

Federal State Autonomous Educational Institution of Higher Education
«Peoples' Friendship University of Russia»

Medical Institute

Recommended MCSD

SYLLABUS
(STUDY GUIDE)

Subject

Histology, Embryology, Cytology

Recommended for the direction of training (specialty)

31.05.01 General Medicine

Program (profile, specialization)

General Medicine

1. Goals and objectives of the educational discipline: the purpose of teaching histology, cytology and embryology is to study the structure of living matter in the norm at different levels of its organization: molecular, subcellular, cellular, tissue, and organ' systems, as well as to study the patterns of development of tissues, organs, and the human body as a whole.

2. The place of the educational discipline in the structure of EP HE (Educational Program of Higher Education):

The discipline "Histology, Embryology, Cytology" belongs to the basic part of the block 1 of the curriculum.

Table 1 shows the previous and subsequent disciplines aimed at forming the competencies of the discipline in accordance with the matrix of competencies of the EP HE.

Table №1

Previous and subsequent study disciplines aimed at forming the competencies

№ №	General Professional Competence Category	Previous study disciplines	Subsequent study disciplines (groups of disciplines)
1.	GPC-5	biology, anatomy, latin chemistry, physics	general pathology and pathologic physiology, pathologic anatomy, general and clinic pharmacology, forensic medicine, neurology, obstetrics and gynecology

3. The specialist's programme is to set the following general professional competences:

The process of studying the educational discipline is aimed at the formation of the following competencies:

Table №2

General Professional Competence Category	General Professional Competence Code and Name	General Professional Competence Achievement Indicator Code and Name
Etiology and pathogenesis	GPC-5. Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	GPC-5.2. Being able to evaluate the results of clinical, laboratory and functional diagnosis when dealing with professional tasks. GPC-5.3. Being able to determine morpho-functional, physiological states and pathological processes of the human body.

As a result of studying the discipline, the student should:

Know:

- safety regulations and work in physical, chemical, biological laboratories with reagents, devices, animals;
- the physical and chemical essence of the processes occurring in a living organism at the molecular, cellular, tissue and organ' systems levels;
- - the main patterns of development and vital activity of the body on the basis of the structural organization of cells, tissues and organs; histo-functional features of tissue elements, methods of their research;

- structure, topography and development of cells, tissues, organs and systems of the body in interaction with their function in normal and pathological conditions, features of the organizational and population levels of life organization.

Able to:

- use educational, scientific, popular science literature, the Internet for professional activities;
- work with magnifying equipment (light microscopes, optical and simple magnifiers);
- give a histo-physiological assessment of the state of various cellular, tissue and organ structures;
- explain the nature of deviations in the course of development that can lead to the formation of variants of anomalies and defects;
- describe the morphological changes in the studied macroscopic and microscopic preparations and electronograms.

Possess:

- the skills of microscopy and analysis of histological preparations and electronic micrographs.

4. The volume of the discipline and types of academic work

The total labor intensity of the discipline is 7 credits.

№	Type of academic work	Total	academic semesters	
		hours	II	III
1.	Classroom settings (total)	144	72	72
	Including:	-	-	-
1.1	<i>Lectures</i>	34	17	17
1.2	<i>Practical classes (PC)</i>	-	-	-
1.3	<i>Seminars (C)</i>	-	-	-
1.4	<i>Laboratory workshop (LW)</i>	108	54	54
2.	Self-study (total)	72	36	36
3.	Total labor intensity	hours	252	108
		credits	7	3

5. Content of the Discipline

5.1. Content of the discipline sections

№	Section	Content of the section (Topic)
1.	Introduction to the subject. Methods of study in cytology, histology and embryology.	The purpose, content, and place of histology, cytology, and embryology in the medical training system. Development of histology, cytology and embryology in the XX century. Present-day stage of histology, cytology and embryology development. Methods of histological specimens' preparation for the light microscopy. Types of the histological preparation: sections, smears, total preparations. Micro techniques. The light microscopy. Luminescent microscopy, phase-contrast microscopy, interferential microscopy, laser confocal microscopy. Electron microscopy: transmission microscopy and scanning microscopy. Special methods of histological studies: histochemistry, radioautography, immunohistochemistry. Methods of study of living cells. Quantitative methods of study. Methods of study in the embryology.
2.	Cytology	
	2.1. Cytology . cell structure.	The subject and tasks of cytology, its significance in the system of biological and medical sciences Tissue components. The principal types: cell, symplast, syncytium,

