3	8	4	2	2		1	1				8					8		8
3.9	The structure of organs of the endocrine system. Central organs.	3	9	4	2	2		1	1				9					9		9
3.10	The structure of organs of the endocrine system. Peripheral organs.	3	10	4	2	2		1	1				10					10		10
3.11	Self-study to control lesson	3	11	2	-	2		0,5	0,5					11		11		11		11
3.12	Control lesson with diagnostics micro slides and electronograms № 5	3	12	2	-	2		0,5	0,5				12					12		12
3.13	The structure of organs of the excretory system.	3	13	4	2	2		1	1				13					13		13
3.14	The structure of organs of the male	3	14	4	2	2		1	1				14					14		14

	reproductive system.																			
3.15	The structure of organs of the female reproductive system. Female genitals. Oogenesis. Ovulation.	3	15	4	2	2		1	1				15					15		15
3.16	The structure of organs of the female reproductive system. Pregnancy. Postpartum period. The structure of the placenta.	3	16	2	-	2		1	1				16					16		16
3.17	Mammary gland. Changes in the mammary gland during the sexual cycle and pregnancy.	3	17	2	-	2		1	1				17					17		17
3.18	Self-study to control lesson	3	18	2	-	2		0,5	0,5					18		18		18		18
3.19	Control lesson with diagnostics micro slides and electronograms № 6	3	19	2	-	2		0,5	0,5				19					19		19
	Course work (project)	2						*15*			*15*								17	
	Preparing for the examination							*36*				*36*								
	General workload, in hours			142	36	106		110	59		15	36	Interim attestation							
													Form					Semester		
													Test					-		
													Exam					3		

4.2. Subject's contents

I General cytology and embryology

History of the development of histology, cytology, embryology

The emergence and development of histology and cytology as an independent science. P.I. Peremezhku, Fleming, Leydig. The role of cell theory in the development of histology and medicine. Work of Schwann, Purkinje, etc.

Creation of independent departments of histology in Russia. A.I. Babukhin, F.V. Ovsyannikov, K.A. Arnstein, P.I. Peremezhku etc.

Importance of domestic researchers in the development of embryology. K.E. Baer, I.I. Mechnikov.

Development of histology, cytology and embryology in Russia (D.N. Nasonov N.G. Hlopin, G.K. Khrushchev, T.A. Grigorieva, D.P. Filatov. P.G. Svetlov A.G. Knorre etc The present stage in the development of histology, cytology and embryology. The close relationship with physicochemical sciences, the use of their achievements. Electron microscopy. Development of histochemical studies, autoradiography and morphometric techniques.

Methods histological, cytological and embryological research

Basic principles of making preparations for light and electron microscopy. The nature and methods of fixing objects. Methods seal (fill). Microtome. Techniques of staining and contrast preparations.

Methods of learning by light microscopy of living and fixed, stained and unstained preparations, ultraviolet microscopy, fluorescence microscopy. Electron microscopy (transmission and scanning). Specific methods: ultracentrifugation, autoradiography, cultivating tissues outside the body, histochemistry, electron-microscopic histochemistry, intravital coloring, and microphotography. Quantitative research methods: morphometry, cytophotometry, their automation. Methods of descriptive and experimental embryology. Methods of serial sections and plastic reconstruction of embryological objects.

Cytology

Notion of cell as an elementary living system, basis the structure and function of eukaryotic organisms. Notion of non-cellular structures (symplast, syncytium intercellular substance). Cytology value for medicine. Main provisions of the cell theory at the present stage of scientific development. General organization of animal cells: the cytoplasm with the cell membrane, nucleus.

The shape and size of cells in relation to their functional specialization.

Structural components of cells

Cytoplasm

Biological membrane as a structural basis of cell activity, its molecular organization and basic functions.

Cell membrane. Cell membrane (cytolemma) overmembrane and submembrane layers, their structural-chemical and functional characteristics. Mechanisms of transport of substances, receptions, adhesion. Endo- and exocytosis.

Intercellular connections (contacts). Functional and structural characteristics of different types of connections. Simple connections. Complex connections: dense connections, gap connections (nexus), intermediates connections, desmosomes, fingerlike connections.

The main components of the cytoplasm - organelles, inclusions, hyaloplasm (matrix).

Organelles – definition, classification.

Organelles common values. Organelles having membrane structure

Endoplasmic reticulum – structure and function of the granular and agranular endoplasmic reticulum, their importance in the synthesis of substances; structural features due to the different cell metabolism. Golgi complex – structure, functions, role in the processes of the secretion of glandular cells, the value in the interaction of membrane structures. Lysosomes – structure, the main enzymes, role in intracellular digestion, primary and secondary lysosomes, hetero-and autophagosomes, the value of lysosomes in cells of the protective functions in the body.

Peroxisome – the structure, the enzyme composition, functions. Mitochondria – the structure, the main enzyme composition, functions, representation of an autonomous protein synthesis in mitochondria, mitochondrial reproduction.

Organelles without membrane structure

Ribosome – the structure, chemical composition, function. Free ribosomes, polyribosomes, communicate with other structural components of cells. Cytocentrum – structure, functions in interphase and during cell division. Microtubules – structure and functions. Microfibrils and microfilaments – actin, myosin, its chemical composition, functional characteristic.

Special organelles

Formation of special organelles which is based on the conversion of the basic value organelles, or other parts of the cell. Microvilli. Basal folds. Cilia. Flagella. Tonofibrils. Myofibrils. Neurofibrils. The structure and function of specific organelles.

Inclusion. Definition, classification, the value in cell activity and body. The structure and the chemical composition of different types of inclusions.

Hyaloplasm. Definition. Physical and chemical properties, the notion of chemical composition. The value in the metabolism and maintaining the integrity of the cell cytoplasmic structures.

Nucleus

Nucleus value in the life of cells and in the transfer of genetic information in a series of generations of cells. Shape, size, number of nuclei in cells with different specialization. Nuclear-cytoplasmic ratio as an indicator of the functional state of the cell. The main components of the nucleus: the nuclear membrane, chromosomes, nucleolus, karyoplasm (nucleoplasm).

Nuclear membrane. Structure. Participation of the nuclear membrane in the exchange of substances between the nucleus and the cytoplasm. The role of pore complexes in the nuclear-cytoplasmic processes. Interaction the nuclear membrane with membrane system of the cell cytoplasm.

Chromosome. The structure of chromosomes in the interphase nucleus. Their molecular organization and role in activity of cells. Notion of chromatin. Euchromatin (diffuse) and heterochromatin (condensed). Sex chromatin. Structure and role of chromosomes in dividing cells. Karyotype.

Nucleolus. Structure. The role nucleolus at the RNA synthesis and ribosome formation. Participation nucleolus organizer of chromosomes in the formation of the nucleolus. Functional lability of nucleoli.

The main manifestations of the activity of cells

Synthetic processes in the cell

Interactions of structural cell components in the synthesis of proteins and non-protein substances. Notion of secretion and its forms.

Life (cell) cell cycle. Life cycle definition. Characteristic of its stages (mitotic cycle, growth and differentiation, active functioning, aging and cell death). Life cycle features of different cell types.

Reproduction of cells and cell structures

Mitotic cycle. Definition and biological significance. Periods (interphase and mitosis). Characteristics of the main processes of the mitotic cycle.

Mitosis. Biological essence. The phases of mitosis. Conversion structural components of the cell during each phase.

Cell sensitivity in different periods of the mitotic cycle to the effects of physical and chemical factors (radiation energy, toxic substances, drugs).

Endoreproduction. Ploidy, its functional and biological significance. Mechanism of polyploidy: endomitosis, formation of dual-nuclear and multi-nuclear cells.

Meiosis. Its characteristics and biological significance.

Intracellular regeneration. General morphological and functional characteristics. Biological significance.

Cell reaction to damaging effects. Reversible and irreversible changes in the cells in the changed conditions of existence. Necrosis, apoptosis.

Embryology

Periodization of the development of animals. Progenesis. Fertilization. Major stages of embryogenesis. Crushing, gastrulation, histo-and organogenesis. Features of the structure mammalian embryo at different developmental stages. Understanding of the biological processes underlying the development of the embryo – induction, determination, division, cell migration, growth, differentiation, cell interaction, destruction. Notion of provisional organs, their role and structure.

Human Embryology

Subject and tasks of human embryology. Medical embryology. Mammalian embryology as a basis for understanding of features of human embryonic development. Ratio of ontogeny and phylogeny. The contribution of A.O. Kovalevsky, A.N. Severtsov, L.P. Ivanov and A.V. Ivanov in the development of embryology evolutionary problems. Main stages of the human embryo development.

Progenesis

Germ cells. Structure and function of male and female germ cells, the main stage of their development.

Fertilization. The biological significance of fertilization. Stages of fertilization. Merging pronuclei. Conditions necessary for normal fertilization.

