

Teaching Program for the students of the Faculty of Dentistry
5-year English Program at the Pomeranian Medical University in Szczecin
Course: Histology, Embryology, Cytology

Name and address of Department:
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Head of the Department:
Prof. Barbara Wiszniewska

Person responsible for the didactics:
Dr Wojciech Głąbowski

Total hours:
90 h total
30 h seminars
60 h practical classes

ECTS points: 11

Teaching Program:

Topics of seminars and practical classes:

Topics of Seminars:

1. The cell:

Cell components - cytoplasm, plasma membrane, mitochondria, ribosomes, endoplasmic reticulum, Golgi complex, lysosomes, proteasomes, peroxisomes, the cytoskeleton – microtubules, actin filaments, intermediate filaments; nucleus, nucleolus, nuclear matrix, cell cycle.

2. Methods of study in histology:

Preparation of tissues for microscopic examination – fixation (examples of fixatives), embedding (demonstration of hard blocks), staining (types of dyes - hematoxylin and eosin for routine staining, dyes which are used in histological sections staining for classes), immunohistochemistry Cell cultures (demonstration of culture vessels, discussion the practical reasons of *in vitro* cultures). Describe the structure of light microscope and education the practical exploitation.

3. Epithelial tissue and the exocrine glands:

types of epithelia (simple, pseudostratified, stratified), basal lamina and basement membrane, specialization of the cell surface (microvilli, stereocilia, cilia and flagella), intercellular

adhesion and intercellular junctions (tight junctions, gap or communication junctions, adherent junctions), adhesion molecules and carcinogenesis. Exocrine glands (goblet cell, serous cells, mucus-secreting cells, merocrine or eccrine, apocrine, holocrine mechanisms of releasing the cellular contents into the lumen).

4. Connective tissue:

Fibroblasts and fibrocytes, extracellular matrix (fibers – collagen fibers and biosynthesis of collagen type I, reticular fibers, elastic fiber system) and ground substance (GAG - glycosaminoglycans, proteoglycans, multiadhesive glycoproteins), cells of connective tissue (macrophages, mast cells, plasma cells, leukocytes), types of connective tissue (connective tissue proper, elastic tissue, reticular tissue, mucous tissue, mesenchyme), adipose tissue (unilocular adipose tissue – structure, function, histogenesis; multilocular adipose tissue – structure, distribution, function, histogenesis; tumors of adipose tissue.

5. Cartilage and bone:

hyaline cartilage, elastic cartilage, fibrocartilage; bone cells (osteoblasts, osteocytes, osteoclasts) bone matrix, periosteum, endosteum, types of bones (primary and secondary bone tissues), intramembranous ossification endochondral ossification, bone growth and remodeling, metabolic role of bone tissue.

6. Muscle tissue:

smooth muscles, skeletal muscles, heart muscle, physiology of contraction.

7. Blood and bone marrow:

formed elements of blood (blood count, erythrocytes, leukocytes – granulocytes, agranulocytes, platelets) bone marrow structures, hematopoiesis.

8. Circulatory system:

structural plan of blood vessels (arteries, arterioles, veins, venules, capillaries) and heart.

9. Nerve tissue:

neurons, cell body (perikaryon, dendrites, axons), synaptic communication, glial cells (oligodendrocytes, Schwann cells, astrocytes, ependymal cells, microglia), nerve endings, nerve fibers, ganglia.

10. Central nervous system:

meninges, cerebrum, cerebellum, spinal cord (white matter and gray matter – cell organization), cerebrospinal fluid, degeneration and regeneration of nerve tissue.

11. Skin:

Epidermis (keratinocytes, melanocytes, Langerhans cells, Merkel cells; SALT), dermis, subcutaneous tissue, glands of skin (sebaceous glands, sweat glands), hair, nails, mammary gland.

12. Digestive tract (part I):

oral cavity (epithelium of oral cavity), tongue (papillae on the surface, glands in mucous membrane), teeth (crown and root – enamel dentin, cementum, pulp) and associated structures (periodontium), pharynx, esophagus.

13. Digestive tract (part II):

stomach, small intestine large intestine, appendix – general characteristic.

14. Glands associated with the digestive tract:

Small salivary glands, large salivary glands (parotid, submandibular and sublingual glands), saliva, liver classic lobule, portal lobule, liver acinus), exocrine part of the pancreas, gallbladder.

15. The immune system:

Antigen – terminology, antibodies, cells of the immune system: lymphocytes (B, T, NK), antigen-presenting cells (APCs); diffuse lymphatic tissue; thymus, lymph nodes, spleen, tonsils; thymus-depending zones.

16. Endocrine glands:

Hypophysis (adenohypophysis, neurohypophysis, hypothalmo-hypophyseal system, adrenal glands (control of adrenal cortex), thyroid, parathyroid glands, islets of Langerhans, , pineal gland.

17. The urinary system:

Kidney (renal corpuscles and blood filtration, juxtaglomerular apparatus, elements of nephron, collecting tubules and ducts) ureters, urinary bladder.

18. The female reproductive system:

Ovary (ovarian follicles, follicular growth, follicular atresia, corpus luteum, hormonal control of ovarian function), oviduct, uterus (endometrium, myometrium), the menstrual cycle, vagina (exfoliative cytology), female steroids (estrogens, progesterone).

19. The male reproductive system:

testis, spermatogenesis, excurrent duct system, accessory sex glands, penis, main androgens (testosterone, dihydrotestosterone).

20. The respiratory system:

Nasal cavities (olfactory mucosa), pharynx, larynx, trachea, bronchi, bronchioles, alveoli, blood-air barrier.