		intercellular substance. The basic statements of the cell theory. The concept of a cell. General plan of the cell structure. Tissue components. The principal types: cell, symplast, syncytium, intercellular substance. The cell theory. The cell. The plasma membrane: chemical composition, arrangement. Barrier-receptor and transport systems of the cell. Mechanisms of intercellular interactions of cells. Intercellular junctions: classification, characteristic, function. Adhesive, tight, communication junctions. The role of the cell membrane in the processes of endocytosis, phagocytosis, pinocytosis. Cell aging. Intracellular regeneration. The reaction of cells to external influences. Cell death: necrosis, apoptosis. Biological significance of the processes of necrosis and apoptosis.
	2.2. Cytology. Organelles and inclusions.	Cytoplasm. Hyaloplasm. Organelles of common significance: membranous organelles (endoplasmic reticulum, mitochondria, Golgi complex, lysosomes, peroxisomes) and non-membranous organelles (ribosomes, cell centre, components of cytoskeleton). The feature of structure and functions of granular and smooth endoplasmic reticulum, depending on types of synthetic processes in the cell. Structure and functions of mitochondria. Autonomous system of mitochondrial protein synthesis. Structure and functions of Golgi complex. Structure, contents and functions of lysosomes. Lysosomes: primary, secondary (phagolysosomes and autophagolysosomes), residual bodies. Structure, functions and content of peroxisomes. Ribosomes: structure, chemical composition and functions. Polysomes. Structure of centrioles. Organelles of special significance: myofibrils, microvilli, cilia, flagellae. The cell inclusions: definition, classification, their significance in the cell activity. Structure and chemical composition of various types of inclusions
	2.3. Cytology. Nucleus: structure, functions.	Structure and chemical composition of the cell nucleus. The role of nuclear structures in the life of the cell. Interphase nucleus: chromatin, nucleolus, nuclear envelope, karyoplasm (nucleoplasm). . Structure of nuclear envelope, nucleolus, and nucleoplasm. Structure of nuclear pore complex/ Nucleoplasm: functions and physical and chemical properties. Chromatin (euchromatin, heterochromatin). Sex chromatin. Chromosomes. Nucleus shape and quantity. The mechanism of nuclear import and export. The nucleolus. The number and size of the nucleoli. The nucleolar organizer. Cell reproduction. The cell cycle. Phases and length of the cell cycle. Regulation of the cell cycle. Cell division. Mitosis, dynamics of mitosis. Cell center and cell division. Morphology of mitotic chromosomes. Meiosis, the mechanism of meiosis. Biological significance and forms of endomitosis. Polyploidy. Pathology of mitosis.
3.	Basic Histology.	
	1.1. Basic Histology. The conception "tissue". Epithelia. Glands.	The concept of "tissue". Cells and non-cellular structures. The concept of cell populations. Renewing, growing and stable population' tissues. Histogenesis. Differentiation and determination. Cell growth, migration, and intercellular interactions. Stem cells and their properties. The concept of differon. Monodifferon and polydifferon tissues.

		<p>Physiological and reparative tissue regeneration of tissue.. Classification of tissues and their general characteristics. General morphological and functional characteristics and histogenesis of epithelial tissues. Morphofunctional and histogenetic classification, intercellular junctions. Covering epithelium. Borderline position in the body. Stratified and simple epithelium: structure, functions. Polar differentiation (Polarity). Special organelles of epithelial cells. The basal membrane: structure, functions. Cytokeratins as markers of epithelial tissues. The structure of various types of epithelial tissues. Innervation. Renewal of epithelial cells. Physiological and reparative regeneration of epithelial tissues. Neuroepithelial cells. Myoepithelial cells. Glandular epithelium. Secretory function of epithelial tissues. Glands, their structure, principles of classification. Secretory units (portions) and ducts. Secretory cycle.</p>
	<p>3.2. Basic Histology. The system of the internal environment tissues. Blood and lymph.</p>	<p>The concept of the system of the internal environment tissues. Blood and lymph, their principle functions. Blood Components: formed blood elements and plasma. Formed blood elements: leukocytes, erythrocytes, platelets. Hemogram and different leukocyte count. Physiological regeneration of blood. Erythrocytes: sizes, shape, structure, functions. Hemoglobin types. Reticulocytes. Leukocytes. Common characteristic and classification. Granulocytes: neutrophils, eosinophils, basophils. Agranulocytes: monocytes and lymphocytes. Types of lymphocytes, features of their structure and functions. Platelets: size, structure, function. Lymph: lymphoplasm and formed elements, connection with blood. Age-related and gender-related features of blood.</p>
	<p>3.3. Basic Histology. Hemopoiesis</p>	<p>Prenatal and postnatal hemopoiesis. Formation of blood as tissue. Postnatal hemopoiesis, physiological regeneration of blood. Hemopoietic stem cell, its properties. Regulatory factors: growth factors and factors of differentiation. Compartments of hemopoietic cells. Committed stem cells, progenitor and precursor cells. Conception of colony-forming units. The system of hemopoiesis: erythropoiesis, granulocytopenesis, lymphocytopenesis, monocytopenesis, thrombocytopenesis. Microenvironment for hemopoietic cells' development.</p>
	<p>3.4. Basic Histology. Connective tissues. Fibrous Connective Tissue. Special Connective Tissues.</p>	<p>Connective tissues. The source of development. Classification. Fibrous connective tissue (proper). The morphological and functional characteristic of loose connective tissues. Intercellular substance: common characteristic, structure, physical-chemical properties. Types of intercellular substance' fibers: collagen, reticular and elastic fibers. Amorphous (ground) substance, physical and chemical properties. The cell types: fibroblasts, macrophages, mast cells, adipocytes, plasma cells, pigment cells, pericytes, adventitial cells. Their origin, features of structure, functions. Interaction of blood cells and cells of the loose connective tissue. Common morphological and functional characteristic of the dense connective tissue, its subtypes. Structure of ligaments and tendons. Adipose tissues, its subtypes,</p>