Embryogenesis

Zygote. The structure of the zygote, the principles compartmentalization cytoplasm. Zygote genome.

Cleavage. Characteristic crushing of the human embryo. Timeline, duration.

The structure of the embryo at different stages of cleavage. Morula. Blastocyst. Embryoblast and trophoblast.

Implantation. Its mechanisms. Implantation stages. Features of implantation in humans.

Gastrulation. Characteristics of gastrulation in the human embryo.

The first phase of gastrulation. Processes that take place during this phase in embryoblast and trophoblast. Localization of presumptive rudiments.

The second phase of gastrulation. Migration paths of cells during the formation of germ layers. Interaction of cells, embryonic induction, determination, differentiation. Embryonic rudiments. Formation of tissue stem cells. Neurulation and formation axial complex.

Provisory organs

Chorion, amnion, yolk sac, allantois. Their structure and functional significance. Extraembryonic mesoderm. Chorionic value in forming the placenta. Human placenta. Its structure and function. Changes in the endometrium in the development of pregnancy, fetal membranes. System "mother-featus".

Embryonic histogenesis

The emergence of tissue based on cell differentiation of embryonic rudiments. Histogenesis mechanism: induction, division, determination, migration, differentiation, integration, morphogenetic cell death, etc. Notion of critical periods,

Breach of the determination process as the cause of anomalies and malformations. Basic critical periods of the human embryo development. Feature of newborn organism.

General characteristics and postnatal development periodization. Embryonic and postnatal development in the light of the theory of functional systems (P.K. Anokhin).

II General histology

Tissue as a system of cells and their derivatives – one of the hierarchical levels of the organization alive. Cells as the leading elements of the tissue. Non-cellular structure – symplasts as cells derivatives. Intercellular substance.

The cells in the tissue system. Notion of the cell populations. Stem cells and their properties. Determination and differentiation of cells in a series of successive divisions, lineage commitment potential. Differons. Molecular genetic basis of the determination, differential gene activity, the concept of somatic cell genetics and their epigenetic properties.

Regularity of the formation and evolution of tissues concurrency theory A.A. Zavarzin and divergent evolution N.G. Khlopin, their synthesis at the present level of development of science, morphofunctional (group) and genetic (typical) tissue classification. System factors tissues, assurance mechanisms of tissue homeostasis (tissue-specific and general). Restoration possibilities of tissue – types of physiological regeneration in renewing labile and stationary cell populations reparative regeneration. Limits of variability of tissues, the concept of metaplasia.

Epithelial tissues and glands

General morphological and functional characteristics of epithelial tissue due to their boundary position in the body. Histogenesis of epithelial tissues. morphofunctional genetic classification. The contribution of N.G. Khlopin into the study of epithelial tissues. Intercellular connections in epithelial tissues.

Special cell organelles of epithelial tissues. Basal membrane. Horizontal and vertical anisomorphic epithelial layers, cell polarization.

The structure of various types of epithelial tissues. Simple and stratified epithelium. Pseudostratified epithelium. Non-keratinized and keratinized epithelium. Transitional epithelium. Physiological and reparative regeneration of epithelial tissues. Differons of various epithelial tissues. Location cambial cells in various epithelia.

Secretory function of epithelial tissues. The glands, their structure and principles of classification. Histophysiology of secretory process. Secretory cycle. Features of the structure of the secretory cells, depending on phases of the secretory cycle. Types of secretion: holocrine, apocrine and merocrine.

Blood and lymph

Composition of the blood and lymph, their main function. Formed elements of the blood and lymph – leukocytes, postcellular (acellular) structure of human blood – red blood cells and platelets (thrombocytes). Morphological classification of leukocytes (granulocytes and agranulocytes). The structure of the formed elements and their functions. Hemogram and WBC. The age and sex characteristics of blood. Features of fetuses blood, newborn blood, postnatal dynamics. Notion of physiological regeneration of blood and lymph.

Connective tissue

General and morphofunctional characteristics, classification. Age-related changes of cells and intercellular substance of connective tissue.

Fibrous connective tissue. Classification. Loose fibrous connective tissue. Cells of loose fibrous connective tissue. Fibroblasts, their origin, variety and potency further differentiation; structure and cytochemical characterization; intracellular and extracellular stages of fibrillogenesis. Macrophages, their origin, structure, function, role in the protective reactions of the organism, the concept of the mononuclear macrophage system. Adipocytes (fat cells), their origin, structure, and cytochemical characteristics, adipocytes of white and brown adipose tissue and their role in metabolism. Adventitial cells, their origin, structure, and meaning in connection with various differentiation. Pericytes, their origin, structure and functional characterization. Plasma cells, their origin, structure, cytochemical characteristics, function, role in immunity. Tissue basophils (mast cells), their origin, structure, function, participation in regulation of connective tissue state and in the exchange of biogenic amines (monoamines). Pigment cells, their origin, structure, function.

Intercellular substance. General characteristics and structure. Basic substance, its physical and chemical properties and value.

Collagen and elastic fibers, their role, structure and chemical composition. Reticular fibers. Origin of the intercellular substance.

Relationships of blood and fibrous connective tissue. Operation of leukocytes in the fibrous connective tissue. Cell interaction in the processes of histogenesis, regeneration, inflammation, their participation in the defense reactions of the organism.

Other types of connective tissue. Dense fibrous connective tissue, its variety, structure and functions. Reticulum, structure, histophysiology and meaning. Adipose tissue, variety, structure and meaning. Pigment fabric. Mucous tissue. The tendon as organ.

Skeletal tissue

General morphofunctional characteristic. Classification. Cartilaginous tissues. General morphofunctional characteristic. Cartilage cells – chondroblasts, chondrocytes and chondroclasts. Isogeneic group of cells. Types of cartilage. Histochemical characteristics and structure of various types of intercellular of cartilage tissues. Chondrogenesis and age-related changes of cartilage tissues.

Cartilage as an organ. The structure of hyaline, fibrous and elastic cartilage. Perichondrium. Its importance in the nutrition, growth and regeneration of cartilage.

Bone tissue. Morphofunctional characteristics, classification. Bone cells: osteocytes, osteoblasts, osteoclasts. Intercellular substance of bone, its physico-chemical properties and structure. Spongy bone. Lamellar (fine fiber) bone. Their location in the body and morphofunctional features. Regeneration of bone tissue. Ectopic bone development. Osteogenesis direct and indirect. Changes with age. Bone as an organ. Microscopic structure of bone. Periosteum (the periosteum and endosteum), its structure, the role of nutrition, growth and regeneration of bone. Vessels and nerves of the bone. The development of bone directly on site embryonic connective tissue. Development of the bones in place of cartilage. Rebuilding bone during growth of the organism. Factors affecting the growth of bones.

Muscle tissue

General morphofunctional characteristics of muscle tissue, the source of their development and classification.

Smooth muscle tissue. Histogenesis, structure, morphofunctional and histochemical characteristics. Smooth myocyte. The organization of the contractile apparatus. Regeneration of smooth muscle tissue. Age-related changes.

Striated muscle tissue. Skeletal muscle (somatic type). Histogenesis. Muscle fiber (symplast) as a structural unit of the tissue. The structure of muscle fiber: basal membrane, sarcolemma, nuclei, organelles common values, special organelles. Sarcotubular system. Sarcomere as a structural unit of myofibrils. Mechanism of muscle contraction. Various types of muscle fibers. Myosatellites. Regeneration of skeletal muscle tissue.

Muscle as an organ. Microscopic structure of muscles, their innervation and vascularization. Communication muscle with tendon. Muscle regeneration.

Cardiac muscle tissue. Histogenesis. Classification: contractile and conductive (rhythm giving) cardiac muscle tissue. Structure and function of the two types of cardiac muscle tissue. Cardiomyocytes; common values organelles and special organelles of cardiomyocytes, morphological characteristics and functional significance of intercalated discs. Possibilities of cardiac muscle tissue regenerating.

Nervous tissue

General morphological and functional characteristics. Sources of development. Histogenesis.

Neurocytes (neurons). Neurocyte classification: morphological and functional. Structure of axon and dendrites. General and specific organelles, their significance, transport processes in neurocyte. Formation of neurotransmitters and neuropeptides. Neurosecretory cells.

Neuroglia. General characteristics and the main varieties. Macroglia. Types of gliocytes. Central gliocytes (ependimocytes, astrocytes and oligodedrogliocytes), peripheral gliocytes (gliocytes of ganglia) neurolemmocytes. Their structure and meaning. Microglia.

Nerve fibers. Overall morphofunctional characteristics. Classification. The structure of myelinated and unmyelinated nerve fibers, degeneration and regeneration of nerve fibers.

