

## **Exam questions**

### **"General Medicine", "Dentistry"**

1. The main periods of prenatal development, their sequence and general characteristics.
2. Sperm cell. The structure, function.  
Spermatogenesis, spermatocytogenesis, spermiogenesis. Regulation of spermatogenesis.
3. Ovum. The structure of the cell and its envelopes, their function. Oogenesis.  
The structure of the primordial, primary, secondary, tertiary and mature follicles. Regulation of oogenesis.  
Differences of ovogenesis and spermatogenesis.
4. Fertilization. The sequence of events and their characteristics during fertilization. Capacitation, acrosome reaction, cortical reaction, their meaning.
5. Zygote. Its formation and characteristic. Cleavage, morula formation. Compactization. The blastocyst formation and structure. Characteristics of the inner cell mass and trophoblast, their derivatives.
6. Primary embryonic induction and its value. Formation, structure and value of the primitive streak. Gastrulation. Derivatives of germ layers. Neurulation: the sequence of events. The main stages of prenatal development of the nervous system. The neural tube as a source of development of the brain and spinal cord.
7. Implantation. Trophoblast, chorion formation and structure (primary, secondary and tertiary villus). The placenta and its functions. The structure of maternal (decidua) and fetal (chorionic) parts of placenta. The placental barrier, structure, functions. The endocrine function of the placenta.
8. Provisional (extraembryonic) organs: amnion, yolk sac, allantois, the umbilical cord; their formation and special functions.
9. Tissue definition. Classification of tissues and their general characteristics. Histological elements that form the tissue (cell, symplast, syncytia, intercellular substance). The populations of cells: cell type, differon. Stem cells, their meaning, structure, functions.
10. Epithelial tissue. General characteristics, origin, functions, classification with examples. Types of epithelial cells according to their specialization, their structure and functions, examples (transporting, absorbing, secreting, contractile). The polarity of epithelial cells. Features of the structure and function of the lateral surfaces. Intercellular junctions: classification, structure and functions. Features of the structure and function of the basal surfaces. The basal membrane, its structure and function.
11. Exocrine glands. Development, structure, morphological classification (by ducts, secretory portions, type of secrete and mode of secretion). Examples.
12. Connective tissue: general characteristics, composition, origin and function. Classification of the connective tissue. Extracellular matrix. Collagen,

- reticular, elastic fibers, their structure, synthesis, secretion, organization, properties and distribution. Types of collagens with examples.
13. Connective tissue proper, its histogenesis, classification, structure, structural features, examples.
  14. Adipose tissue, histogenesis, general characteristics, types of adipose tissue. Features of the structure, distribution and function of brown and white adipose tissue. Examples. Reticular, mucous connective tissue, structural features, examples.
  15. Cartilage tissue, general characteristics, classification. The structure, composition and location of hyaline cartilage, its histogenesis, growth, function. The structure of the articular cartilage.
  16. Cartilage tissue, general characteristics, classification. Structural features, histogenesis, growth, localization and function of elastic and fibrous cartilage. The structure of the intervertebral disc.
  17. Bone. General characteristics. Classification (spongy/compact, primary (woven)/secondary (lamellar) bone). Periosteum, its structure; endosteum, bone marrow cavity. The bone cells: osteoprogenitor cells, osteoblasts, osteocytes, osteoclasts, their morpho-functional characteristics. Bone matrix, its physical and chemical properties and structure. Intramembranous and endochondral bone formation.
  18. Lamellar bone tissue structure. Haversian system (osteon), its structure. Volkmann channels. Bone growth in length. Epiphyseal plate: its structure and function. Age-related changes in bone tissue. Growth in girth, the value of the periosteum. Remodeling of bone. Bone regeneration, bone healing after a fracture.
  19. Bone. Origin. General characteristics. The role of bone in metabolism. Bone as a calcium depo. Calcium mobilization and deposition and role of vitamin D, parathyroid hormone and calcitonin in this process. Significance of protein, calcium, vitamins A, D, C, and hormones (growth hormone, sex hormones) in bone histophysiology.
  20. Skeletal muscle tissue. Its origin, organization: epimysium, perimysium, endomysium. Muscle –tendon junction. General characteristics of skeletal muscle fibers (sarcolemma, sarcoplasm, sarcoplasmic reticulum, myofibrils and myofilaments, T-tubes, etc.). The myofibrils structure. Sarcomere, its structure: thick and thin filaments; their proteins, structure and role in the contraction. Neuro-muscular synapses. Its structure and functioning. The mechanism of contraction and relaxation of skeletal muscle fibers. Regeneration. Proprioceptors. Muscle spindle. Golgi tendon organs. Their structure, localization, function.
  21. Cardiac muscle tissue. The origin and structure of cardiac muscle fibers. Intercalated disks. Types of cardiomyocytes, their structure and function. Regulation of contraction and relaxation of cardiomyocytes. The cardiomyocytes regeneration.