		structure and functions. Reticular tissue. Pigment tissue. Mucous tissue.
	3.5. Basic Histology. Skeletal Cartilage	General characteristic of skeletal tissues. Classification. Types of cartilage: hyaline, elastic, fibrocartilage. Chondrogenous differon and embryonic chondrogenesis. The cells of cartilage, their structure and functions. Structure and functions of intercellular matrix. The features of intercellular matrix of cartilage different types. Perichondrium, its significance. Types of cartilage growth. Structure of articular cartilage. Age-related alterations of cartilage and regeneration.
	3.6. Basic Histology. Skeletal tissues. Bone.	General characteristic. Classification. The bone cells: osteocytes, osteoblasts, osteoclasts, their morphofunctional characteristic. Intercellular matrix of bone tissue, its physical-chemical properties and structure. Woven (reticulo-fibrous) bone. Lamellar bone tissue. Their localization in the body and morphological and functional features. Osteogenesis. Intramembranous ossification. Endochondral ossification. The structure of epiphyseal growth plate. Age-related alterations. Regeneration after bone fractures. Remodeling of bone tissue, and influencing factors. Bone joints.
	3.7. Basic Histology. Muscle Tissues	General morphologic and functional characteristic, sources of development, histogenesis. Skeletal striated muscle tissue. Development, morphological and functional characteristics. Microscopic and ultramicroscopic structure. Myofibrils. Sarcomere as structural-functional unit of myofibril. Mechanism of muscle contraction. Types of muscle fibers, their innervation. Myosatellite cells. The muscle as organ. Its connection with tendons. Cardiac muscle tissue. Source of development, Morphological and functional characteristic of typical and conducting cardiac muscle cells. Intercellular junctions. Smooth muscle tissue. The source of development. Morphological and functional characteristic. Regeneration.
	3.8. Basic Histology. Nerve Tissues	Morphological and functional characteristic, sources of development, histogenesis. Neurons. Classification. The structure of soma, axon and dendrites. Cytoskeleton of neurons. Basophilic (Nissl) substance. Plasma membrane and its role in generation and conduction of nerve impulse. Transport processes in the nerve cell. Axonal transport: anterograde and retrograde transports. Neurosecretory cells: structure and functions. Neuroglia: sources of development, classification. Macroglia and microglia, structure and functions. Nerve fibers: structure, types. The features of formation and function of unmyelinated and myelinated nerve fibers. Conduction of nerve impulses. Envelops of peripheral nerve stem. Reaction of neurons and nerve fibers on injury. Degeneration and regeneration of nerve fibers. Nerve endings: classification, structure. Nerve synapses: structure, types. Neurotransmitters. Types and functions of receptor endings. Types and functions of motor nerve endings. Conception of reflex arc. Sensory, motor and

