

Questions for final exam Histology, Cytology and Embryology

GENERAL INFORMATION

1. Histology. Definition, contents and objectives of modern histology. Its chapters importance to biology and medicine.
2. History of histology as a science.
3. Methods of histological investigations.
4. Basic principles and stages of preparation of histological slides.

CYTOLOGY

1. Cytology. Definition, objectives, importance for biology and medicine.
2. The cell theory. History of the problem. Main principles.
3. The cell as an elementary living system of multicellular organism.
4. The modern idea of biological membranes. Cluster-mosaic model of the structure of biomembranes.
5. Superficial complex of the cell. The membrane, perimembranous components. Their structure and functions.
6. Intercellular junctions, their types, structure and function.
7. Cytosol - determination, chemical composition, physical-chemical properties, the value in cell metabolism.
8. Organelles: definition, classification. Functional units of the cells.
9. Ribosomes. The molecular organization, structure, functions.
10. The system of cytoprotection of renewal of cytosol proteins. Proteasomes.
11. Endoplasmic reticulum. Types, structure and mechanisms of functioning, functional meaning.
12. Golgi complex. The structural characteristics, functions, relationship with other organelles.
13. Lysosomes. Structure, functional meaning.
14. Mitochondria. Structure, functional meaning.
15. Cytoskeleton: components, structure and function.
16. Centrosome (cell center). Structure, functional significance.
17. Inclusions. Classification and meaning.
18. The nuclear apparatus of the cell, its value. The main components of the nucleus, their structural and functional characteristics. The nuclear-cytoplasmic ratio.
19. The cell cycle: its stages, morphofunctional characteristics, peculiarities in different types of cells.
20. Types of cells reproduction. Their morphological characteristics. Value for biology and medicine.
21. Mitosis. Its meaning, phases and regulation. Mitotic and interphase chromosomes.
22. Mitosis. Its regulation. The value of mitosis for biology and medicine.
23. Mitosis. General characteristics of different phases. The concept of endoreproduction and polyploidy.
24. Meiosis. Its meaning. The difference from mitosis.
25. Cell growth, differentiation, aging and death. The reaction of cells to external stimuli.

GENERAL HISTOLOGY TISSUES

1. Tissues. Definition, concept. Classification.
2. The concept of determination and differentiation of tissues. Patterns of development. The stages of embryogenesis. Gastrulation, its meaning. Germ layers and their derivatives.

3. Histological elements (cells, postcellular structures, syncytium and symplast, intercellular substance).
4. The concept of stem cells.
5. Tissues. Physiological and reparative regeneration of different tissue types.

EPITHELIAL TISSUES

1. Epithelial tissues. General characteristics. Morphofunctional and genetic classification of their types.
2. Epithelial tissues. Morphofunctional characteristics of different types of covering epithelium.
3. Glandular epithelium. Classification and structure of glands. Morphology of secretory cycle. Types of secretion.

TISSUES OF INTERNAL ENVIRONMENT

1. Tissues of internal environment. Classification, sources of development, general morphofunctional characteristics.

BLOOD AND HEMATOPOIESIS

1. Characteristics of blood as a tissue.
2. Formed elements of the blood. Erythrocytes, structure and functional meaning.
3. Trombocytes, their amount, function, duration of existence.
4. Human blood picture in the norm and leukocytes' count (leukocytes' formula).
5. Structural bases of immunity.
6. Leukocytes. Classification, morphofunctional characteristics. Leukocytes' count and its peculiarities at different stages of ontogenesis.
7. Granulocytes. Basophils and eosinophils. Neutrophils, structure, functions, mechanisms of recruitment and elimination of microbes.
8. Monocytes. Morphofunctional characteristics. Role in the formation of macrophages and dendritic cells.
9. Lymphocytes. Structure, classification, molecular markers, functional meaning.
10. Characteristics of immunocompetent cells. T- and B-lymphocytes. Their development, proliferation and differentiation.
11. Embryonic hematopoiesis. Development of blood as the tissue. Localization, periods, peculiarities of hematopoiesis.
12. Postembryonic hematopoiesis. Hematopoietic stem cells, structure, markers, properties.
13. Hematopoiesis. The modern scheme of hematopoiesis.

CONNECTIVE TISSUES

1. General characteristics of connective tissues. Classification.
2. Fibrous connective tissues. Loose connective tissue: sources of development, localization, structure, function.
3. Cells of loose connective tissue. Classification, functional meaning.
4. Stromal stem cells: localization, markers, importance in regeneration of organs.
5. Fibroblasts, their types: structure and functions. Fibrocyte.
6. Myofibroblasts – structure, markers, their role in reparative regeneration.
7. Secretory active fibroblast: structure, properties and functions.
8. Intercellular substance. Amorphous (ground) substance: chemical composition, structure and functions.
9. Collagen fibers: chemical composition, structure and functional meaning.
10. Stages of formation of collagen and reticular fibers. Intracellular stage of collagen synthesis. The extracellular phase of fibrils' genesis.