Nerve endings. General morphofunctional characteristics. Receptory and afferent endings, their classification and structure. Notion of the synapse. Interneuronal synapses. Classification, structure. Mediators, mechanism of excitation transfer in the synapses. Morphological substrate reflex activity of the nervous system (the notion of simple and complex reflex arcs). The role of synapses in the "polarization" of the reflex arc.

III Private histology

Nervous system

General morphofunctional characteristics. Sources and course of embryonic development.

The peripheral nervous system.

Nerve. Structure. Reaction to injury and regeneration. Sensory ganglia (spinal and cranial). Sources of development. Tissue composition. Structure: capsule neurocytes and gliocytes. Position of the nodes in the reflex arc.

The central nervous system.

Features of the structure of gray and white matter. Notion of the nerve centers. The structure of the meninges.

Spinal cord. General morphofunctional characteristics. Development. The structure of the gray matter. Neural structure, gliocytes. Nucleus, their structure and functional characteristic. Own apparatus of reflex activity. Front and rear rootlets. The structure of the white matter. Morphofunctional characteristic of conductive pathways.

Brain. General morphofunctional characteristics. Embryogenesis. Gray and white matter.

The brain stem. Neural organization of the gray matter. Medulla. Reticular formation. Hypothalamus. Characteristics of the main nuclear groups. Functions of the diencephalon. Cerebellum. Structure and functional significance. Neuronal composition of the cerebellar cortex. Afferent and efferent fibers. Interneuronal communication. Gliocytes of the cerebellum.

The cerebral cortex of the brain. General morphofunctional characteristics of the cortex. Cytoarchitectonics. Neural structure. Plate (strata) of the cerebral cortex. Notion of the column. Interneuronal communication. Mieloarchitectonics: radial and tangential fiber. Gliocytes. The blood-brain barrier, its structure and significance,

Autonomous (vegetative) nervous system. General morphofunctional characteristic and the division into departments. Ganglia of the autonomic nervous system (extra- and intramural). The nucleus of the central divisions of the autonomic nervous system. Pre- and postganglionic nerve fibers Features of the structure reflex arcs of the autonomic nervous system.

Pre- and postnatal development of the nervous system organs. Age-related changes of the cortex. Pre-and postnatal dynamics of myelination processes in the central and peripheral nervous system.

The sense organs

General characteristics of the sensory organs in the light of the doctrine of the analyzers (sensory systems). Receptor cells and mechanisms of reception. Classification of sensory organs on the genesis and structure of the receptor cells.

The organ of vision. General morphofunctional characteristics. Sources and course of embryonic development. The general plan of the structure of the eyeball. Shells, their departments and derivatives, tissue composition. The main functional devices: diopter (light-refracting), accommodative, receptor apparatus. Photoreceptor cells. Photoreception mechanism. Neuronal structure and gliocytes of the retina. The pigment layer. The macula and the central fossa. The optic nerve disc. The structure of the optic nerve. Uvea. Auxiliary apparatus of the eye. Age-related changes.

Olfactory organ. General morphofunctional characterization. Sources and course of embryonic development. Receptory or olfactory cells. Supporting or basal cells. Histophysiology of olfactory organ. Age-related changes.

Organ of taste. General morphofunctional characteristics of embryonic development and progress. Taste buds. Taste cells. Supporting and basal cells. Innervation of taste buds. Histophysiology of taste organ.

Organs of hearing and balance. General morphofunctional characteristics. The internal ear. Bone and the membranous labyrinth. Sources and course of embryonic development. Vestibular portion of the membranous labyrinth: utricle, saccule and the semicircular canals. Their receptor departments; spots and ampullary crests. Hair (sensory epithelium) and supporting cells. Macula. Histophysiology of bony labyrinth. Cochlear portion of the membranous labyrinth. Spiral organ of Corti. Hair (sensory epithelium) and supporting cells. Histophysiology of sound perception.

Cardiovascular and lymphatic system

General morphofunctional characteristics of the cardiovascular system. Sources and course of embryonic development of the vascular system organs.

Blood vessels. General principles of the structure, tissue composition and histochemical features of the walls of blood vessels. Dependence of the vascular structure from the hemodynamic conditions. Restructuring and regeneration of blood vessels. Vascularization of vessels (vasa vasorum). Innervation of blood vessels. Vascular system of the newborn. Postnatal changes in the vascular wall due to age and profession.

Artery. The structure of the arterial wall due to hemodynamic conditions. The structural features and function of the arteries of different types: muscular, muscular-elastic and elastic. Organ features of arteries.

Microcirculation vessels. Structure, hemodynamic conditions, the value in metabolism.

Arterioles, their role in the circulation. Structure. Hemocapillaries. Classification, structure and function. Morphological basis of the process of capillary permeability and regulation of their functions. Particular organ capillaries.

Venules. Functional value and structure.

Arteriolar-venular anastomoses. Value for circulation. Classification. The structure of arteriolo-venular anastomoses of different types.

Vein. The structure of the walls of veins due to hemodynamic conditions. Features of the structure of various types of veins (muscle and amyous). The structure of the venous valves. Organ features of veins.

Lymphatics. Structure and classification. The structure of lymphatic capillaries and various kinds of lymphatic vessels. Participation of lymphatic capillaries in the microcirculation system.

Heart. General morphofunctional characteristics of the heart. Sources and course of embryonic development. The structure of the heart wall, of its layers, their tissue composition. Vessels of the heart. Innervation of the heart. Endocardium and its derivatives – the heart valves. Myocardium, its typical and atypical muscle tissue, the value in work of heart, its morphofunctional characteristics. Epicardium and the parietal layer of the pericardium. Newborn heart. Process of rebuilding the heart after birth. Age-related changes of the heart. Vascularization and innervation of the heart.

Organs of hematopoiesis and immune defense

General morphofunctional characteristics. Main sources and stages of hematopoietic organs formation in the phylogeny of humans, animals and vertebrates.

Central hematopoietic and immunogenesis organs

Bone marrow. Structure and function of the bone marrow. Features of vascularization and structure of hemocapillaries. Yellow bone marrow. Age-related changes. Regeneration of bone marrow.

Thymus. Role in T-lymphocytopoiesis. Structure and tissue composition of cortex and medulla. Vascularization. Regeneration. Age-related changes.

Peripheral hematopoietic and immunogenesis organs. Lymph follicles in the wall of the airway and digestive tract (single and multiple).

Lymph nodes. The structure and composition of tissue. Cortex, medulla, paracortical area. Sinusoidal system. Vascularization. Role of blood vessels in the development and histophysiology of lymph nodes. Innervation, regeneration of the lymph nodes. Age-related changes.

Haemolymphatic nodes. Structure and functional importance. Spleen. White and red pulp, their structure and tissue composition. Blood supply of the spleen. Structural and functional features of the venous sinuses. Innervation. Regenerative potential of the spleen. Age-related changes.

Hematocytopoiesis and immunocytopoiesis.

Development blood as tissue (embryonic hematopoiesis). Postnatal hematopoiesis and immunnopoiesis – physiological regeneration of blood. Characteristics of stem and semistem blood cells (pluripotent precursors), unipotent precursors. Circulation of stem cells in the body. Notion of colony forming units (CFU) of blood cells. Characteristics of blast forms blood cells. Morphologically identifiable stages of development of blood cells – differentiating (maturing) and differentiated cells (mature) cells. Microscopic, ultramicroscopic and cytochemical characterization of cells in differons of erythrocytes, granulocytes, monocytes, T-lymphocytes,

B-lymphocytes and platelets. Characterization of myeloid and lymphoid tissues and the role of the microenvironment for the development of hematopoietic cells. Regulation of hematopoiesis and immunopoiesis.

Morphological basis of immunological reactions

Immunocytopoiesis processes in the central organs (antigen-independent). Recirculation of T- and B-lymphocytes. T-and B-dependent areas of the peripheral organs. Antigen-independent reaction cells and their cooperation in the immune response to various types of antigenic stimulation.

The effector cells and memory cells of cellular and humoral immunity. Natural killer cells. Plasma cells. Cooperation macrophage cells. T and B lymphocytes in the immune reactions. Morphological changes in lymphoid organs in the immune response.

The endocrine system

General and morphofunctional characteristics of the system. Notion of the hormones and their significance in the body. Classification of endocrine glands. Central and peripheral units of the endocrine system. Notion of the target cells and hormone receptors. Mechanisms of action of hormones on the target cells. The relationship of the endocrine and nervous systems.

Hypothalamic-pituitary neurosecretory system.

Hypothalamus. Sources and course of embryonic development, big-cellular and small-cellullar nucleus of the hypothalamus.

Features of structure and function of neurosecretory cells. Classification of neurohormones on their chemical composition and function. Adenohypophysis area of the hypothalamus. Liberins and statins. Pathways of regulation of the endocrine glands by the hypothalamus. Regulation of hypothalamic functions by the nervous and endocrine systems.