22. Smooth muscle tissue: histogenesis, the structure of smooth muscle cells, mechanisms of contraction and relaxation. Smooth muscle cells localization. Regeneration.
23. Nervous tissue: histogenesis, general structure. Neuron: structure, classification and function. Neuron cytoskeleton: microtubules, microfilaments, intermediate filaments, their structure and function. Axon transport, its types, functions. Neuroglia: cells in the CNS and PNS. Blood-brain barrier: structure, function.
24. Nerve fibers. Myelinated and unmyelinated nerve fibers, their structure. Nodes of Ranvier. Structure of the peripheral nerve, endoneurium, perineurium, epineurium. Regeneration of nerve fibers in the peripheral nerve. Structure of the ganglion. Synapse. The structure of the synapse. Generation and transmission of the impulse.
25. Eye: structure. The structure of the eyeball layers and the light conducting parts, production and flow of aqueous humor. The retina: structure (10 layers), function. The neurons of the retina, the photoreceptor cells (rods and cones), neuroglial cells, its structure and functions.
26. Organ of hearing: the internal ear, structure of the cochlea. The organ of Corti, the mechanism of hearing.
27. Organ of balance: embryogenesis, the structure of the vestibule and the semicircular canals, the receptor cells, the mechanism of perception of body position.
28. Skin. General structure of skin and its functions. The structure of the epidermis and dermis: its layers and cell types. The cells involved in the generation of epidermis and dermis. Thick and thin skin (difference in their location and structure). Sensitive nerve endings. Free and encapsulated nerve endings of the epidermis and dermis. General characteristics, localization, and functions.
29. Sweat and sebaceous glands (location, structure, function, its secret). Hormonal regulation and innervation. Classification and structure of the hair. The structure of the hair follicle, the hair bulb. Hair growth. Structure of the nail.

### **Digestive system**

30. General characteristics of the tooth structure, the types of teeth. Dentin, enamel, cementum (composition, structure and formation). The pulp of the tooth. Periodontal ligament. Tooth development. Development of the crown and root of the tooth. Teething. Development of permanent teeth.
31. Tongue: structure. Taste buds. Pharynx and esophagus. Origin. The structure of the walls. Esophagus glands (localization, structure, functions).
32. Stomach, general characteristics, wall structure, origin. Cell composition of the gastric mucosa, the structure of cells and their functions. Features in the gastric mucosa structure of cardia, fundus, body and pylorus of the stomach. Bicarbonate barrier formation and its function.

33. General characteristics of small intestine. Origin. The structure of the small intestine wall, its features in different parts. Cells of mucosa: structure and functions. The structure of the mucosa in duodenum, jejunum and ileum.
34. General characteristic of large intestine (colon). Origin. The structure of the colon wall. Cells of the colon mucosa: structure and their functions. The structure of the appendix, rectum and anal canal.
35. Large salivary glands. General characteristic. Morphology and function of the secretory cells (mucous and serous cells). Myoepithelial cells. The structural features of the parotid, submandibular and sublingual glands. Intralobular (intercalated, striated) and interlobular ducts.
36. Pancreas. Histogenesis. Exocrine and endocrine pancreas: structure, functions. The structure of the exocrine pancreas. Acinar cells. The excretory ducts system. Centroacinar cells. Regulation of pancreatic exocrine secretion.
37. Liver. Histogenesis. Structural and functional organization of the liver (classic and portal segments, acinus). Liver function. Blood supply of the liver (hepatic portal vein, hepatic artery, sinusoidal capillaries, central vein, hepatic veins). The structure of hepatic sinusoids, space of Disse. Epithelial cells of the liver, their structure and function. Structure and organization of Kupffer`s cells.