11. Elastic fibers: chemical composition, molecular organization, structure, functional meaning.
12. Stages of synthesis and maturation of elastic fibers.
13. Reticular fibers: chemical composition, structure, visualization methods, functional meaning.
14. Macrophages: sources of formation, markers, structure and functions.
15. Molecular basis of recognition of foreign material, migration, phagocytic activity.
16. The role of macrophages in remodeling of intercellular substance.
17. Mast cells: sources of formation, localization, structure, functions.
18. Plasma cells. Sources of formation. The structure under light and electron microscopy, functional meaning.
19. The interaction of blood cells and connective tissue in inflammation.
20. The mechanisms of reparation of connective tissue after damage.
21. Dense fibrous connective tissues, their types – regular and irregular, localization, structure and functions.
22. Connective tissues with special properties: classification, localization, structure and functions.
23. Adipose tissue. White adipose tissue. Localization, structure, functional meaning.
24. Brown adipose tissue. Localization, structure, functional meaning in ontogenesis. Mechanisms of thermogenesis.
25. Reticular tissue. Localization, general characteristics, functional meaning.
26. Mucous tissue (Wharton's jelly). Localization, structure, functions.
27. Pigment tissue. Localization, structure, functions.

SUPPORTING TISSUES

1. General characteristics of skeletal tissues (sources of development, structure, functions). Classification.
2. Cartilage. The structural composition. Histogenesis of cartilage.
3. Cells of cartilage. Isogenous groups of cells, regulation of metabolism and secretory activity of chondrocytes.
4. Intercellular substance. Fibers. Collagen type II and type IX. Architectonics of fibers in cartilage. Amorphous (ground) substance, chemical composition. Cartilage proteoglycans.
5. Hyaline cartilage. Localization, peculiarities of structure and chemical composition of matrix, properties, functional meaning.
6. Cartilage as an organ. Perichondrium, its importance in nutrition, growth and regeneration of cartilage. Zone of young cartilage. Zone of mature cartilage.
7. Appositional and interstitial growth of cartilage. Peculiarities of chondrocyte metabolism.
8. Elastic cartilage. Localization, structure, properties and functional meaning.
9. Fiber cartilage. Localization, structure, properties, functions. Structure of intervertebral disc.
10. Bone tissues. General structure and functions. Classification.
11. Cells of bone tissue: osteoblasts, osteocytes, osteoclasts.
12. Osteoblasts: localization, metabolism, main regulators, cytophysiology of osteoblasts.
13. Osteocytes. Localization, structure, trophism, functional meaning.
14. Osteoclasts. Sources of formation, structure, cytophysiology, role in regulation of calcium homeostasis.
15. Intercellular substance: components, chemical composition, functional meaning. Stages and mechanisms of formation of intercellular substance.
16. Types of bones (flat and tubular). Parts of tubular bone. Histological architectonics in different zones of tubular bone.
17. Periosteum, its role in nutrition, growth and regeneration of bone.
18. Endosteum. The structure of the spongy substance.

19. The structure of compact substance. Osteon. Trophism of the bone. The lacunar-tubular system.
20. Direct and indirect osteogenesis. Stages, regulation.
21. Growth of tubular bones in length. Epiphyseal plate. Regulators and growth mechanisms.
22. Bone remodeling under conditions of changes of physical activity. Zones, steps and cells-participants of bone remodeling.
23. Connections of bones. Classification.
24. Joints. Articular cartilage, zones, histo-and cytoarchitectonics, trophism, adaptation to physical activity, regeneration.
25. Articular capsule: layers, tissue composition. Synovial membrane. Layers. Synovial cells.

MUSCLE TISSUES

1. General characteristics of muscle tissues, properties, classification.
2. Muscle fiber as the structural-functional unit of the tissue.
3. General structure of skeletal muscle. Загальна будова скелетного м'язу. Intercellular relationships: cooperation of muscle and connective tissues. Endomysium, perimysium, epimysium.
4. Skeletal striated muscle tissue: sources and way of development, characteristics of contraction.
5. Structure of skeletal muscle fiber: myosinoplasm, satellite cells, basal membrane.
6. Contractile apparatus of skeletal muscle fiber: myofilaments, myofibrils, sarcomere.
7. Sarcoplasmic reticulum, structure, location, mechanisms of regulation of intracellular Ca^{2+} level, mechanisms of contraction and relaxation.
8. Supporting apparatus of skeletal muscle fiber: molecular composition, structural elements, molecular determinants of myodystrophies.
9. Trophic apparatus of skeletal muscle fiber. Structural bases of growth and hypertrophy of muscle fibers.
10. Regeneration of skeletal muscle tissue.
11. Cardiac muscle tissue. Source of development, structure, characteristics of contraction.. Cardiac muscle fibers. Types of cardiac muscle cells.
12. Smooth muscle tissue. Histogenesis, structure, characteristics of contraction.
13. Smooth muscle cell. Organization of contractile apparatus. Mechanism of contraction.
14. Supporting apparatus of smooth myocytes: dense bodies. The system of caveolae.
15. Regulation of contractile function of smooth myocytes: peculiarities of innervation, humoral regulation.
16. Regeneration of smooth muscle tissue.
17. Myoid and myoepithelial cells. Sources of development, functional meaning.