Pituitary gland. Sources and course of embryonic development of adeno-and neurohypophysis. Structure, tissue and cellular composition of the adenohypophysis. Morphofunctional characterization of adenocytes. Change adenocytes in violation of hormonal status. Hypothalamic- adenohypophysis circulation, its role in the transport of hormones.

Structure and function of the neurohypophysis. The pituitary gland of the newborn and its reconstruction on the stages of ontogeny.

Pineal gland. Sources and course of embryonic development. Structure, cellular composition. Relationship with other endocrine glands. Innervation. Age-related changes.

Peripheral endocrine glands.

Thyroid. Sources and course of embryonic development. Structure, tissue and cellular composition. Follicles as morphofunctional units, interfollicular connective tissue. Thyrocites and their hormones, the phases of secretory cycle. C-cells. Sources development, secretory function. Vascularization and innervation of the thyroid gland. Proliferation of thyroid epithelium in newborn and in ontogenetic stages.

Parathyroid glands. Sources and course of embryonic development. Structure and cellular composition. Role in the regulation of mineral metabolism. Vascularization, innervation and mechanisms of regulation of the parathyroid glands.

Adrenal gland. Sources and course of embryonic development.

Zone and their cellular composition. Features of the adrenocorticocytes structure and relation their structures to the nature of the synthesis and secretory functions of adrenocorticocytes. Role of adrenal hormones in the development of tension syndrome and morphological manifestations of the latter in the structure of the adrenal gland. Adrenal medulla. Structure, cellular composition, hormones. Vascularization and innervation of the adrenal gland. Adrenal gland of newborn and age-related changes.

Single hormone producing cells are not endocrine organs (APUD-system).

Sources of development. Localization, the cellular composition of elements of the system. Hormones and their role in regulating organ functions and body.

Digestive system

The structure of the walls of the digestive canal. General morphofunctional characterization. Mucosa, submucosa, muscular layer, the outer layer, their layers and tissue composition. General characteristics of the mucosa, its structure and meaning. Features mucosa, various portions of the digestive canal. Innervation and vascularization of the digestive tube, its lymphoid apparatus.

Gland of the digestive apparatus, localization and structural organization, principles of blood supply and innervation.

Endocrine apparatus of the digestive tract, morphofunctional characteristic.

Oral cavity. Development. Function. The structure of the mucosa in connection with the function and features of the conditions in the oral cavity. Lips, cheeks, hard and soft palate, tongue, gums, tonsils, and their structure, blood supply, innervation.

Large salivary glands. Exo- and endocrine function. Structure, histophysiology in pre-and postnatal periods, blood supply and innervation.

Tongue. Function, structure. Features of the structure of the mucous membrane on the upper and lower organ surfaces. Tongue papillae and their types. Blood supply and innervation.

Teeth. Structure. Sources and course of embryonic development.

Enamel, dentin and cement – structure, value and chemical composition. Dental pulp – the structure and meaning. Periodontal – structure and meaning. Blood supply and innervation of the tooth. Replacement of teeth. Age-related changes.

Pharynx and esophagus. Function, wall structure, sources and progress of embryonic development. The structure of the various parts of the esophageal wall. Gland of the esophagus, their histophysiology. Features of the structure of the esophageal wall in the newborn and in different periods after birth.

Stomach. Morphofunctional characteristics, sources and progress of embryonic development. Wall structure, its tissue composition. Features of the structure of the mucous membrane in different parts of the organ. Localization, structure and cellular composition of the glands. Histophysiology of secretory cells, blood supply and innervation of the stomach wall. Regenerative potency of organ. Age features of the stomach wall structure.

Small and large intestines. Sources of embryonic development of the intestinal tube. Development of villi, crypts, glands. Notion of physiological atresia. Development of the intestine into the pre-and postnatal periods.

The small intestine. Morphofunctional characteristic. The structure of the wall. System "crypt-villus" as structural and functional unit. Types of epithelial cells, their structure and cytophysiology. Features of the structure of the mucous membrane in the various departments of intestine (duodenum, jejunum and ileum). Histophysiology of digestion process. Role of microvilli of enterocytes in the parietal digestion. Blood supply and innervation of the small intestine wall. Regenerative potency. Age-related changes of the small intestine wall.

Colon, morphofunctional characterization. The structure of the wall. Features of the mucosa structure in connection with the function. Blood supply and innervation.

Appendix, its structure and meaning.

Rectum. Morphofunctional characteristics of the wall.

Pancreas. Morphofunctional characteristics, sources of embryonic development. The structure of exocrine and endocrine parts. Cytophysiological characteristic of acinar cells. Cell types of endocrine part and their morphofunctional characteristics. Blood supply and innervation of the pancreas. Regenerative potency of organ.

Features of histophysiology in different period of childhood. Age-related changes in aging prostate.

Liver. Morphofunctional characteristic. Sources and course of embryonic development. Features of the blood supply of the liver. The structure of lobule as the structural and functional unit.

Notions of the portal lobule and acinus. Histofunctional characteristics of intralobular hemocapillars. Hepatocytes, their structure, cytochemical features and functions. Notions of the morphofunctional differences of hepatocytes within the limits the hepatic lobule. Regenerative potency of liver. Features of liver histostructure in term and preterm infants. Morphofunctional characteristics of the liver of young children and of aging the organism.

Gallbladder and bile duct. Development, classification, wall structure. Regenerative potency.

Respiratory system

General morphofunctional characteristics. Airways and respiratory department. Sources and course of embryonic development. Tissue composition. Notions of not respiratory functions of breathing apparatus, barrier-metabolic, immune defense, and others, and their structural ensuring.

Layers of the airway wall: mucosa, submucosa, fibro-cartilaginous shell, the outer shell and their layers.

Extrapulmonary airways. The structure of the airways walls: nasal cavity, larynx, trachea and main bronchi. Histofunctional features of the mucosa.

Lungs.

Intrapulmonary airways: bronchi and bronchioles. Dependence of the bronchi and bronchioles wall structure of their caliber.

Acinus as morphofunctional unit of the lung. Structural components of the acinus. Structure of alveolar walls. Types of pneumocytes, their histofunctional characteristics. Structural and chemical organization and function of surfactant-alveolar complex. The structure of the interalveolar septa. Aero-hematic barrier and its significance in gas exchange. Lung macrophages. Blood supply and innervation of the lung. Age features of the lung. The structure of newborn lung (alive and stillborn), child lung, development of lung in the postnatal period. Age-related changes in lung.

Regenerative potency of respiratory organs.

Pleura. Morphofunctional characteristic.

Skin

Skin. Morphofunctional characteristics of the skin as an organ, and cover system. Sources and course of embryonic development. Tissue composition of the skin. Postnatal development, regional features. Secularization and innervation. The skin as a sense organ. Skin regeneration. Age-related changes.

Epidermis. Layers of the epidermis. Notion of the process of keratinization, and soft keratin as protein complex. The basal layer. Styloid layer as the area of synthesis of sulfur-containing component of keratin. The transition zone (granular and shiny layers). Changing cells in the process of keratinization. Stratum corneum. Cell renewal of the epidermis and the idea of its column organization. Additional epidermis differons: macrophage and melanocytic. Melanosomes and skin pigmentation. Basal plate, the dermal-epidermal junction.

Dermis. Papillary and reticular layers, their tissue composition. Glands of the skin. Sebaceous and sweat glands, their development, structure, histophysiology.

Squamous skin appendages. The solid keratin cells, and changes associated with its production. Hair. Development, structure, growth and change of hair. Nails. Structure and growth of nails.

Urinary organs

General morphofunctional characterization. The sources and course of embryonic development. Tissue composition.

Kidney. Cortex and medulla of the kidney. Nephron - functional unit of the kidney. Types of nephrons. Histophysiology of nephrons and collecting tubules. Vascularization of the kidney. Structure of countercurrent system. Morphofunctional basis of the urine formation process regulation. Juxtaglomerular complex, structure and function of each components. Innervation of the kidney. Regenerative potency. Features of the newborn kidney.

Urine diversion path. The structure of the wall of the renal calyx, cups and pelvis. Morphofunctional characteristics of the ureter, bladder and urethra.

Genital organs

General morphofunctional characteristics. Sources and course of embryonic development. Primary gonocytes initial localization, migration routes in the gonad primordium. Histologically indifferent stage of gonad development and histogenetic processes at this stage. Sexual differentiation factors. Tissue composition of the reproductive system organs.

Male genitalia. Histogenetic processes in embryo gonad, leading to the development of the testis. Sources and progress of the seminiferous ways in embryogenesis.

Testicle. Its generative and endocrine function. convoluted seminal tubule its wall. Spermatogenesis. Role of sustentotcytes in spermatogenesis. Glandulocytes (interstitial glandulocytes), their participation in the regulation of spermatogenesis and development of secondary sex characteristics. Blood-testis barrier. Histophysiology of straight tubule network and efferent tubules of testis. Regulation of testicular generative and endocrine function. Age-related changes of testis – structural features of the newborn before puberty, puberty and aging.