		associative chains of reflex arch.
4.	Systemic Histology	
	4.1. Systemic Histology. Nerve System	Common characteristic. The central nerve system and peripheral nerve system' organs. Sources of development. Peripheral nerve: structure, regeneration ability. Structure of nerve ganglia. The spiral ganglion structure. The central nerve system. The spinal cord. Common characteristic. White matter and grey matter, their components. The spinal cord nuclei. The central canal and cerebrospinal fluid. The cerebral cortex. The cerebral cortex neurons. Modular organization of the neocortex. The cyto- and myeloarchitectonics. Features of the cerebral cortex structure of the sensory and the motor areas. The blood-brain barrier, its structure and function. The cerebellum. Structure and neurons of the cerebellar cortex. The afferent and efferent nerve fibers. Interneuronal connections. Glial cells in the CNS. Autonomic (vegetative) nerve system. Structure and neurons of vegetative ganglia (extra- and intramural ganglia). The meninges. Blood supply of the central nerve system. Age-related changes in the nerve system
4.2.	4.2. Systemic Histology. The sensory system (Organs of Senses).	Classification. The common principle of cellular organization of receptor areas. Neurosensory and sensory epithelial receptor cells. The visual sensory system. The organ of vision. The common characteristic. The sources of embryonic development and histogenesis. The common plan of the eye ball' structure. Tunics, their compartments and derivatives, tissue composition. The principal functional apparatus: refractive, accommodative, and receptor ones. Structure and functions of the cornea, the iris, the lens, the retina. Neurons and glia of the retina, their morphofunctional characteristic. Structure of the rod cells and the cone cells. The feature of the fovea structure and the blind spot. The retinal pigment epithelium. The features of the orb blood supply. Morphological basis of aqueous humor circulation. Age-related changes. Additional apparatus of the eye: eyelids, lacrimal glands. The olfactory apparatus. Common characteristic, development. Structure and cells of the olfactory epithelium: receptor, supporting, and basal cells. Age-related changes. The vomero-nasal organ. The organ of Hearing and Equilibrium. Development, structure, functions. The external ear: structure of the external auditory meatus and the tympanic membrane. The middle ear: auditory ossicles, auditory tube. The internal ear: the bone and the membranous labyrinth. The vestibular portion of the membranous labyrinth: the utricle, the saccule, the semicircular canals. The structure and cellular composition of maculae and cristae ampullaris. Histophysiology of the vestibular labyrinth. Innervation. The cochlear duct, the spiral organ of Corti, its cells. Histophysiology of sounds perception. Age-related changes. The gustatory sensory system. The organ of taste. Common characteristic, development. Structure and cells of taste buds. Histophysiology of the taste sensations, innervation, age-related changes.

	<p>4.3. The Systemic Histology. The Cardiovascular System</p>	<p>Common characteristic of the circulatory system' organs. The sources of the development. The common principles of the structure and tissues of blood vessel walls. Classification of blood vessels. Tissue components of vascular wall. Vasa vasorum. Morphological bases of neurohumoral regulation of blood vessels tonus. Age-related changes and regeneration.</p> <p>The arteries. Classification. The features of the structure and functions of different arteries types: muscle, muscle-elastic and elastic arteries. Features of arteries structure in different organs. The veins. Depending of a vein wall' structure from hemodynamic conditions. Classification. Fibrous and muscle types of veins. The valves' structure. Features of vein structures of different organs. Blood vessels of microcirculatory bed: arterioles, venules, capillaries. Types and structure of hemocapillaries, their functions. Arteriole-venule anastomoses. Classification, structure, their significance for blood circulation. The lymphatic vessels. The structure and classification. Structure of lymphatic capillaries and various types of lymphatic vessels.</p> <p>The heart. The embryonic development. The structure of the heart wall, its tunics and tissue components. The endocardium and heart valves. The myocardium, working, conducting and secretory cardiac muscle cells. Features of their structure. The heart conducting system, its morphological-functional characteristic. Epicardium and pericardium. Vascularization. Innervation and age-related features. Lymphatic vessels. Structure and classification. The structure of lymphatic capillaries and various types of lymphatic vessels. Involvement of lymphatic capillaries in the microcirculation system</p>
	<p>4.4. The Systemic Histology. The system of organs of hemopoiesis and immune defense.</p>	<p>General characteristics of the organs of hematopoiesis and immune defense. Main sources and stages of formation. The central and peripheral organs of hemopoiesis and immunogenesis. Red bone marrow: structure, tissues, function, blood vessels, age-related changes, regeneration. Thymus: structure of the cortex and the medulla, functions. Role of the thymus in T-cells' differentiation. Blood-thymus barrier, its significance. Age-related involution of thymus. Accidental involution. Secretory function. The lymph nodes: development, structure and tissues. The cortex, the paracortex and the medulla. Their morphofunctional characteristic. T- and B-dependent zones. Lymph sinuses and lymph circulation. Role of lymph nodes in immune reactions. Vascularization. The spleen: embryonic development, structure, tissues. The white and the red pulps, T- and B-dependent zones. The features of blood circulation: open and closed systems. Functions of the spleen (hemopoiesis, immune defense, elimination of aged and abnormal erythrocytes). Structural and functional features of venous sinuses. Lymphoid tissue associated with the mucosa; solitary lymph nodules and their aggregations. Their structure, cells, functions. Tonsils, their structure, cell composition and significance.</p> <p>The immune system and cell interactions (cooperation) in the immune responses. Morphological basis of the body</p>