NERVOUS TISSUE

1. Nervous tissue: sources of development, structure, functional properties and meaning.
2. Nerve cells (neurons). Morphological and functional classification.
3. Parts of neuron: perikaryon, processes, endings.
4. Structure of perikaryon. Chromatophilic substance (Nissl bodies).
5. Cytoskeleton of neurons. Molecular and structural organization. System and types of transport of substances in neuron.
6. Neurosecretory cells.
7. Neuroglia. Classification, sources of development, structure, functional meaning.
8. Oligodendrocytes: morphology, functional meaning.
9. Astrocytes: types, structure, molecular markers. Their role in the formation of blood-brain barrier.
10. Ependymocytes: localization, structure, functions.

11. Microglia. Sources of development, structure, functions.
12. Peripheral glial cells. Schwann cells (neurolemmocytes): sources of development, structure, functional meaning.
13. Nerve fibers. General characteristics, classification, characteristics of providing impulse.
14. Myelinated and unmyelinated nerve fibers.
15. Structural and molecular bases of providing impulse.
16. Myelination in central and peripheral nervous system.
17. Regeneration of nerve fibers.
18. Nerve endings. Receptor (afferent) nerve endings. Classification, structure, localization, relationships with other tissues, functional meaning.
19. Efferent nerve endings. Target cells. Neuromuscular junctions: structure, functional meaning, mechanisms of regulation.
20. Interneuronal synapses (classification, structure, mediators). The mechanism of transmission of excitation in the synapses.
21. Morphological substrate of reflex activity of the nervous system (the concept of simple and complex reflex arc).

SPECIAL HISTOLOGY AND EMBRYOLOGY CARDIO-VASCULAR SYSTEM

1. General characteristics. Sources of development. Functional meaning.
2. Blood vessels. Classification. General structure: layers, tissue composition.
3. Endothelium. General characteristics. Structural manifestations and biomarkers of functional activity and status of the endothelium.
4. Arteries. General structure. Classification.
5. Elastic arteries. Peculiarities of the layers' structure, secretory type of smooth muscle cells, role in atherosclerosis development.
6. Muscular arteries. Structure, nutrition, innervation.
7. Mechanisms of regulation of vascular tone and peripheral vascular resistance.
8. Microvasculature. Arterioles, capillaries, venules. Arteriolar-venular anastomoses.
9. Arterioles: structure, functional meaning. Myoendothelial interactions.
10. Capillaries. Classification, structure, functional meaning. Peculiarities of endothelial structure.
11. Histophysiology of transcapillary exchange.
12. Angiogenesis during development and postnatal organs' remodeling.
13. Endothelial precursors: sources, molecular characteristics, role in vascular regeneration and growth.
14. Venules: (classification) types, structure, functional meaning.
15. Pericytes: structure, connection with endothelial cells, role in regeneration of vascular wall and perivascular connective tissue.
16. Neurohumoral, endothelium-dependent and local mechanisms of regulation of microcirculation.
17. Veins, peculiarities of structure depending upon hemodynamic conditions. Classification of veins. Structure of venous valves. Organ and age characteristics of veins' histophysiology.
18. Lymphatic vessels. Classification of lymphatic vessels of different types. Classification of lymphatic vessels of different types. Lymphatic capillaries: peculiarities of structure, mechanisms of development and lymph composition.
19. Intraorganic and extraorganic lymphatic vessels: structural features.
20. Heart. Embryogenesis. The heart of the newborn. Restructuring, development and age-related changes of heart after birth.
21. General structure of the heart wall. Endocardium, myocardium, epicardium.
22. Contracting apparatus of the heart. Myocardium: structural peculiarities and functions.

23. Cardiac muscle tissue: cardiac fibers, cardiac muscle cells, characteristics of contraction. Role and molecular organization of gap junctions.
24. Conducting system of the heart: structural features and functioning of the excitatory and conducting cardiomyocytes.
25. Secretory cardiomyocytes. Atrial natriuretic polypeptide - a role in regulating blood volume and vascular tone.
26. Fibrous skeleton of the heart. Endocardium. Heart valves.
27. Innervation apparatus of the heart. Intramural ganglia. The sympathetic and parasympathetic innervation of the heart structures.

