

## **Required knowledge in examination of Histology and Embryology**

**Exam rules are specified by the Provision of the Head of the Department.**

### **Cytology, general histology and microscopic anatomy**

- Methods used in study of cells and tissues. Preparation of samples for histological examination by light and electron microscopy.
- Cytology. Cell definition and characteristic. General structure of the cytoplasm. The cell surfaces and intercellular junctions; cytoskeleton, nucleus and nucleolus; cell organelles; cell inclusions. Vital manifestation of a cell. Cell cycle and cell division: mitosis and meiosis.
- Cell differentiation and development of tissues. Definition of the tissue. Types of the tissues and their general characteristics.
- Epithelial tissue. Classification of epithelia according to the structure and function. The covering epithelium. The glandular epithelium. The absorptive, respiratory and sensory epithelia.
- Connective tissues. Ground substance and fibers. Types of the cells of connective tissue proper. Structure, function and distribution of the individual types of connective tissue proper. Cartilage. Bone tissue and its regeneration. Ossification. Skeletal joints: synarthroses and diarthroses.
- Smooth muscle tissue. Skeletal (striated) muscle tissue. Submicroscopic structure of the myofibrils; sarcomere. Mechanism of the muscle contraction. Cardiac (striated) muscle tissue.
- Nerve tissue. Structure of the neuron, the types of neurons. Synapses. Central and peripheral nerve endings. Neuroglia. Sheathes of nerve fibers.
- Composition of the human peripheral blood. Erythrocytes, leukocytes, thrombocytes.
- Differential white cell count. Microscopic structure of the bone marrow. Prenatal and postnatal hematopoiesis.
- Structure, function and types of the blood capillaries. Structure of the arteries and veins. Structure of the heart. Conducting system of the heart.
- The lymphatic capillaries and vessels. Structure and function of the thymus. The lymph nodes. Tonsils and lymph nodules in the wall of the digestive tube and the respiratory

passages (GALT). Structure of the spleen. Blood circulation of the spleen. Mononuclear phagocytic system.

- Mucosa of the respiratory tract; nasal cavity and paranasal sinuses; larynx, epiglottis and trachea; bronchi and lungs. Blood circulation of the lungs. The pulmonary lobules and alveoli. Pleura.
- General structure of the wall of hollow (tubular) organs. Structure of the pharynx, esophagus and stomach. Function of the gastric mucosa. Gastro-entero-pancreatic system (GEP cells). Small intestine and large intestine. Structure of the intestinal villus. Appendix vermiformis. Rectum and anus. Peritoneum.
- Structure and function of the liver. The liver lobule and blood circulation in the liver.
- Intra- and extrahepatic bile ducts. The gallbladder. Structure and function of the pancreas.
- Structure and function of the hypophysis. Diencephalo-hypophyseal system, the hypophyseal portal circulation. Pineal gland. Thyroid and parathyroid glands. Adrenal gland. Paraganglia. The islets of Langerhans. The principles of the neurohumoral regulation. Malfunctions caused by hypo- or hyperfunction of the endocrine glands.
- The kidney - structure and its blood circulation. The nephron - structure and function of its individual parts. Juxtaglomerular apparatus. Intrarenal excretory ducts. The renal pelvis. The ureter and the urinary bladder. The male and female urethra.
- Structure and function of the testis. Spermatogenesis (spermatocytogenesis) and spermiation (spermatohistogenesis). Structure of the spermatozoon. Structure of the epididymis, ductus deferens and ductus ejaculatorius. The prostate gland and seminal vesicles. Composition of ejaculate. Structure of the penis and mechanism of erection.
- Structure and function of the ovary. The follicular atresia. Ovarian cycle and its regulation. Corpus luteum. The oviduct (fallopian tube). Structure of the uterus and its blood supply. The endometrium and menstrual cycle. The vagina and vaginal cytology. External genitalia. The placenta - structure and function. The umbilical cord.
- Structure of the skin - epidermis, dermis and subcutaneous coat. Keratinisation of the epidermis. The accessory organs of the skin (glands, hair, nail). The mammary gland.
- Structure of the cerebral cortex (isocortex and allocortex). Cyto- and myeloarchitecture. Structure of the cerebellum. Synapses of the cerebellum. Structure of the spinal cord. Ependyma, choroid plexus, meninges. Structure of ganglia and peripheral nerves. Autonomic nervous system.

- Organ of vision: structural components of the retina, the layers of the retina and interrelationships of the neurons. The sclera and cornea; the choroid, ciliary body and iris. Refractile (dioptric) media of the eye (cornea, aqueous humor, lens and vitreous body). The eyelid, lacrimal apparatus, conjunctiva, extrinsic ocular muscles.
- Organ of hearing and balance: structure of external, middle and internal ear (maculae staticae, cristae ampullarum, ductus cochlearis, organon spirale Corti). Structure of the organ of taste and the organ of smell.