		<p>defense reactions. Inflammation, healing, repair. The cellular basis of inflammatory reaction and wound healing. Immunity, its types. The cells of the immune system. Characteristic of immunocompetent cells. Interaction of the cells in the immune response. Conception of antigens and antibodies. Antigen-independent and antigen-dependent proliferation of lymphocytes. Humoral and cell-mediated immune responses. Mechanisms of immune system elements' integration. Regulation of immune responses: cytokines, hormones.</p>
	<p>4.5. The Systemic Histology. The Endocrine System.</p>	<p>Common characteristic and classification of the endocrine system. The central and peripheral parts of the endocrine system. Hormones and their classification. Hypothalamus-hypophysis system: structure, vascularization. Neuroendocrine cells of hypothalamus, conception of liberins (releasing factors) and statins (inhibitory hormones). Sources of hypophysis development. Structure of the pituitary gland lobes and their cells and hormones produced by pituitary endocrinocytes. The control of anterior pituitary hormones' synthesis and releasing. Neurohypophysis, its connection with hypothalamus. Hypothalamus-hypophysis regulation of hormones synthesis and its mechanisms. Hypothalamus-adenohypophysis vascular system. Innervation, age-related changes and regeneration of the hypophysis. Pineal Body. Sources of development, structure, cells, functions. The Thyroid Gland. Sources of development, structure, functions. Follicles as morphological-functional units of the thyroid gland. Follicular and parafollicular cells. The secretory cycle of follicular cells. Vascularization, innervation and regeneration of the thyroid gland. Parathyroid glands: sources of development, cells. Parathyroid hormone (PTH), its effects, and interaction with calcitonin. The suprarenal glands: sources of development, structure. Features of the cortex structure, its zones and cell types. Features of the medulla development and cells. Suprarenal glands' hormones, and effects of hormones. Vascularization and innervation and age-related changes. The cells of diffuse neuroendocrine system, localization, cell types. APUD-system.</p>
	<p>4.6. The Systemic Histology. The Digestive System.</p>	<p>Common characteristic of the digestive system. The main sources of digestive system development in embryogenesis. Common principles of digestive tube structure: Mucosa, Submucosa tela, Muscularis Externa, outermost tunic (Adventitia or Serosa); their tissue and cell components. Innervation and vascularization of the digestive canal. Lymphoid apparatus of the digestive canal. The anterior part of the digestive system. The oral cavity. Histological structure of the oral cavity structures: lips, cheeks, soft and hard palate, tongue, gingiva, tonsils. The tongue: structure and functions. Localization and structure of lingual papillae (filiform, fungiform, foliate,</p>

		<p>circumvallate papillae). Teeth. Structure. Tooth tissues: enamel, dentin, cementum, pulp. The blood supply and innervation of the teeth .Tooth development. Teeth generations. Age-related alterations. Major salivary glands. Classification, sources of development, structure and functions. Pharynx and esophagus. Regional differences in structure and tissue components of pharynx and esophagus. Esophagogastric junction.</p> <p>The middle and posterior parts of the digestive system. The features of the structure of different portions. The stomach. The structure of the stomach wall, the features of the glands and their cellular composition from the gastric different regions. Digestion in the stomach. Vascularization and innervation of the stomach. Regeneration of stomach epithelium. The small intestine. The features of the wall structure of different segments. The structure of villi and crypts. Histophysiology of terminal digestion and absorption. Lymphoid nodules in the intestine wall. Age-related changes. Blood supply and innervation of the small intestine. Regeneration of the small intestine epithelium. The large intestine. The wall structure, tissues. The features of the mucosa structure depending on its function. Blood supply and innervation. Appendix. Features of the structure and functions. The structure of rectum.</p> <p>Pancreas. Common characteristic. Structure of exocrine and endocrine portions. Structure of acini and ducts. Islets of Langerhance. Types of insulocytes, their morphofunctional characteristic, hormones. Blood supply, innervation, regeneration, age-related changes.</p> <p>Liver. Common characteristic The features of blood supply. Structural-functional units of liver (classic lobule, acinus, portal lobule). Hepatic cells. Structure of intralobular sinusoids, perisinusoidal spaces. Structure of intralobular and interlobular biliary ducts. Functions of the liver. Innervation. Regeneration abilities. Gallbladder and bile ducts. Structure and functions.</p>
	<p>4.7. The Systemic Histology. The Respiratory System.</p>	<p>Common characteristic of the respiratory system. The conducting and the respiratory portions. Features of the conducting portion wall structure: nasal cavity, larynx, trachea, primary bronchi. The respiratory epithelium: cells, functions, features of different regions. Intrapulmonary conducting portion: structure of walls depending of bronchi diameter. The respiratory portion. Pulmonary acinus as a morphological and functional unit of the lung. Structural components of acinus. Structure of alveolus epithelium, interalveolar septa. Pulmonary surfactant. The blood-air barrier, its role in gas exchange. Alveolar macrophages. Blood supply of the respiratory system. Morphological and functional characteristic of pleura.</p>
	<p>4.8. The Systemic Histology. The Skin and its derivatives</p>	<p>The skin. Common characteristic. Sources of development. Tissue components. Regeneration. The principle differons of the epidermis. Epidermis layers, their cellular</p>