ENDOCRINE SYSTEM

1. The concept of the chemical nature of hormones and their importance to the organism. Target cells. Receptors of hormones: types (membrane and nuclear), mechanism of action and biological effects of hormones.
2. Classification of structures of endocrine system. The hierarchical organization and the principle of feedback.
3. The central element of the endocrine system. Sources of development. General characteristics.
4. The hypothalamus, parts, nuclei, structural and functional connections with other parts of the nervous system.
5. Neurosecretory cells: structure, markers, cytophysiology.
6. Hypothalamic-pituitary system.
7. Pituitary gland. Embryonic development of adeno- and neurohypophysis.
8. Adenohypophysis: parts, tissue and cellular composition, principles of regulation. Endocrine cells of adenohypophysis: types, structure, hormones and their target biological effects.
9. The intermediate part of adenohypophysis, structural peculiarities, functional meaning. Hypothalamic-adenohypophyseal vascular system, its role in transport of hormones.
10. Neurohypophysis: parts, structure, communication with the hypothalamus, functional meaning. Blood supply of hypothalamic-pituitary system.
11. Pineal gland: development, structure, cellular structure, communication with other parts of the nervous system. Pinealocytes: structure, hormones, their targets and biological effects. Age-related changes.
12. Adrenal glands. Sources and course of development. General structure and functional significance.
13. Adrenal cortex. Morphofunctional characteristics: zones, structure, types of adrenal corticotropocytes, regulation of secretory activity.
14. Adrenal medulla: structure, cellular composition, hormones and their effect.
15. Hypothalamic-pituitary-adrenocortical system: regulation principles, biological role. Sympathoadrenal system, structure, principles of functioning, the biological significance.
16. Thyroid gland. Development. General structure, tissue composition.
17. Follicles: structure, cellular composition.
18. Thyrocytes (follicular cells): structure, secretory cycle, its regulation, hormones, their targets and biological effects.
19. Restructuring of follicles in connection with different functional activity. Hypothalamic-pituitary-thyroid system.
20. Parafollicular cells (C cells): sources of development, localization, structure, regulation, hormones, their targets and biological effects.
21. Parathyroid glands. Development, structure and cellular composition.
22. The principles of the regulation of calcium metabolism, thyroid and parathyroid hormones, vitamin D.

23. Single endocrine cells of non-endocrine organs. Diffuse endocrine system: localization, cells, hormones and their biological role. Neuroendocrine cells of ARUD system, localization, hormones and their effect.

IMMUNE ORGANS

1. General morphofunctional characteristics and classification of organs of hematopoiesis and immunogenesis.
2. Immune defense system. Nonspecific and specific immunity.
3. Antigen-presenting cells: structure, markers, functional meaning.
4. Types of lymphocytes. Clusters of differentiation (CD). Classification of T lymphocytes: T-cytotoxic, T-helpers, T regulatory cells: formation stages, markers, functional meaning.
5. B lymphocytes: classification, markers, functional meaning.
6. Red bone marrow. Localization, structure and function, tissue composition, cytoarchitecture, vascularization.
7. Natural killers.
8. Antigen-independent proliferation and differentiation of B-lymphocytes.
9. The thymus as the central organ of T lymphocytopoiesis. Localization, structure, tissue composition, functions.
10. Lobule of thymus: structure, functional areas. Thymic epithelial cells: types, structure, markers, functional significance.
11. Lymphocytopoiesis in the thymus. Positive and negative selection of lymphocytes.
12. Hassal corpuscles.
13. Age-related thymus involution.
14. Spleen: localization, structure and function.
15. Stroma of spleen, tissue composition, role in functioning. Blood supply of the spleen.
16. Parenchyma of the spleen, tissue and structural composition, white and red pulp.
17. The white pulp of the spleen, zones, cell structure, the functional significance.
18. The red pulp of the spleen, components, structural composition, functional meaning.
19. Lymph nodes: localization, structure and function. Functional areas of lymph nodes.
20. The system of sinuses. Histophysiology of lymph nodes.
21. Lymphoid tissue of the mucous membranes and skin.
22. The cellular bases of immune responses. The stages of the immune response. Intercellular cooperation and regulators of immune response.
23. Morphological manifestations of immune responses implementation in peripheral organs of immunogenesis and in blood.

NERVOUS SYSTEM

1. General morphological and functional characteristics. Regularities of development. Classification.
2. Central nervous system. The gray and white matter. The nerve centers: types, cytoarchitecture.
3. Brain meninges: tissue composition, structural features, functions.
4. Histo-hematogenous brain barriers.
5. Choroid plexus. Choroid ependymal cells.
6. Cerebrospinal fluid. Dynamics of the liquor. Filtration, circulation, reabsorption of cerebrospinal fluid. Hemato-liquor barrier. Arachnoid granulations.
7. Brain. General characteristics: development, structure, functions. Parts.
8. Big brain. The cortex of the brain: grooves, functional fields, morphological types of neurons.
9. Pyramidal and non-pyramidal neurons: structure and functional significance. Neuroglia of the cortex.
10. Histophysiology of cerebral cortex: layers, cytoarchitecture.