Ejaculatory way. Epididymis. Vas deferens. Seminal vesicles. Ejaculatory duct. Prostate. Penis.

Female genitals. Histogenetic processes in embryo gonad, leading to the development of the ovary. Sources and progress of the oviduct uterus development.

Ovary, its structure and function - generative and endocrine. Oogenesis. Differences between spermatogenesis and oogenesis. Structure and development of follicles. Ovulation. Notion of ovarian cycle and its regulation. Development, structure and function of the corpus luteum during the cycle and in pregnancy. Atresia of follicles. Atretic follicles, atretic body. Age-related changes of the ovary. Features ovarian of newborn, girls before puberty, puberty and aging. Vascularization and innervation of the uterus. Fallopian tubes. Structure and function of the fallopian tube. Uterus. The structure of the uterus wall in its various departments. The menstrual cycle and its phases. Features of the endometrium structure in different phases of the cycle. Communication ovarian and menstrual cycle. Restructuring of the uterus during pregnancy and after childbirth. Vascularization and innervation of the uterus. Age-related changes. Features uterus of new born girls before puberty, the adult women and aging.

Vagina. The structure of its walls due to the menstrual cycle. Use of vaginal smears in determining the phase of the female sexual cycle.

Thoracic (mammary) gland. Sources and course of development during embryogenesis. Postnatal changes. Functional morphology of lactating and non-lactating (defunct after lactation) mammary gland. Neuroendocrine regulation of functions of the mammary glands. Changes in the mammary gland during the sexual cycle and pregnancy. Vascularization and innervation. Regenerative capabilities.

5. Educational technologies

- Traditional classes on visual aids.
- Study of micro slides in the light microscope and fixing basic histological elements in the notebook.
- Multimedia lectures.
- Out-of-classwork with literature and micro slides.
- Course work

As part of the implementation of an individual approach to teaching students who carry out the learning process on their own trajectory within the framework of an individual work plan, the study of this discipline is based on the following possibilities: providing out-of-class work with students in the electronic educational environment with the use of appropriate software equipment, distance learning forms, the possibilities of Internet resources, individual consultations, etc.

6. Educational and methodological support of students' out-of-class work.

Assessment means for current progress monitoring, interim attestation of subject mastering results

6.1. Plan of students' out-of-classwork

Week №	Topic	Out-of-classwork type	Task	Recommended literature	Amount of hours
1	History of development and research methods in histology, cytology and embryology.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
1	Cytology: cell theory, cell types, symplast, syncytium intercellular substance cytolemma.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
2	Cytology. Cytoplasm. Organelles and inclusions.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
2	Cytology. Nucleus, cell division, cell cycle	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
3	Embryology: gametes, fertilization	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
3	Embryology: cleavage, gastrulation	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines- Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
4	Embryology: histogenesis, organogenesis, provisory organs	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines- Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1

4	Self-study to control lesson	Preparing for class work	- Repeat the theoretical material on the theme control classes. - Answer self-assessment questions in the guidelines - Repeat the micropreparations and fill the album on the theme control classes	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
5	Control lesson with diagnostics micro slides and electronograms № 1	Preparing for class work	Working with micro slides. Combining those passed into a unified system of knowledge	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
5	Epithelial tissue.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
6	Blood. Lymph. Plasma. Erythrocytes. Platelets.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
6	Blood. Leukocytes. Leukocyte formula.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
7	Hematopoiesis.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
7	Connective tissue. Fibrous connective tissue. Connective tissue with special properties.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
8	Connective tissue. Skeletal tissue. Development and structure of cartilage.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2

			- Fill in the album topic		
8	Connective tissue. Skeletal tissue. Direct and indirect osteogenesis. The structure of the bone tissue.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
9	Muscle tissue. Striated skeletal muscle tissue.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
9	Muscle tissue. Striated cardiac muscle, smooth muscle tissue.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
10	Nervous tissue. Neurocytes. Neuroglia.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
10	Nervous tissue. Nerve fibers. Nerve endings. Synapses. Reflex arcs.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
11	Self-study to control lesson	Preparing for class work	- Repeat the theoretical material on the theme control classes. - Answer self-assessment questions in the guidelines - Repeat the micropreparations and fill the album on the theme control classes	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
11	Control lesson with diagnostics micro slides and electronograms № 2	Preparing for class work	Working with micro slides. Combining those passed into a unified system of knowledge	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
12	The structure of organs of the	Preparing for	- To study theoretical material on the topic.	Junqueiro`s Basic Histology - Mc	2

	nervous system. CNS.	class work	- Answer self-assessment questions in the guidelines - Fill in the album topic	Graw Hill Education, 2013.	
12	The structure of organs of the nervous system. PNS.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
13	The structure of organs of the nervous system. The autonomic nervous system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
13	The sense organs. The structure of the organs of sight and smell.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
14	The sense organs. Structure of the organs of hearing, balance, and taste	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
14	The structure of organs of the cardiovascular system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
15	The structure of organs of the cardiovascular system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
15	The structure of central organs of the hematopoiesis and immunogenesis.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1

16	The structure of peripheral organs of the hematopoiesis and immunogenesis.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
16	Self-study to control lesson	Preparing for class work	- Repeat the theoretical material on the theme control classes. - Answer self-assessment questions in the guidelines - Repeat the micro slides and fill the album	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
17	Control lesson with diagnostics micro slides and electronograms № 3	Preparing for class work	Working with micro slides. Combining those passed into a unified system of knowledge.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	2
17	Course project	Preparing for class work	- To study theoretical material on the topic of course project	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
1	The structure of organs of the digestive system. General morphofunctional characteristic. Features mucous membrane of parts of the digestive tube.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
2	The structure of organs of the digestive system. Anterior part.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
3	The structure of organs of the digestive system. Middle and rear section.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
4	The structure of organs of the digestive system. Liver. Pancreas. Gallbladder.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5

			- Fill in the album topic.		
5	Self-study to control lesson	Preparing for class work	- Repeat the theoretical material on the theme control classes. - Answer self-assessment questions in the guidelines - Repeat the micro slides and fill the album	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
6	Control lesson with diagnostics micro slides and electronograms № 4	Preparing for class work	Working with micro slides. Combining those passed into a unified system of knowledge.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
7	Skin. Derivatives of skin.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
8	The structure of organs of the respiratory system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
9	The structure of organs of the endocrine system. Central organs.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
10	The structure of organs of the endocrine system. Peripheral organs.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
11	Self-study to control lesson	Preparing for class work	- Repeat the theoretical material on the theme control classes. - Answer self-assessment questions in the guidelines - Repeat the micro slides and fill the album	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5

12	Control lesson with diagnostics micropreparations and electronograms № 5	Preparing for class work	Working with micropreparations. Combining those passed into a unified system of knowledge.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
13	The structure of organs of the excretory system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
14	The structure of organs of the male reproductive system.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
15	The structure of organs of the female reproductive system. Female genitals. Oogenesis. Ovulation.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
16	The structure of organs of the female reproductive system. Pregnancy. Postpartum period. The structure of the placenta.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1
17	Mammary gland. Changes in the mammary gland during the sexual cycle and pregnancy.	Preparing for class work	- To study theoretical material on the topic. - Answer self-assessment questions in the guidelines - Fill in the album topic.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
18	Self-study to control lesson	Preparing for class work	Preparing for test control, work with micro slides.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	0,5
19	Control lesson with diagnostics micropreparations and electronograms № 6	Preparing for class work	Working with micro slides. Combining those passed into a unified system of knowledge.	Junqueiro`s Basic Histology - Mc Graw Hill Education, 2013.	1

6.2. Instructional guidelines on students' out-of-class work organization

Independent work performed by students on the basis of educational-methodical materials of discipline "Histology, embryology, cytology".

Independent study of theoretical material involves working with academic, scientific and reference literature. This kind of works are planned on the topics of the course are given in table. 6.1. Plan of independent work of students. Topics and questions for self-study of the theoretical course "Histology, embryology, cytology" are grouped by sections of the discipline and is given in section 6.3. The materials for the current and intermediate control of students' knowledge.

Recommended sources of information for the study of this discipline are presented in section 7. Educational-methodical and information support of the discipline.

At independent studying of the discipline "Histology, embryology, cytology" is recommended as a form of self-control test solution. To identify gaps in knowledge, after studying each theoretical Chapter, it is recommended to use the tests developed for each Chapter of the course, which allow to assess the degree of assimilation of theoretical material.

Independent work performed by students in the classroom: repeats previously learned theoretical material is practical skills – micro specimens and microscopes, using atlases and methodological recommendations for practical training issued by the sub-department.