		composition. Keratinocytes, melanocytes, Merkel's cells, Langerhance cells. The features of the "thick" and "thin" epidermis structure. Process of keratinization, its significance. The dermis. Papillary and reticular layers, tissue composition. Hypodermis. Vascularization and innervation of the skin. The skin derivatives: sweat and sebaceous glands, structure, types of secretion, functions. Hairs, nails, their structure, growth and regeneration.
	4.9. The Systemic Histology. The Urinary System	Common characteristic of the urinary system organs. Development. The common plan of the kidney structure. The cortex and medulla structure. Nephron as morphofunctional unit of the kidney, its structure. Types of nephrons. Vascularization of the kidney. Renal corpuscles, their main components. Structure of the filtration barrier, its role in urinopoiesis. Histophysiology of renal tubules and collecting tubules, their role in urinopoiesis. Renal stroma. Countercurrent multiplier system. Endocrine functions of the kidney. Juxtaglomerular apparatus: structure, function. The kidney innervation and age-related changes. Extrarenal passages. The structure of walls of the urinary passages: ureters, urinary bladder, urethra.
	4.10. The Systemic Histology. Reproductive Systems.	<p>Common characteristic of the male reproductive system. Development of the male reproductive system. The testis. Seminiferous tubules, structure. Spermatogenesis, its phases, regulation. Sertoli cells. Blood-testis barrier. Endocrine function of the testis: interstitial endocrinocytes. Histophysiology of testicular tubules. Regulation of intratesticular and extratesticular genital ducts. Epididymis. Prostate gland, seminal vesicles, bulbourethral glands: their structure and functions. The penis. The blood supply, innervation and age-related changes.</p> <p>Common characteristic of the female reproductive system, function of its different organs, sources of development. The ovary: structure of the cortex and the medulla. Generative function. Oogenesis, its stages, regulating factors. Structure and development of the follicles. Ovulation. Concept of ovarian cycle, its regulation. Development, structure and function of the corpus luteum. Atresia of follicles. Endocrine function of the ovary, its structural bases. Age-related features. The uterus, oviducts, structure of their walls. Menstrual cycle. Its phases. The cyclic changes of endometrium structure. Vascularization and innervation of the uterus. Vagina: development, structure, function. The mammary glands: development, structure. The structural features of inactive gland and active gland in lactation. The endocrine regulation of the mammary gland activity.</p>
5.	Embryology	
	5.1. Comparative Embryology	Embryology of mammals as the basis for understanding of human embryogenesis. Periods of embryonic development in animals and human. Fertilization, cleavage, gastrulation, histogenesis, organogenesis. Biological processes occurring

		<p>in the embryogenesis: induction, determination, proliferation, cell migration, growth, differentiation, cell interaction, cell death. Provisory organs: amnion, serous membrane, yolk sac, allantois, chorion, placenta. Features of their formation and functions in various classes of animals. Types of placentae.</p>
	<p>5.2. Human Embryology</p>	<p>Features of human embryogenesis. Progenesis. The germ cells and their development. Meiosis. Structure of germ cells. Sperm cells. Egg cells and their classification. Spermatogenesis. Oogenesis. Fertilization: the sequence of events, significance of capacitation and acrosomal reactions. Distant and contact interaction of the germ cells. The cortical reaction. Male and female pronuclei. Biological significance of fertilization.</p> <p>The first week of embryonic development. Zygote formation. Features of cleavage. Morula. Blastocyst. Embryoblast and trophoblast. Free blastocyst. Chronology of implantation processes: adhesion, invasion. Histirotrophic type of nutrition. Cytotrophoblast. Syncytiotrophoblast. Formation of primary and secondary chorionic villi.</p> <p>The second week of embryonic development. Gastrulation (delamination) and formation of primary germ layers (epiblast and hypoblast). Formation of primary yolk sac. Formation of amniotic sac. The second stage of gastrulation. Immigration. Formation of primitive streak, primitive node. Differentiation of the germ layers. Formation of germ mesoderm, notochord, prechordal plate. Formation of extra-embryonic mesoderm.</p> <p>The third week of embryonic development. Differentiation of germ mesoderm: somites, nephrogonotomes, visceral and parietal layers of splanchnotome, coelom. Formation of chordal process. Formation of neural tube and neural crest. Formation of the body folds and primitive gut. Formation of primitive blood vessels. Formation of primitive heart, pronephros, lungs. Formation of tertiary villi, hematotropic type of nutrition.</p> <p>The fourth week of embryonic development. Completion of neurulation and mesoderm' segmentation. Formation of mesonephros. Formation of otic and lens placodes, stomodaeum. Development of endocrine system organs, liver, pancreas. Extraembryonic organs: amnion, yolk sac, chorion, placenta. Features of development, structure, functions. Placentation. Types and structure of chorionic villi. Functions of placenta. Blood-placenta barrier. Endocrine function of placenta. Amnion, its structure and function. Umbilical cord, its formation and structural components. The system mother-placenta-fetus, and factors influencing its physiology. The critical periods of development.</p>