11. Morphological types of cortex: connection with the functions of the cortex.
12. Cerebellum: localization, structure, functions. Cortex of cerebellum, layers cytoarchitecture, afferent and efferent fibers. Interneuron connections in the cortex of the cerebellum.
13. The brain stem: parts, peculiarities of the structural organization, functional meaning. Reticular formation.
14. Spinal cord. General morphological and functional characteristics. Gray matter: horns, nuclei, neurons.
15. White matter. Anterior, posterior roots: structural composition, functional value. Tracts
16. The peripheral nervous system, ganglia, peripheral nerves, nerve endings.
17. Peripheral nerve: general structure, structural composition. Endoneurium, perineurium, epineurium. Blood-neural barrier.
18. The nerve ganglia: types, general structure.
19. Sensory ganglia (spinal and cranial). Sources of development. The structure: tissue structure, neurons, glial cells, functional meaning.
20. The somatic nervous system. The somatic reflex arc: components, localization, interneuron connections, functional significance. Simple and complex reflex arc.
21. Histophysiology of vegetative (autonomic) nervous system. General characteristics. Parts.
22. Neurons of sympathetic and parasympathetic ganglia: morphological and functional characteristics, glial cells, fibers.
23. Intramural ganglia: localization, morphological and functional characteristics, neurotransmitters.
24. The autonomic reflex arc: composition, location, neurotransmitters.

SENSORY SYSTEMS. SENSORY ORGANS

1. Sensory systems: types, links, functional meaning.
2. General characteristics of the sensory organs. Classification of organs of senses. Cellular and molecular basis of the reception.
3. Visual analyzer: links, their structural components, principles of functioning.
4. The eye (organ of vision). Sources and course of development.
5. Eyeball: general structure, tunics (layers), tissue structure and functions.
6. Aqueous humor: role in the functioning and in nutrition of structures of the eye. Filtration of aqueous humor. Aqueous-blood-barrier.
7. Circulation and reabsorption of aqueous humor. Iridescent-corneal angle (the angle of the anterior chamber of the eye). Trabecular meshwork. Scleral venous sinus (canal of Schlemm).
8. Functional apparatus of the eye. Dioptric apparatus: structural components, general features of light refracting structures, sources of their nutrition.
9. Corneal layers, trophism, structural and molecular determinants of refraction. The anterior (external) epithelium.
10. Stem cells of the limbus - role in regeneration and application in regenerative medicine.
11. Corneal stroma: keratocytes, chemical composition of intercellular substance.
12. Corneal endothelium: structure, mechanisms of transport, role in maintaining the hydrophilicity and corneal nutrition.
13. The lens: surfaces, zones, trophism. The capsule of the lens. The epithelium of the lens. Morphogenesis of lens fibers, its regulation.
14. Growth and regeneration of the lens.
15. Vitreous body: structure, peculiarities of the chemical composition of matrix, functions trophism.
16. Accommodative apparatus: the iris, ciliary body.
17. Iris: layers, peculiarities of the cellular structure, the muscles of the iris, their regulation, their role in adapting to the intensity of light.

18. Ciliary body: parts, muscles, regulation, ciliary processes, role in changing the shape and refractive power of the lens.
19. Photoreceptor apparatus. Retina. Tissue structure, trophism. Neurons and glial cells of the retina.
20. The layers of the retina. Cytoarchitecture. Retinal pigment epithelium: structure and functions.
21. Photoreceptor cells. The rods and cones neurons: the number, location, structure, functional significance.
22. The macula lutea. Fovea centralis. The optic nerve. Optic disc (blind spot).
23. Trophism of retina. Choroid: layers, structure. Basal Complex. Hemoretinal barrier.
24. Accessory structures of the eye. Lacrimal glands and lacrimal fluid.
25. Conjunctiva: structure, functional and diagnostic meaning. Age-related changes.
26. Vestibuloauditory system.
27. The Ear: origins and course of development, anatomical parts, functional characteristics. External ear. Middle ear. The inner ear.
28. Bone and membranous labyrinth: zones, perilymph.
29. Cochlear (auditory) part of the membranous labyrinth: vestibular membrane, basilar membrane, stria vascularis. Endolymph: structure, mechanisms of filtration.
30. Spiral organ: cell structure, tectorial membrane, cytophysiology of the hearing apparatus.
31. Vestibular part of the membranous labyrinth. Receptor zones of vestibulum: maculae, crista ampullaris.
32. The cell structure of the receptor zones: type I hair cells and type II hair cells, supporting cells. Cytophysiology of hair sensitive cells.
33. Olfactory Analyzer: parts, structural composition, functional value. Organ of smell. Olfactory epithelium: localization, cellular composition.
34. Olfactory neurosensory cells. Supporting and basal cells. The mechanisms of smell perception. Age-related changes.
35. Taste analyzer. The organ of taste. General description: sources of development, localization, functional significance.
36. Taste buds: structure, cellular composition. Taste sensorepithelial cells, supporting and basal cells. Histophysiology of organ of taste.
37. Morphological bases of dermal, deep and visceral sensitivity.