6.3. Materials to carry out current monitoring and interim attestation of students' knowledge

Competence mastering assessment

№	Assessment type	Monitored topics (sections)	Competences that include components under assessment
1	Interview	Topic 1, 2, 3, 4, 5, 6	GEC-1, GPC-9, SPC-20
2	Test marking	Topic 1, 2, 3, 4, 5, 6	GEC-1, SPC-5
3	Practical skills	Topic 1, 2, 3, 4, 5, 6	GEC-1, GPC-9, SPC-5
4	Workbook (album)	Topic 1, 2, 3, 4, 5, 6	GEC-1, GPC-9
5	Course work	Topic 1, 2, 3	GEC-1, GPC-9, SPC-20

Interview questions

Concluding session 1

1. The emergence and development of histology and cytology as an independent science. The role of cell theory in the development of histology and medicine. Work of Schwann, Purkinje, etc.
2. Development of histology, cytology and embryology in Russia. The present stage in the development of histology, cytology and embryology.
3. Basic research methods in cytology, histology and embryology. The notion of histological preparation. Main stages of its preparation. The structure of the light microscope and rules for dealing with them.
4. Additional methods of microscopy: UV, fluorescence, phase contrast. Design and principle of operation of the electronic microscope.
5. The notion of cell as an elementary living system, basis the structure and function of eukaryotic organisms. The notion of non-cellular structures (symplast, syncytium intercellular substance). Relationship of cells and non-cellular structures.
6. Main provisions of the cell theory at the present stage of scientific development. General organization of animal cells: the cytoplasm with the cell membrane, nucleus. The shape and size of cells in relation to their functional specialization.
7. Cytolemma: structure, chemical composition and function. Feature overmembrane and submembrane layer of the cell membrane. Specialized structure of cell membranes, their structure and functions.

Concluding session 2

1. Levels of organization of living things. Determination of tissue. Tissue classification. Structural elements of the tissues. The concept of stem cells and cell populations differons. Characterization of cell

populations: renewing labile and stationary. Derived cells: symplast, syncytium, intercellular substance and their characteristics. The regeneration of tissues.

2. General morphological and functional characteristics of epithelial tissue due to their boundary position in the body. Histogenesis of epithelial tissues. morphofunctional genetic classification. Intercellular junctions in epithelial tissues.
3. The structure of various types of epithelial tissues. Monolayer and multilayer epithelium. Pseudostratified epithelium. Nonkeratinizing and keratinizing epithelium. Transitional epithelium. Physiological and reparative regeneration of epithelial tissues.
4. Morphofunctional characteristics of the surface epithelium. Classification. Multilayered epithelium: different types of sources of development, structure, epidermal differons, physiological regeneration, localization of cambial cells.
5. Epithelial tissue. Morphofunctional characterization. Classification (morphofunctional and genetic). Single-layer epithelium. Their variety, structure and function. Basal membrane.
6. Morphofunctional characteristics of the surface epithelium. Classification (morphofunctional and genetic). Multilayered epithelium. Physiological regeneration, localization of cambial cells.
7. Secretory function of epithelial tissues. Gland, their structure and principles of classification. Histophysiology of secretory process. Secretory cycle. Features of structure of the secretory cells, depending on phases of the secretory cycle. Types of secretion: golocrine, apocrine and merocrine.

Concluding session 3

1. Morphofunctional characteristics of the nervous system. Composition of the structural elements of the CNS and PNS. Spinal ganglia: development, structure and functions. The structure of the peripheral nerve. Reflex arc: sensory, motor and associative links. Nerve regeneration.
2. . Morphofunctional characteristics of the nervous system. The concept of the CNS and PNS. Spinal cord. The structure of white and gray matter. Neuronal structure and types of glial cells. Nucleus of gray matter. The structure of the white matter.
3. The brain stem. Neural organization of the gray matter. Medulla. Reticular formation. Hypothalamus. Characteristics of the main nuclear groups. Functions of the diencephalon.
4. Brain. General morphological and functional characteristics of the cerebral hemispheres. Embryogenesis. Cytoarchitectonics and neural structure of the cerebral cortex. Idea of modular organization of the cortex. Mieloarchitectonics. Age-related changes of the cortex.
5. Cerebellum. Structure and functional characterization. Neuronal composition of the cerebellar cortex. Interneuron connection. Afferent and efferent nerve fibers of the cerebellum.
6. Autonomous (vegetative) nervous system. General morphofunctional characteristics and the division into departments. The nucleus of the central divisions of the autonomic nervous system. Pre-and postganglionic nerve fibers. Avilable reflex arcs of the autonomic nervous system.
7. The organ of vision. General morphological and functional characteristics. Sources and course of embryonic development. The overall plan of the structure of the eyeball. Shells, their departments and derivatives, tissue composition.

Concluding session 4

1. The structure of the walls of the alimentary canal. General morphological and functional characteristics. Mucosa, submucosa, muscular layer, the outer shell of their layers and tissue composition. Features mucosa, various portions of the digestive canal ..
2. Oral cavity. Development. Function. The structure of the mucosa in connection with the function and features of the conditions in the oral cavity. Lips, cheeks, hard and soft palate, tongue, gums, tonsils, and their structure.
3. Language. Function, structure. Avilable on the mucosal surfaces of the upper and lower body. Papillae language and their types.
4. Teeth. Structure. Enamel, dentin and cement structure, value and composition. Dental pulp - the structure and meaning. Periodontal - structure and meaning. Replacement of teeth. Age-related changes.
5. Pharynx and esophagus. Function, structure, wall, power and progress of embryonic development. The structure of the various divisions of the esophageal wall. Glands of the esophagus, their histophysiology.
6. Stomach. Morphofunctional characteristics, origins and progress of embryonic development. Wall structure, its tissue composition. Features of the structure of the mucous membrane in different parts of the organ. Localization, structure and cellular composition of the glands.
7. The small intestine. Morphofunctional characterization. The structure of the wall. Types of epithelial cells, their structure and cytophysiology. Features of the structure of the mucous membrane in the various

departments of intestine (duodenum, ileum and skinny). Histophysiology of digestion process. Role of microvilli of enterocytes in the wall digestion.

8. Colon, morphological and functional characteristics. The structure of the wall. Peculiarities of structure of the mucosa in connection with the function. Appendix. Features of its structure and meaning.

Concluding session 5

1. General and morphofunctional characteristics of the endocrine system. The concept of the hormones and their significance in the body. Classification of endocrine glands. Central and peripheral units of the endocrine system. The concept of the target cells and hormone receptors. Mechanisms of action of hormones on the cells - the target. The relationship of the endocrine and nervous systems.
2. Hypothalamic-pituitary neurosecretory system. Hypothalamus. Structure and function of neurosecretory cells. Classification of neurohormones on their chemical composition and function. Adenohypophysis area of the hypothalamus. Liberins and statins. Pathways of regulation by the hypothalamus gland of the endocrine system.
3. Pituitary gland. Sources and course of embryonic development of adeno-and neurohypophysis. Structure, tissue and cellular composition of the adenohypophysis. morphofunctional characterization adenocytes. Hypothalamic- adenohypophysis circulation, its role in the transport of hormones. Structure and function of the neurohypophysis.
4. Epiphysis. Sources and course of embryonic development. Structure, cellular composition. Relationship with other endocrine glands. Age-related changes.
5. Thyroid. Sources and course of embryonic development. Structure, tissue and cellular composition. Follicles as morphofunctional units interfollicular connective tissue. Thyrocites and their hormones, the secretory phase of the cycle. C-cells.
6. Parathyroid glands. Sources and course of embryonic development. Structure and cellular composition. Role in the regulation of mineral metabolism. Mechanisms of regulation of the parathyroid glands.
7. Adrenals. Sources and course of embryonic development. Zone and their cellular composition. Avilable adrenocorticocytes structures and their relation to the nature of the synthesis and secretory functions adrenocorticocytes. Adrenal medulla. Structure, cellular composition, hormones.

Concluding session 6

1. Kidney. Cortex and medulla of the kidney. Nephron - functional unit of the kidney. Histophysiology of nephrons and collecting tubules. Vascularization of the kidney. morphofunctional basis of the regulation of the process of urine formation. Juxtaglomerular complex structure and function of each of its components.
2. Urinary tract. The structure of the wall of the renal cups, cups and pelvis. morphofunctional characteristics of the ureter, bladder and urethra.
3. Male genitalia. Testicle. His generative and endocrine function. Convoluted seminiferous tubule, its wall. Spermatogenesis. Role of sustentotcytes in spermatogenesis. Glandulocytes (interstitial glandulocytes), their participation in the regulation of spermatogenesis and development of secondary sex characteristics. Blood-testis barrier. Histophysiology of straight tubule network and efferent tubules eggs. Generative and endocrine regulation of testicular function.
4. Male genitalia. Prostate. Structure and functions.
5. Epididymis, vas way, seminal vesicles, penis. Their structure and function.
6. Female genitals. Ovary, its structure and function - generative and endocrine. Oogenesis. Differences of spermatogenesis oogenesis. Structure and development of follicles.
7. Ovulation. Notion of ovarian cycle and its regulation. Development, Structure and function of the corpus luteum during the cycle and in pregnancy. Atresia of follicles. Atretic follicles, atretic body.