5.2. Sections of disciplines and types of classes

№	The discipline section	Lect.	PC	LW	Self-study	Hours
1.	Introduction to the subject. Methods of study in cytology, histology and embryology.	1	-	2	1	4
1,2.	Сytology (клеточная биология)	1	-	12	4	17
3.	Basic Histology	14	-	40	31	85
4.	Systemic Histology (Histology of organ' systems)	16	-	42	30	88
5.	Basic Embryology. Human Embryology	2	-	12	6	20

6. Laboratory workshop

№	№ of discipline section	Subject of laboratory work	labor intensity (hours)
1.	1.	Preparation of tissues for microscopic examination. Methods of Microscopy	2
2.	2.	Cytoplasm: Organelles and Inclusions. Nucleus. Cell Division	6
3.	3.1.	Epithelia. Glands.	4
	3.2.	Blood. Hemopoiesis	4
	3.3.	Connective Tissue. Fibrous Connective Tissue	4
	3.4.	Connective Tissue with special properties	4
	3.5.	Skeletal Connective Tissue: Cartilage, Bone	4
	3.6.	Muscle Tissue	4
	3.7.	Nerve Tissue	4
	3.8.		4
4.	4.1.	Nerve System.	4
	4.2.	Organs of Senses: Organ of Vision.	4
	4.3.	Organs of Senses: Organ of Hearing and Equilibrium, Organ of Taste	4
	4.4.	Cardiovascular System.	4
	4.5.	Endocrine System.	4
	4.6.	Organs of Hemopoiesis and Immunogenesis	4
	4.7.	Digestive System: Anterior part.	4
	4.8.	Digestive System: Salivary Glands.	4
	4.9.	Digestive System: stomach, intestine.	4
	4.10.	Digestive System: Liver. Pancreas.	4
	4.11.	Respiratory System. Skin and its derivatives.	4
	4.12.	Urinary System.	4
	4.13.	Female Reproductive System	4
	4.14.	Male Reproductive System	4
5.	5.1.	Germ cells. Fertilization. Cleavage, its types. Gastrulation, ways of gastrulation.	4
	5.2.	Embryonic Development in Birds and Mammals. Extra-embryonic (Provisory) Organs in Birds and Mammals	4
	5.3.	Human embryology: fertilization, implantation, cleavage,	4

	gastrulation, neurulation. Provisory Organs: chorion, amnion, yolk sac, allantois, placenta	
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7. Material and technical support of the discipline:

- 1) educational laboratories are equipped with multimedia projectors, individual microscopes for students, projection microscopes, computers, laptops;
- 2) scientific-educational laboratory of medical biotechnologies;
- 3) museum of embryology with visual aids;
- 4) sets of tables for laboratory classes in cytology, embryology with the basics of age-related histology, basic and systemic histology;
- 5) handout material in the form of sets of histological preparations, electronic microphotographs, methodological manuals on each topic of the discipline.

8. Information support of the discipline:

a) software:

Corporate Licensing Program (Microsoft Subscription) Enrollment for Education Solutions (EES) № 56278518 от 23.04.2019 (renewed annually, the program is assigned a new number).

b) databases, information-reference systems and search engines:

1. ELS of RUDN and third-party ELS, to which students have access on the basis of concluded contracts:

- Electronic library system of RUDN – RUDN ELS <http://lib.rudn.ru/MegaPro/Web>
- ELS «University Library on-line» <http://www.biblioclub.ru>
- ELS Urait <http://www.biblio-online.ru>
- ELS «Student Advisor» www.studentlibrary.ru
- ELS <http://e.lanbook.com/>
- TUIS: <http://esystem.pfur.ru/course/view.php?id=46>

2. Database of medical and biological publications:

- **NCBI:** <https://p.360pubmed.com/pubmed/>
- <http://journals.rudn.ru/>
- **Elibrary.ru:** access by IP addresses of the RUDN :<http://www.elibrary.ru/defaultx.asp>
- **ScienceDirect (ESD), «FreedomCollection», "Cell Press" ID "Elsevier".**
- **Google Scholar** - free search engine for full texts of scientific publications in all formats and disciplines <https://scholar.google.ru/>
- **Scopus** - scientometric database of the publishing house "Elsevier". There is remote access to the database. Access via RUDN IP addresses and remotely by login and password (Grant of the Ministry of Education and Science). Access mode: <http://www.scopus.com/>
- **Web of Science.** <http://login.webofknowledge.com/>