### **Respiratory system**

38. Respiratory system, general characteristics. The structure of the wall of the respiratory tract: respiratory epithelium: structure and function. Olfactory epithelium: structure, function.
39. The upper part of respiratory system (nasal cavity, paranasal sinuses, pharynx, larynx, trachea). The structure of the airway walls at various levels; functions. Bronchial tree. The structure of the wall of the bronchi and bronchioles.
40. The structure of the alveolar tree. The structure of the walls of the alveoli. Alveolar cells: type I and type II; alveolar macrophages. Structure and function of the air-blood barrier. Production and function of pulmonary surfactant. The regeneration of the alveolar epithelium.

### **Urinary and reproductive systems**

41. Kidney, histogenesis, structure, functions. Nephron: structure and function of each part. Podocytes. Filtration barrier. Types of nephrons. Cortical and juxtamedullary nephrons, structure and function, blood supply. Primary and secondary capillary networks. Interstitial kidney cells: structure and function. Juxtaglomerular apparatus. Renin-angiotensin system and its role in blood pressure regulation.
42. The structure of the urinary tract. The wall structure of renal pelvis, ureter, bladder, urethra. The structural features of the transitional epithelium. Comparative characteristics of the male and female urethra.

43. General structure of testis. Seminiferous tubules, its structure. Spermatogenic epithelium: cells characteristics, functions. Sertoli cells: structure and function. Blood-testis barrier, its structure and function. Leydig cells: structure and function.
44. Accessory genital glands (seminal vesicles, prostate gland, bulbourethral glands): structure and function.
45. General structure of the ovary: cortex and medulla. Ovarian cycle, follicular and luteal phase. Ovulation. Hormonal regulations of the ovarian cycle.
46. Uterus, histogenesis, general characteristics, functions. The structure of the wall of the uterus. The features of the endometrium. The menstrual cycle and its phases. Hormonal regulation of the menstrual cycle.
47. Fallopian tubes, general characteristics, functions. The structure of the wall of the fallopian tube. Vagina: structure of the wall; functions.
48. Mammary gland, its structure, embryonic development. Changes during puberty, pregnancy and lactation. Hormonal regulation of gland development and lactation.

### **Endocrine system**

49. General characteristic of the endocrine system. Hormone classification. Types of receptors that bind hormones. The structural features of hormone-producing cells. Endocrine, paracrine and autocrine regulation types.
50. Neuroendocrine system, principal organization and function (feedback mechanism). The hypothalamus: structure, hormones, targets and their effects.
51. Pituitary gland: structure and development. Adenohypophysis: its parts, structure, cells, hormones, their targets and effects. Blood supply. Neurohypophysis: development, structure of neurosecretory cells, their function, communication with the hypothalamus, hormones, their target and effects. Blood supply.
52. Epiphysis: structure, cells, hormones and their biological role.
53. Adrenal gland: structure. Adrenal cortex and medulla: structure, hormones, their targets and effects. Regulation of hormonal synthesis. Hyper- and hypofunction, symptoms.
54. Pancreatic islets of Langerhans: cells, hormones, their targets and effects. Regulation of blood glucose levels.
55. Thyroid gland: embryogenesis, structure. Thyroid follicles: cells, their structure and function. Synthesis, storage and secretion of hormones. Regulation of hormone synthesis. Symptoms of hyper- and hypofunction.
56. Parafollicular cells (C-cells): structure, function. Calcitonin, its action. Parathyroid gland: development and structure, cell types, parathyroid hormone, its effects. Regulation of calcium levels in the blood.
57. Endocrine function of the testis. Leydig cells, their localization and structure. Androgenic hormones, their targets and effects; the role in the

- regulation of spermatogenesis. The role of the hypothalamus and adenohypophysis in the regulation of spermatogenesis.
58. Endocrine function of the ovary. Follicular cells and corpus luteum cells, their structure. Hormones, their targets and effects. Hormonal regulation of ovarian function. The role of the hypothalamus and adenohypophysis. Age related changes.