INTEGUMENTARY SYSTEM

1. Skin and its derivatives. General morphofunctional characteristics. Sources of development: layers, tissue composition, functions. Regeneration.
2. Structural and functional types and zones of the skin.
3. The epidermis: layers, structural peculiarities of the "thick" and "thin" skin.
4. The cellular structure of the epidermis. Keratinocytes: sources of formation, mechanisms and manifestations of keratinization process.
5. Langerhans cells: origin, structure, functions, markers.
6. Melanocytes of epidermis: source of development, structure, functions, markers and mechanisms of melanogenesis.
7. Tactile epithelial cells (Merkel cells): origin, structure, functions.
8. Dermis. Papillary and reticular layers. Dermis-epidermal connection. Peculiarities of innervation and blood supply.
9. The glands of the skin. The sebaceous and sweat glands: localization, structure of secretory parts, cell structure, secretion mechanisms, regulation of secretory cycle.
10. Hair. Development, structure, growth, hair change, hair growth cycle: anagen, catagen, telogen – characteristics, regulation.
11. Stem cells of the epidermis: localization of stem niches, morphological and functional characteristics, molecular markers. Pilosebaceous unit.

12. Nails. Development, structure, growth.

DIGESTIVE SYSTEM

1. General morphofunctional characteristics. Sources of development. Distribution of parts (units) according to the development, structure and functions.
2. General structure of the alimentary canal wall. Tunics (layers): tissue composition, functional meaning.
3. Tunica mucosa(mucosa layer) – layers, tissues, relief. Innervation and vascularization of the digestive tube.
4. Oral cavity. The sources and the development of the oral cavity and face.
5. Peculiarities of oral mucosa. Functional types of oral mucosa.
6. Lips, cheeks, gums, hard and soft palate.
7. Tongue. Sources of development. General plan of structure. Dorsal and ventral surfaces. Tongue papillae: localization, structure, functional significance.
8. Teeth. Milk and permanent teeth. Developing teeth. The sources and the development of teeth.
9. Tissues. Enamel, dentin, cementum - structure, chemical composition, function. The pulp of the teeth, structure, function. Periodontal ligament. Age-related changes of teeth.
10. Pharynx (throat): parts, structural features of the pharyngeal wall.
11. Lymph-epithelial pharyngeal ring. Tonsils: general structure, the functional significance. Lymph-epithelial cooperation in implementing immunity.
12. Esophagus: sources of development, layers, tissue composition. Peculiarities of the esophageal wall in different parts.
13. Stomach. Sources and course of development. Parts. The structure of the wall: layers, their tissue composition, topography, functions.
14. Tunica mucosa of the stomach (mucosa). Epithelium: structure, functions, peculiarities of regeneration.
15. Mucous-bicarbonate barrier.
16. Gastric glands: types, morphological type, cellular composition of glands, comparative characteristics. Fundic glands of stomach: parts, cell distribution.
17. Chief cells: structure, functional significance, regulators of secretory activity.
18. Parietal cells: localization, structure, functions, mechanisms of secretory activity, regulation, role in the metabolism of vitamin B₁₂. Mucous neck cells.
19. Gastric stem cells: types, location, structure, function, main hormones, their targets and effects.
20. Epithelial stem cells of the stomach: localization, markers, role in the regeneration of the surface epithelium and glands, microenvironment.
21. Endocrine cells of stomach: location, types, hormones, their biological effects.
22. Intramural ganglia: localization, structure, role in the regulation of motor and secretory functions of the stomach.
23. Small intestine. General characteristics of various anatomical parts, structure of the wall. Peculiarities of mucosa relief. The system "crypt-villus".
24. The mucous membrane of the small intestine. Peculiarities of blood and lymph supply.
25. Covering epithelium: cellular composition, types of epithelial cells, their structure and function.
26. Epithelial stem cells of the small intestine: localization, markers, microenvironment - pericryptal myofibroblasts. The regeneration of the epithelium of the small intestine.
27. Endocrine cells of the small intestine: types, location, structure, functions, targets of hormones and their effects.
28. Intramural ganglia, role in the regulation of motility.
29. Histophysiology of intestinal digestion: phases, chemical and structural support.
30. Peculiarities of structure of duodenum, jejunum and ileum.