9. Educational and methodological support of the discipline:

a) main literature

1. Kierszenbaum A. Histology and Cell Biology: An Introduction to Pathology, 4d Edition /Elsevier – Philadelphia, 2016
2. O.B.Savrova, V.M.Botchey, I.Z Eremina. Basic Cytology [Electronic resource] = Цитология: Course of lectures for students of English-media groups / М.: PFUR, 2019.
3. O.B. Savrova Basic Histology [Electronic resource]. The course of lectures for students of English-media groups / М.: PFUR, 2017.
4. O.B. Savrova, I.Z.Eremina Basic Embryology [Electronic resource] = Основы эмбриологии - М.: PFUR, 2013.
5. O.B.Savrova, V.M.Botchey, I.Z Eremina Systemic Histology Part 1. [Electronic resource] The course of lectures for students of English-media groups / М.: PFUR, 2018.
6. O.B.Savrova, V.M.Botchey, I.Z Eremina Systemic Histology Part 2. [Electronic resource] The course of lectures for students of English-media groups / М.: PFUR, 2018

7. O.B.Savrova, I.Z Eremina, V.M.Botchey Histology: Organ System [Electronic resource] The coursebook = Частная гистология / М.: PFUR, 2019
8. V.M.Botchey, O.B. Savrova, I.Z.Eremina, M.V.Grinberg Histology, Cytology, Embryology/ Educational- methodical manual / М.: PFUR, 2020.

b) additional literature

1. Junquera's Basic Histology: Text and Atlas, 16th Ed by A.Mescher, 2019
2. Stevens A. Human Histology, 3d Edition /Elseiver – London
- 3, Johnson Ph.D, Kurt E. Histology and cell biology, 2-d Ed./ Harwal Publishing Company – Baltimore
4. Ross M.H., Pawlina W. Histology: A Text and Atlas, 7th Ed, 2018
5. Gartner L.P., Hiatt J.L. Color Atlas and Text of Histology
6. Douglas F. Paulsen. Basic Histology. - Prentice - Hall International Inc.
7. Paul R. Wheater, H. George Burkitt, Victor G. Daniels. Functional Histology: a text and colour atlas. - Churchill Livingstone Inc. - 1987.
8. Wheater, Paul R. Functional Histology: a text and colour atlas. - 5nd ed. Longman Group UK Limited.

10. Methodological guidelines for students on the development of the discipline (a module)

The study of the discipline Histology, Cytology, Embryology consists of classroom classes, which include a lecture course, laboratory work, and self-studies. In the course of studying the discipline, it is necessary to use the knowledge of the structure and development of cells and tissues and to master the practical skills of analyzing histological preparations using a light microscope, analyzing electronic microphotographs and solving situational tasks.

Laboratory classes are conducted in the form of interviews, demonstrations of histological preparations and electronic micrographs, visual aids, solutions to situational tasks, answers to control tests. During the study of the discipline, students independently conduct the study of histological preparations and draw up the protocol of the lesson. Interactive forms of teaching are also widely used in the educational process: presentations, electronic training courses, electronic atlases, analysis of histological preparations.

Independent work of students includes the development of histological techniques, preparation for laboratory classes, control test papers, colloquiums, homework, working with special educational and scientific literature, viewing preparations of past and future topics of classes. Each student is provided with access to the sets of histological preparations at the department and to the library collections of the University for self-training.

Methodological recommendations for students have been developed for each section of the discipline.

The current control of students ' knowledge is carried out in the form of control test papers, surveys, analysis of diagnostics of micro-preparations, solving situational tasks on the topics of the discipline.

At the end of the study of the academic discipline, an intermediate control of students ' knowledge (exam) is conducted.

11. Fund of evaluation funds for conducting intermediate attestation of students in the discipline (module)

Materials for assessing the level of development of educational material of the discipline "histology, embryology, cytology" (evaluation materials), including a list of competencies indicating the stages of their formation, a description of indicators and criteria for evaluating competencies at various stages of their formation, a description of assessment scales, standard control tasks or other materials necessary for assessing knowledge, skills, and (or) experience of activities that characterize the stages of competence formation in the process of mastering the educational program, methodological materials, the defining procedures for assessing

knowledge, skills, and (or) experience of activities that characterize the stages of competence formation are fully developed and are available to students on the discipline page in the TUIS RUDN.

The program is designed in accordance with the requirements ES HE RUDN.

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