21. The photoreceptor and audioreceptor system:

Eye (external layer, vascular layer, retina - three layers of retinal neurons), ear (external ear – auditory tube, middle ear, inner ear – maculae, cristae ampularis, organ of Corti).

22. Fertilization, implantation, principles of assisted reproductive techniques (ART).

23. Development of head and neck:

pharyngeal arches – derivatives, pharyngeal pouches, pharyngeal clefts, tongue, face and facial clefts, teeth, salivary glands.

Practical classes with slides:

1. Light microscope:

Practical classes on education of the light microscope exploitation based on the structure of light microscope knowledge.

2. Examples of slides stained with different staining methods:

Mallory-Azan staining – umbilical cord; Sudan III – yellow adipose tissue; OsO₄ – myelin sheets of nerve in cross section; Hematoxylin and eosin (H&E) staining - Nissl bodies in pseudounipolar neurons of ganglion; orcein and resorcine staining – elastic fibers; silver staining- reticular fibers; periodic acid schiff (PAS) technique – visualization of polysaccharides, neutral mucosubstances, glycogen, carbohydrate-rich molecules and basement membrane; iron hematoxylin staining – intercalated disc in cardiac muscle cells.

3. The epithelial tissue.

Histological slides of different types of epithelia: simple squamous of frog skin, intestinal simple columnar epithelium with goblet cells, transitional (stratified cuboidal) epithelium of ureter, stratified nonkeratinized squamous epithelium of cornea, stratified keratinized squamous epithelium of skin, ciliated pseudostratified epithelium of trachea.

4. The connective tissue.

Histological slides of connective tissue examples: loose connective tissue of mesentery, dense regular connective tissue of a tendon; irregular connective tissue of perichondrium; , mucus tissue (Warton's jelly) of an embryo umbilical cord, mesenchyme in fetal head, yellow (unilocular) isolated adipose tissue with signet ring cells, adipose tissue stained with Sudan III.

5. Cartilage and bone.

Histological slides of elastic cartilage of the auricle of ear stained with orcein, hyaline cartilage in wall of rat trachea, decalcified bone in cross and longitudinal sections, ground section of bone. Intramembranous ossification – primary bone tissue in fetal head.

6. Muscle tissue.

Histological slides of smooth muscle cells in wall of duodenum, skeletal muscle in longitudinal and cross sections – organization of skeletal muscle; cardiac muscle stained with iron hematoxylin in longitudinal section.

7. Blood and bone marrow.

Histological slides : human blood smear – recognition of erythrocytes and types of leucocytes: granulocytes – neutrophils, eosinophils; lymphocytes, monocytes, platelets. Pathological human blood smears to see basophils. Bone marrow of rat – megakaryocytes, adipocytes, cells with blue and pink cytoplasm.

8. Circulatory system.

Histological slides of heart wall in cross section stained with orcein (to see epicardium), elastic arteries stained with orcein or resorcin-fuchsin, muscular artery, large vein – metachromatic staining.

9. Nerve tissue.

Histological slides of multipolar neurons, isolated from anterior horns of spinal cord, nerve in cross sections stained with hematoxylin-eosin (H-E) and OsO₄ and nerve in longitudinal sections stained with H-E and AgNO₃, sensory ganglion with pseudounipolar neurons, nerve ending – encapsulated Vater-Paccini ending in rat pancreas.

10. Central nervous system.

Histological slides of cerebral cortex and cerebellar cortex, spinal cord stained with H&E, and iron hematoxylin.

11. Skin.

Histological slides of thick skin (epidermis, sweat glands with excretory ducts) and thin skin in cross and longitudinal sections (hair, sebaceous glands arrector pili muscle, sweat glands), mammary gland.

12. Digestive tract (part I).

Histological slides of lip, tongue with serous and mucus glands in mucosa, tongues with fungiform papillae, foliate papillae, circumvallate papillae, decalcified teeth, teeth in development in fetal head. Esophagus in cross section.

13. Digestive tract (part II).

Histological slides of stomach – fundus&body, duodenum, jejunum, large intestine, appendix in cross sections.

14. Glands associated with the digestive tract.

Histological slides of parotid gland, submandibular gland, liver in cross section stained with H-E and Arabic ink to see Kupffer cells in lumen of sinusoids, exocrine part of pancreas, gallbladder.

15. The immune system.

Histological slides of thymus, lymph nodes, spleen, palatine tonsil, appendix.

16. Endocrine glands.

Histological slides of hypophysis stained with Ingesti method, thyroid gland with parathyroid glands, pancreas - islets of Langerhans, adrenal glands – adrenal cortex and adrenal medulla.

17. The urinary system.

Histological slides of the kidney stained with H-E and PAS method to see brush border in proximal tubules, ureter, urinary bladder.

18. The female reproductive system.

Histological slides of the ovary, fallopian tube, uterus.

19. The male reproductive system.

Histological slides of the human and rat testes stained with H-E and PAS method, epididymis (caput, corpus, cauda), vas deferens, prostate.

20. The respiratory system.

Histological slides of the olfactory epithelium, trachea, lung (bronchi, bronchioli, alveoli).

21. The photoreceptor and audioreceptor system.

Histological slides of the anterior part of eye and the posterior part of eye.

Forms of activities: see the regulations below

Evaluation: see the regulations below

Obligatory booklist:

Basic Histology, LC Junqueira, J. Carneiro, McGraw-Hill Companies.

Langman's Medical Embryology, T.W. Sadler, Lippincott Williams&Wilkins

Optional booklist:

Wheaters Functional Histology, B. Young, J.S. Lowe, Elsevier

for average mark 4,51 – 5,0 - grade 5

11. Final examination is divided:

Practical exam

Theoretical exam – test containing single-choice questions and multiple-choice questions of the histology, cytology and embryology