### **Circulatory system**

59. General structure of the circulatory system. Cardiovascular and lymphatic system. The structure of the blood vessel wall, cell types, structure and function of cells. Capillaries: the structure of the wall, the types of capillaries, examples of localization in tissues. Transport across capillary wall. Arteriovenous anastomoses, their function.
60. Arteries. Structure of the wall of elastic arteries, muscular arteries, arterioles and metarterioles. Localization in tissues and functional characteristics. Carotid sinus, carotid and aortic bodies, their structure and function. Veins: structure of large and small veins walls, venules and postcapillary venules, functional characteristics. The structural features of lymphatic capillaries, vessels and ducts.
61. Heart, general structure. The structure of the heart wall: endocardium, myocardium, epicardium. Features of atrial and ventricular myocardium. Conducting system: location and structure of sinoatrial node, atrioventricular node, the bundle of His, Purkinje fibers. The structural features of conductive cardiomyocytes.

### **Blood**

62. Blood, general characteristics. Plasma: composition and function of its components. Functions of albumin,  $\alpha$ -,  $\beta$ -,  $\gamma$ - globulins. Formed elements, their functions. Blood formula.
63. Erythrocytes: quantitative characteristics, structure, function. Structure of erythrocyte plasmalemma and its stroma. Reticulocytes, their structure and function. Erythropoiesis. Differentiation of red blood cells and characteristic of different stages of maturation of red blood cell, regulating factors. Erythropoietin. Reticulocytes: quantity, structure. The death and destruction of red blood cells. The role of macrophages in iron metabolism.
64. Granulocytes (neutrophils, eosinophils, basophils). Quantitative characteristics, structure, contents of the granules, main functions. Granulocytopoiesis, characteristic of different stages of maturation of neutrophils, eosinophils, basophils.
65. Agranulocytes (lymphocytes, monocytes). Quantitative characteristics, structure, main functions. Lymphopoiesis: development of B- and T- lymphocytes. Myelopoiesis. Leucopoiesis regulation.
66. Platelets (thrombocytes). Quantitative characteristics, structure, main functions. Thrombopoiesis: characteristics of cells at different stages of development. Platelet production. Thrombopoietic regulation.

67. Bone marrow, structure and functions. The concept of blood stem cells and the colony-forming units (CFU). Properties of stem cells. The concept of toti-, pluri, poly (multi) and unipotent cells.
68. Stages of hematopoiesis. Hematopoiesis in the embryo and fetus. Main stages and its characteristics.

### **The immune system**

69. Thymus: development, structure of the cortex and medulla, functions. Differentiation of T-lymphocytes in thymus (positive and negative selection). Blood-thymus barrier: structure, function. Thymus hormones, their effects. Thymus involution.
70. Spleen: development, structure, functions. Structural and functional organization of the red and white pulp.
71. Lymph node: development, structure, functions. The structure of the cortex and medulla, paracortex, sinuses.
72. Lymph follicles, the tonsils, Peyer's patches, their localization, structure and functions.
73. Cells of the lymphoid tissue: T-lymphocytes, B-lymphocytes, NK-cells, macrophages, plasma cells, reticular cells, antigen-presenting cells; their structure and function.
74. Humoral and cellular immune response. The cell interaction in the immune response (main stages). Molecules of the major histocompatibility complex (MHC) and its function. The antibody as the protein of the immunoglobulin family. Immunoglobulin molecule. The major classes of immunoglobulins (IgA, IgG, IgE, IgM, IgD), their function.