**General and special embryology:**

- Gametogenesis. Oogenesis, structure of the oocyte during ovulation. The ovarian and menstrual cycles - mutual correlations and endocrine regulation. Meiosis and the principal differences between spermatogenesis and oogenesis. Composition of ejaculate, density (count) of spermatozoa. Properties of the spermatozoa.
- Fertilization and cleavage of the human ovum. The morula and blastocyst. Implantation of the conceptus. Abnormal implantation sites, tubal pregnancy. Changes in the blastocyst during implantation. Germ disc, development of axial organs (formations). Development of notochord (= chorda dorsalis). Extraembryonic structures (amniotic sac, yolk sac, connecting stalk, allantois).
- Somites (somitomers) - their development and differentiation. Intra- and extraembryonic mesoderm. Origin of mesenchyme. Derivatives of the germ layers and mesenchyme.
- The germ disc and its differentiation. Development of external appearance of the embryo and fetus (head and face and limbs. Fetus. Human fetal membranes - amnion, chorion, and decidua. Development of the placenta and umbilical cord. Blood circulation in the placenta. Anomalies of the placenta and umbilical cord.
- Growth of embryo in the uterus. Monthly position of the uterus during pregnancy. Presentation, position and posture of fetus. Marks of mature and full-term fetus, including dimensions of the head; the rule of Hasse. Delivery of fetus.
- Multiplied number of embryos: mono- and dizygotic twins and triplets; frequency. Arrangement of fetal membranes in multiple pregnancy.
- Congenital malformations - critical periods, cause and mechanism of their formation. An overview of main teratogens. Invasive and non-invasive prenatal diagnostics of congenital malformations.

- Development of the spine, the ribs and the sternum. Chorda dorsalis. Development of the skull. Development of the muscle tissue. Development of the limbs.
- Branchial (pharyngeal) apparatus of embryo: pharyngeal arches, pharyngeal clefts (branchial grooves) and pharyngeal pouches. Cervical cysts and fistulae.
- Development of the esophagus, stomach and intestine, development of the rectum.
- Development of the liver, pancreas and spleen. Congenital malformations.
- Development of the respiratory passages and lungs. Histogenesis of the lungs. Prenatal and postnatal maturation of the lungs. Congenital malformations.
- Pronephros and mesonephros, relations of the mesonephros to development of efferent genital passages. Metanephros. Cloaca - development of the urinary bladder and urogenital sinus. Congenital malformations.
- Indifferent stage in development of the reproductive system. Development of the testis and the ovary. Development of genital passages in male and female. Development of external genital organs. Congenital malformations.
- Primitive blood circulation in the human embryo. Development of vessels and the heart. Formation of the cardiac septa and valves. The aortic arches (the branchial arteries) and their derivatives. Development of vena cava. Fetal blood circulation. Congenital malformations of the heart and vessels. Congenital malformations.
- Development of the eye (the wall of the eyeball, lens, vitreous body, anterior and posterior chambers of the eye).
- Development of the external, middle and internal ear.
- Development of endocrine glands (hypophysis, epiphysis, thyroid and parathyroid glands, suprarenal glands).
- Development of the skin and skin adnexal organs.
- Development of coelom. Development of diaphragm.
- Early development of nervous system. Histogenesis of the neural tube. Neural crest (crista neuralis) and its differentiation. Development of the spinal cord and brain - differentiation of primary and secondary brain vesicles and ventricular system. Congenital malformations of the spinal cord and brain.

<b>List of slides</b>			
1	Oesophagus	31	Labium minus
2	Cardia	32	Hypophysis cerebri
3	Fundus ventriculi	33	Corpus pineale (Epiphysis)
4	Pylorus	34	Glandula thyreoidea
5	Duodenum	35	Glandula parathyreoidea
6	Intestinum tenue	36	Corpus suprarenale
7	Intestinum crassum	37	Thymus
8	Appendix vermiformis	38	Arteria et vena
9	Hepar	39	Aorta
10	Vesica fellea	40	Vena cava
11	Pancreas	41	Myocardium
12	Epiglottis	42	Lymphonodus
13	Larynx	43	Lien
14	Trachea	44	Cutis - phalanx distalis digiti manus
15	Pulmo	45	Cutis - axilla
16	Ren	46	Cutis capilata (s vlysy, with hair)
17	Ureter	47	Unguis (nehet, nail)
18	Vesica urinaria	48	Mamma non lactans
19	Testis	49	Mamma lactans
20	Epididymis	50	Cortex cerebri
21	Funiculus spermaticus	51	Cerebellum
22	Vesicula seminalis	52	Medulla spinalis
23	Prostata	53	Ganglion
24	Penis	54	Nervus
25	Ovarium, corpus luteum	55	Bulbus oculi - segmentum anterius
26	Tuba uterina – ampulla	56	Bulbus oculi - segmentum posterius
27	Tuba uterina – isthmus	57	Palpebra
28	Uterus – phasis proliferativa	58	Auricula
29	Uterus – phasis secretoria	59	Funiculus umbilicalis
30	Vagina	60	Placenta