The criteria for the evaluation of the answer to the classroom

"5" – "excellent" is set for complete, error-free response. The student is freely guided in the theoretical material.
"4" – "good" rating is set for correct, but not complete answer.
"3" - the rating "satisfactory" is assigned when the response contains significant errors.
"2" – "failed" is assigned if the student makes serious mistakes, not focused in the theoretical material.

Demonstrative test on the subject "Histology, embryology, cytology"

1. Proteins destined for their own needs cells synthesized. All true, except...

A) free cytoplasmic ribosomes
B) mitochondrial ribosome
C) free polyribosomes

D) polyribosomes of granular endoplasmic reticulum
E) lysosomes

2. Nuclear plate characterized all except...

A) separates the inner nuclear membrane of the content of the nucleus
B) consists of intermediate filament proteins - lamins
C) involved in the synthesis of proteins into cisterns perinuclear
D) forms a perinuclear chromatin
E) involved in the organization of the nuclear envelope

3. The function of the Golgi complex is not included...

A) sorting of proteins on different transport vesicles
B) glycosylation of proteins
C) reutilization membranes of secretory granules after exocytosis
D) secretory product packing
E) synthesis of steroid hormones

4. What is characteristic of the endoplasmic reticulum membrane tanks - depot Ca^{2+} ?

A) the membrane belongs to the granular endoplasmic reticulum
B) in Ca^{2+} - channel ions are located in the cytosol down a concentration gradient
C) includes a pump pumping out from the tank Ca^{2+}
D) is present in the cells of all tissues
E) the concentration of cytosolic Ca^{2+} does not affect the condition of Ca^{2+} channels

5. Microfilaments characteristic of all except...

A) formed clusters on the periphery of the cells
B) associated with plasmolemma by intermediate proteins
C) consist of two strands of F- actin
D) provide a chromosomes mobility
E) provide a non-muscle cell mobility

6. At what stage of mitosis, the chromosomes are located on the equator , forming a record?

A) prophase
B) prometaphase
C) metaphase
D) anaphase
E) telophase

7. At what stage of meiosis is synapsis occurs?

A) leptotena
B) zygotene
C) pachytene
D) diplotene
E) diakinesis

8. Microtubules as cytoskeletal elements, characterized by all except ...

A) maintain cell shape
B) interact with kinesin
C) are involved in the intracellular transport of macromolecules and organelles
D) polar - at one end joined by new subunit , and on the other - are separated old
E) provide mobility of microvilli

9. In the Golgi complex occur processing and modification of proteins for...

A) lysosomes
B) plasmolemma
C) the secretory granules
D) cytosol
E) endoplasmic reticulum

10. The nuclear pore complex. All true , except...

A) is integrated into the inner nuclear membrane
B) contains a receptor protein , able to increase the diameter of the pores channel
C) is used to exchange between the nucleus and the cytoplasm
D) receptor of nuclear pores formed large protein granules located circumferentially near the edge of the pores
E) a large central granule is composed of subunits of ribosomes

Criteria of Test Evaluation

«Excellent» («5») – 91% of correct answers to test questions.
«Good» («4») – 81-90% of correct answers to test questions.
«Satisfactory» («3») – 71-80% of correct answers to test questions.

«Failed» («2») – 70% and less of correct answers to test questions.

Exemplary list of examination questions and tasks

1. The emergence and development of histology and cytology as an independent science. The role of theory in the development of cell histology and medicine. Schwann work, Purkinje, etc.
2. Development of histology, cytology and embryology in Russia. The present stage in the development of histology, cytology and embryology.
3. Basic research methods in cytology, histology and embryology. Idea of histological preparation. Main stages of its preparation. The structure of the light microscope and rules for dealing with them.
4. Additional methods of microscopy: UV, fluorescence, phase contrast. Design and principle of operation of the electronic microscope.
5. The concept of the cell as a living system, the unit, based on the structure and function of eukaryotic organisms. The concept of non-cellular structures (symplast, syncytium intercellular substance). Relationship of cells and non-cellular structures.
6. Main provisions of the cell theory at the present stage of scientific development. The overall organization of animal cells: the cytoplasm to the cell membrane, nucleus. The shape and size of cells in relation to their functional specialization.
7. Cytolemma: structure, chemical composition and function. Feature overmembrane and submembrane layer of the cell membrane. Specialized structure of cell membranes, their structure and functions.
8. Cytolemma: structure, chemical composition and function. Functional and structural characteristics of different types of compounds. Simple compounds. Complex compounds: dense compound, gap junctions (nexus), intermediates, desmosomes, fingerlike connections.
9. Main provisions of the cell theory. The organization of the plasma membrane. Intercellular interactions. Membranous components. Plasmolemma function.
10. The overall plan of the structure of the eukaryotic cell. Relation between the shape and size of cells with their functional specialization. Structural and functional characterization of the organelles involved in the biosynthesis of substances in the cells.
11. Cytoplasmic organelles: concept and classification. Structural and functional characterization of the organelles involved in energy production.
12. Cytoplasmic organelles: concept and classification. Structural and functional characterization of the organelles involved in intracellular digestion, protective and detoxifying reactions.
13. Cytoplasmic organelles: concept and classification. Structural, chemical and functional characterization of the organelles that make up the cytoskeleton of cells. Structure and meaning of centrioles, cilia and flagella.
14. Cytoplasmic organelles: definition and classification. Concept of compartmentalization cells and its functional significance. Lysosomes. Structure, chemical composition, function. The concept of primary and secondary lysosomes, and about Autophagosomes geterophagosomes.
15. Contribution Purkinje Schwann, Virchow, and others in the doctrine of the cage. General plan for the organization of the eukaryotic cell. Cytoplasmic inclusions: definition, classification, chemical and morphological and functional characteristics.
16. Cytoplasmic organelles: concept and classification. Structural and functional characterization of the organelles involved in the synthesis and secretion of substances from cells.
17. Cytoplasmic organelles: concept and classification. Structural and functional characterization of the organelles involved in intracellular digestion, protective and detoxifying reactions.
18. Core: structure, function, chemical composition. Interaction of nuclear and cytoplasmic structures in the process of protein synthesis in cells. Main stages of protein synthesis.

Criteria for Oral Examination/Colloquium Assessment

«Excellent» – the answer is comprehensive, meaningful, logically correct; structure, characteristics, functions and transformations of substances are described correctly, with free use of research terminology; answers to additional questions are short and precise.

«Good» – the answer partly lacks logical coherence with rare mistakes in details; characteristics, functions and transformations of substances are described but not in full; answers to additional questions are correct but not explicit enough.

«Satisfactory» – the answer is not full, lacks correctness in details; structure, characteristics, functions and transformations of substances are described unclearly and not exhaustively; answers to additional questions are not precise, there are mistakes in details.

«Failed» – the answer lacks coherence and meaning, with serious mistakes; structure, characteristics, functions and transformations of substances are described incorrectly; no knowledge of biochemistry terminology; answers to additional questions are wrong.

Exemplary list of practical skills

1. The ability to work with a light microscope at low and high magnification.
2. The ability to identify the organs, tissues, cells and non-cellular structures at a microscopic level.
3. The ability to work with the scientific literature and the mind of use this skill.

Exemplary list of micro slides to the control class:

Test lesson №1.

1– Frog's blood
2– Human blood
3 – Skeletal striated muscle tissue
4 –Epithelial cells of the renal tubules
5 – Ovum
8 – Fatty liver
9 – Mitosis of plant cells
13 – Sperm
21A– The umbilical Cord
86a– Placenta – fetal part
176– Skeletal striated muscle tissue (individual muscle fibers)

Test lesson №2

2 – Human blood
21A – The umbilical Cord
22 – The Epithelial cells of the thyroid gland
23 – Non-keratinize stratified squamous epithelium of the esophagus
25 – Simple columnar epithelium of the colon
27 – Thin Skin
29 – Loose connective tissue
30 – Adipose tissue
31 – Hyaline cartilage
34 – The diaphysis of the bone
35 – Red bone marrow.
36 – Skeletal striated muscle tissue
37 – Cardiac striated muscle tissue
41 – Nerve
42 – The Nerve cells of the brain
47 – The Liver of the newborn
49 – Exo - and endocrine part of the pancreas
85 – The Liver of the fetus
111 – Fibrous cartilage
177 – The mesothelium
178 – Spinal cord (cross section)

Test lesson № 3.