31. Intestinal-associated lymphoid tissue: localization, structural organization, functional value.
32. Large intestine. Sources and course of development, the role of neural crest cells.
33. The structure of the large intestine wall: layers, tissue composition, relief.
34. The mucous membrane. Relief. Crypts. Covering epithelium: cellular composition, structural and functional characteristics of different cells.
35. Endocrine cells of the large intestine: types, location. structure, hormones, their targets and biological effects.
36. Intramural ganglia. Histophysiology of large intestine.
37. Appendix, its structure, function.
38. Rectum, parts, their morphological and functional characteristics. Age-related changes.
39. Digestive glands: types, communication with various parts of the alimentary canal, the general structure, functional meaning.
40. Large and small salivary glands. Sources and course of development. Structural and functional characteristics.
41. Pancreas. Sources and course of development. General morphofunctional characteristics. The structure of exocrine and endocrine parts.
42. Acinus, structure and functions of acinar cells, regulation of secretory activity. Centroacinar cells. The structure of the excretory ducts.
43. Pancreatic islets: localization. structure, types of cells of pancreatic islets, their structural characteristics, hormones, their targets and biological effects.
44. Liver. Sources and course of development. General characteristics: parts, tissue composition, functions.
45. The structure of the classic liver lobules, zones, their functional characteristics. Hepatic plates.
46. Hepatocytes: structural and functional types, their structure, functional zones and surfaces of hepatocytes, bile capillaries.
47. Sinusoidal capillaries. Perisinusoidal space of Disse, cellular composition, peculiarities of chemical composition of the matrix.
48. Stellate macrophages (Kupffer cells), localization, structure, functional significance.
49. Hepatic stellate cells (Ito cells), localization, structure and functions.
50. Regeneration and age-related changes in the liver.
51. Biliary tract: composition, general structure.

RESPIRATORY SYSTEM

1. General morphofunctional characteristics.
2. Conducting portion: parts, sources and course of development. General plan of structure, functions.
3. Layers of walls of the conducting portion: tissue composition, functional value.
4. The mucous membrane. Covering epithelium: its cellular composition, morphology and cell function.
5. Mucociliary apparatus.
6. Broncho-associated lymphoid tissue: structural characteristics, functional significance.
7. Regional structural peculiarities of the wall of air-conducting portion. Nasal cavity, larynx, trachea, bronchi (major, large, medium and small diameter), terminal bronchioles, their structure and function.
8. Lungs. Sources and course of development. General structure of the lungs.
9. The concept of a pulmonary lobule.
10. Acinus as a structural and functional unit of the respiratory portion of lungs.
11. Alveoli: structure, cellular composition, interalveolar septum.
12. Surfactant complex.
13. Air-blood barrier.
14. Alveolar and interstitial macrophages.

15. Pleura: membranes, tissue composition, functional meaning.
16. Age-related changes.

URINARY SYSTEM

1. The kidneys and urinary organs. General morphofunctional characteristics.
2. Kidneys. Sources and course of development.
3. General structure: cortex and medulla. Lobes and lobules of the kidney.
4. Peculiarities of kidney circulation - cortical and medullary systems of blood supply.
5. Nephron as a structural and functional unit of the kidney.
6. Types of nephrons.
7. Parts of the nephron and their topography.
8. Renal corpuscle.
9. Glomerulus. Bowman's capsule, podocytes: structure and functional meaning.
10. Filtration barrier. Chemical composition of filtrate.
11. Tubular apparatus of the nephron: segments, their location, structure and functional significance.
12. The structural and molecular basis of tubular reabsorption and secretion, regulation.
13. The system of concentration and dilution of urine. Upstream-duplicating apparatus: loop of Henle, vasa recta of medulla, collecting ducts.
14. Collecting ducts: cell composition, structural-functional characteristics, regulation.
15. Stages and mechanisms of urine formation, their structural support and regulation.
16. Endocrine part of the kidney. Juxtaglomerular complex, its structure and function.
17. Prostaglandins apparatus of the kidney. Interstitial cells: structure, prostaglandins, their targets and functional significance.
18. Regenerative potential of kidney.
19. Urinary tract: parts, structure and functions. Peculiarities of histophysiology of renal calyces, renal pelvis, ureters, urinary bladder, urethra.

MALE REPRODUCTIVE SYSTEM

1. General characteristics. Sources and course of development. Functions. Principles of regulation.
2. Testis: localization, structure and functions.
3. Testicular stroma: structure, functional significance. Interstitial endocrinocytes of testis, their structure and function. Targets and biological effects of testosterone.
4. Seminiferous tubules, wall structure. Spermatogenic epithelium.
5. Supportive Sertoli cells: structure, basal and adluminal compartments, functional meaning.
6. Blood-testis barrier.
7. Spermatogenesis: cycle and wave of spermatogenesis. The stages of spermatogenesis, processes, that occur and their biological significance.
8. Spermatogenic cells: stem cells - spermatogonia, primary and secondary spermatocytes, spermatids, their structure and set of chromosomes.
9. Spermogenesis: phases, morphological manifestations, molecular determinants. Cytophysiology of sperm cell. Conditions and regulation of spermatogenesis.
10. Histophysiology of testis in different age periods: childhood, puberty, mature age, aging.
11. Excretory genital ducts. Epididymis. Ductus deferens. Ejaculatory duct. Male urethra.
12. Accessory glands. General structure, functional meaning.
13. Seminal vesicles. The structure, characteristics of secret, role in the formation of sperm.
14. Prostate gland: zones, groups of glands, characteristics of stroma and parenchyma. Age-related changes.
15. Bulbo-urethral gland: structure, functional meaning.
16. The composition of sperm. Spermogram.
17. External genitalia. The penis, its structure, vascularization and innervation.

FEMALE REPRODUCTIVE SYSTEM

1. General characteristics. Sources of development. Functions. Principles of regulation.
2. Ovarian cycle: phases, regulation. Ovarian hormones: targets and biological effects. Cyclic changes in women.
3. Ovary: sources and the course of development, general structure, functions.
4. Tunica albuginea of the ovary: structure, surface epithelium, alteration during ontogenesis.
5. Cortex: follicles, peculiarities of stroma.
6. Medulla: hilus cells, their structure and functional significance.
7. The follicles of the ovary: component parts: primary oocyte, follicular epithelium, zona pellucida, theca. Blood-ovarian barrier.
8. Types of follicles. Folliculogenesis.
9. Ovulation: mechanisms, regulation, biological meaning. Atresia of follicles.
10. Corpus luteum: phases of development.
11. Ovarian hormones: targets and biological effects.
12. Oogenesis: phases, their essence, spatial and chronological characteristics, morphological manifestations, connection with folliculogenesis.
13. Histophysiology of ovary in different age periods: before and during puberty, fertile period, during pregnancy and lactation, menopause.
14. Internal genitalia: origins and the course of development, general structure, layers, tissue composition, functional significance.
15. Fallopian tubes: parts, structure and functions, peculiarities of cell composition of surface epithelium, its changes in different phases of the ovarian cycle.
16. Uterus. Structure of the wall (endometrium, myometrium, perimetrium).
17. The endometrium: layers, tissue composition, peculiarities of blood supply of basal and functional layers.
18. Covering epithelium, cellular composition, structure and regulation.
19. Uterine glands: parts, their functional significance. Uterine epithelial stem cells, physiological and reparative regeneration of the endometrium.
20. Menstrual cycle and its phases, relationship with the hypothalamic-pituitary-ovarian system of regulation.
21. Morphogenesis of endometrium in different phases of cycle, regulation, biological significance.
22. Changes in the structure of uterus (endometrium and myometrium) during pregnancy.
23. Cervix: parts, structure of the mucosa, cervical gland, regulation, characteristics of secret, cytological investigation of smears of cervical epithelium: criteria, diagnostic value.
24. Histophysiology of uterus in different age periods: before and during puberty, fertile period, during pregnancy and lactation, menopause.
25. Vagina: sources of development, structure of the wall, changing of mucosa epithelium in different phases of the menstrual cycle.
26. Mammary gland: sources of development, the general structure, functional significance, neuroendocrine regulation.
27. Morphogenesis of mammary gland in different age periods: before and during puberty, the fertile period, during pregnancy and lactation, involution after lactation and age-related involution.

MEDICAL EMBRYOLOGY

1. The periods of embryogenesis: general characteristics, duration, localization.
2. Critical periods of development.
3. Gametogenesis: key events, opportunities and mechanisms of chromosomal aberrations, factors, affecting their frequency.
4. Fertilization: the place and conditions of exercise, characteristics of gametes, involved in fertilization. Phases of fertilization.

5. Cleavage: localization, characteristics, conditions of embryonic transport. Blastomeres: characteristics, types, peculiarities of the cell cycle. Blastocyst formation: the trophoblast, embryoblast (inner cell mass).
6. Multiple pregnancy. Mono and dizygotic twins.
7. Embryonic stem cells: properties. The possibility of using in reparative medicine.
8. Implantation: localization, conditions, characteristics, phases.
9. The interaction between the trophoblast and endometrium: molecular and structural determinants, regulation, morphogenesis of endometrium and trophoblast during implantation. Endometrial receptivity: markers and factors, which affect it.
10. The concept of ectopic pregnancy.
11. Gastrulation: essence, morphogenetic events, phases, time. Early gastrulation: delamination, formation of hypoblast and epiblast, cell migration.
12. Formation of the amnion, yolk sac, chorion, allantois: structure of the wall, functional significance.
13. Late gastrulation: dates, events. The formation of germ layers and notochord.
14. Embryonic induction: molecular-genetic determinants, the role in histo- and organogenesis.
15. Neurulation and morphogenesis of the nervous system: the terms, sequence, genetic determinants, molecular mechanisms, possible abnormalities.
16. Somite period. Formation of coelom.
17. Regularities and terms of development of organs and systems. Terms of diagnostics of development anomalies.
18. Trophism of the embryo. Chorionic villi.
19. Placentation: terms morphogenesis, regulation, functional significance.
20. Placenta: parts, structure, functional significance.