28 – The neurovascular bundle
35 – Red bone marrow
37 – The Heart
41 – The peripheral nerve
42 – The cerebral Cortex
43 – The cerebellar Cortex
45 – Aorta
46 – Spleen

66 – The Cornea. Iris
89 – Fluted papilla of the tongue

Test lesson № 4

78 – Parotid salivary gland
127 – Sublingual salivary gland
23 – Esophagus
121 The transition of the esophagus into the stomach
25 – Large intestine
6 – Appendix
48 – Liver
49 – Pancreas

Test lesson № 5

36 – Bronchus
37 – Lung
38 – Thin skin (scalp)
39 – Thick skin (Palmar surface)
40 – The pituitary gland
41 – The thyroid gland
42 – The adrenal glands

Test lesson № 6

11 – Ovary
62 – Fallopian tube
72 – Cervix
86 – Placenta
60 – Convoluted seminiferous tubules
61 – Prostate gland
81 – The Kidney of the fetus
59 – Kidney

Exemplary list of examination micro slides

1– Frog's blood
2– Human blood
3 – Skeletal striated muscle tissue
4 –Epithelial cells of the renal tubules
5 – Ovum
6 – Fatty liver
7 – Mitosis of plant cells
8 – Sperm
9 – The umbilical Cord
10 – Placenta – fetal part
11 – Skeletal striated muscle tissue (individual muscle fibers)
12 – The Epithelial cells of the thyroid gland
13 – Non-keratinize stratified squamous epithelium of the esophagus
14 – Simple columnar epithelium of the colon
15 – Thin Skin
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18 – Hyaline cartilage
19 – The diaphysis of the bone
20 – Red bone marrow.
21 – Skeletal striated muscle tissue
22 – Cardiac striated muscle tissue
23 – Nerve

24 – The Nerve cells of the brain
25 – The Liver of the newborn
26 – Exo - and endocrine part of the pancreas
27 – The Liver of the fetus
28 – Fibrous cartilage
29 – The mesothelium
30 – Spinal cord (cross section)
31 – The neurovascular bundle
32 – Red bone marrow
33 – The Heart
34 – The peripheral nerve
35 – The cerebral Cortex
36 – The cerebellar Cortex
37 – Aorta
38 – Spleen
39 – The Cornea. Iris
40 – Fluted papilla of the tongue
41 – Parotid salivary gland
42 – Sublingual salivary gland
43 – Esophagus
44 – The transition of the esophagus into the stomach
45 – Large intestine
46 – Appendix
47 – Liver
48 – Pancreas
49 – Bronchus
50 – Lung
51 – Thin skin (scalp)
52 – Thick skin (Palmar surface)
53 – The pituitary gland
54 – The thyroid gland
55 – The adrenal glands
56 – Fallopian tube
57 – Cervix
58 – Convoluted seminiferous tubules
59 – Prostate gland
60 – The Kidney of the fetus
61 – Kidney

The criteria practical skills:

• "excellent" – the student has a systemic theoretical knowledge (knows how to work with the microscope), without errors independently identificeret organelles, cells, tissues and organs on the micropreparations.

• "good" – the student has theoretical knowledge (knows how to work with the microscope), independently identificeret organelles, cells, tissues and organs of micropreparative, allowing some errors (minor errors), which independently detects and corrects quickly,

• "satisfactory" – the student has a satisfactory theoretical knowledge (knows basic provisions of a technique of work with a microscope), makes mistakes in the identification of micro specimens, which may correct the correction by their teacher,

• "failed" – the student does not have sufficient level of theoretical knowledge (knows no method of working with the microscope) and/or can demonstrate practical skills or execute them, avoiding blunders.

Exemplary list of course work

1. The biological significance of meiosis. Fertilization.

2. Classification, structural and functional characterization of the exocrine glands.
3. Classification, structural and functional characterization of integrated on the inner gland secretion.
4. Classification of epithelial tissues and the sources of their development.
5. The bone tissue in the skeleton structure in different periods of ontogeny
6. Macro - microstructure and liver function.
7. Structural and functional characterization of the pancreas.
8. Blood - as a special kind of tissue of mesenchymal origin.
9. The Central Authorities of hematopoiesis and immune defense. Microstructure and function of bone marrow and thymus.
10. Immunocompetent organs, cells and their interactions in immune reactions-tions.
11. Structural and functional characterization of lymph nodes and lymph vessels-cal.
12.Iinfarction, development, structure, value. Regeneration after heart attacks and fur-cal damage.
13. Classification, histological and function arteries, veins and blood vessels microcirculation bed.
14. The age Kidney histology
15. Histological and functional organization urinific and urinary-conducting parts of the urinary system.
16. spermatogenesis. Testes barrier, the impact of environmental hazards, alcohol, drugs, nicotine on germ cells.
17. Oogenesis. The blood-ovary barrier, the impact of harmful environmental facto-ing, alcohol, drugs, nicotine on germ cells.
18. Endocrine function of the sex glands.
19. Morphofunctional organization of the human placenta
20. Features of the regeneration in the various organs and tissues

Evaluate the types of activities in the course work

Activities	**Points**
Analysis of the task formulated in the form of technical requirements and all available baseline data for its implementation, screening of excess and the definition of missing characteristics	15
The choice of methods to achieve the objectives and justification of the choice	15
Perfomance of a task	15
Analysis of the obtained solution and its qualitative evaluation	15
Total	***60***
Protection of the course project	40
Total	**100**

7. Educational, methodological and informational means provided for subject "Histology, embryology, cytology"

a) Basic literature:

1. Junqueiro`s Basic Histology – Mc Graw Hill Education, 2013.

b) Additional literature:

1. Guidelines for practical classes for the 1-2 year students discipline: Histology, cytology, embryology section “Cytology” / A.S. Kupryushin, M.G. Fedorova, Zh.S. Vishnyakova, I.V. Latynova. – Penza.:PGU 2015.

c) Online resources:

1. Single window of access to educational resources - http://window.edu.ru/
2. Scientific electronic library eLibrary.ru - http://elibrary.ru/

3. ELS “Consultant of a student” - http://www.studmedlib.ru

d) Software:

1. Microsoft Windows (DreamSpark/Microsoft Imagine Standart); reg. number 00037FFEBACF8FD7, contract № СД-130712001 of 12.07.2013.

2. Kaspersky Anti-Virus 2016-2017, reg. number KL4863RAUFQ, contract № ХП-567116 of 29.08.2016.

3. Open source software: LibreOffice; Google Chrome; Adobe Reader; 7zip

8. Material and technical means provided for subject “Histology, Embryology, Cytology”

№ п/п	The name of the special rooms and areas for out-of-classwork	Equipment of special rooms and areas for out-of-classwork
1	- Training rooms № 1-6 mortuaries № 2 - Training rooms 202, 205 (10 building) - Section hall mortuaries № 2	1. The audience, equipped with furniture 2. Multimedia learning tools (multimedia projector, screen, computer, TV). 3. Computer equipment capable of connecting to the Internet and access to electronic information-educational environment of the organization. 4. Set of electronic presentations/slides of the lectures. 5. A set of tests on sections of discipline and the discipline as a whole. 6. Demonstration table. 7. Tutorials. 8. Medical microscopes MIKMED 5 9. Medical microscopes MIKMED 6 10. Camera TS – 1000 (the software "Micro – View (MC-PHOTO) 11. Complex image rendering on the basis of the digital video camera of TSA 9-0 for Microscope MIKMED 6 12. Macropreparation. 13. Sets micro slides on sections of discipline. 14. Electron diffraction.

The study programme for the discipline histology, embryology, cytology is composed in accordance with the requirements GEF IN and curriculum for the course 31.05.01 – General Medicine.

The study programme is compiled by:

Ph.D., Assoc. professor of the Department Latynova I.V.

Verification and correction are executed by Y.A. Didyk, associate professor, department of translation.

The programme was discussed and agreed at the meeting of the Department of Clinical morphology and forensic medicine with a course of oncology
Records № 7 on « 4 » 03 2016

The Head of the Department of Clinical morphology and forensic medicine with a course of oncology

Ph.D., Assoc.prof. A.S. Kupryushin

The programme is agreed with the Dean of the medical faculty

M.D., Prof. L.Y. Moiseeva

The programme was approved by methodology council of the Medical Institute Penza State University
Records № 7 on « 05 » 03 2016

Chair of the methodology council of the Medical Institute

M.D., Prof. O.V. Kalmin

Data on re-approval of the program for consecutive academic years and record of alterations

Academic year	Sub-departments' decision (Report№, date, signature of sub-department's head	Introduced alterations	Page numbers		
			changed	new	annulled
2016-2017	Report № 8 on 15.05.2017	Graduate qualification was changed from "General practitioner doctor" at "Medical doctor"	1	1	
2017-2018	Report № 1 on 31.08.17	The amendments have been made to paragraph 5 regarding the possibility of implementing an individual approach to training	21	21	