Special histology – selected basic schemes

List for the final exam

A. Digestive system:

1. Lip
- skin layers with epidermis, dermis, hair follicles
- sweat glands
- sebaceous glands
- skeletal muscle (m. orbicularis oris)
- labial glands (mixed seromucous)
- vestibular mucosa with stratified squamous non-keratinized epithelium

2. Tooth (undemineralized section)
- enamel with prisms, Hunter-Schreger lines, incremental lines of Retzius
- dentin with canals (tubules) containing Tomes' fibres of odontoblasts
- predentin
- odontoblasts
- loose connective tissue of the pulp, blood vessels and nerves
- cementum covering the root

3. Dorsum of the tongue
- stratified squamous keratinized (filiform papillae) and non-keratinized epithelium
- filiform papillae
- fungiform papillae with connective tissue stroma
- serous glands of Ebner
- skeletal muscle fibres and interstitial connective tissue

4. Root of the tongue
- stratified squamous non-keratinized epithelium
- circumvallate papilla surrounded by a trench
- taste buds
- serous glands of Ebner
- mucous glands of Weber
- lymphatic follicles of the lingual tonsil
- crypts of the lingual tonsil

5. Soft palate
- nasal mucosa with pseudostratified columnar ciliated epithelium and goblet cells
- seromucous glands
- skeletal muscle fibres, (adipose tissue)
- minor mucous glands
- oral mucosa with stratified squamous non-keratinized epithelium

6. Oesophagus

- stratified squamous non-keratinized epithelium of the mucosa (lamina epithelialis mucosae)
- lamina propria mucosae
- lamina muscularis mucosae (smooth muscle cells)
- tunica submucosa – loose connective tissue, blood vessels, nerves (mucous glands)
- muscularis externa – the inner circular and the outer longitudinal muscle layer
- adventitia – loose connective tissue (or serosa in the intra-abdominal portion)

7. Stomach

- simple columnar epithelium and gastric glands of the mucosa (lamina epithelialis mucosae)
- lamina propria mucosae with gastric glands
- lamina muscularis mucosae (smooth muscle cells)
- tunica submucosa – loose connective tissue
- muscularis externa – the inner oblique, the middle circular, the outer longitudinal smooth muscle layer
- tunica serosa

8. Gastric glands (principal gastric glands)

- simple columnar epithelium
- gastric pits (foveolae gastricae)
- mucous neck cells
- chief (peptic) cells
- parietal (oxyntic) cells
- enteroendocrine and undifferentiated cells

9. Duodenum

- simple columnar epithelium and goblet cells of the mucosa (lamina epithelialis mucosae)
- intestinal villi
- intestinal crypts (crypts of Lieberkühn)
- lamina propria mucosae with lymphoid follicles
- lamina muscularis mucosae (smooth muscle cells)
- submucosa – loose connective tissue
- submucosal mucous glands of Brunner
- muscularis externa – the inner circular and the outer longitudinal smooth muscle layer
- tunica serosa

10. Large intestine

- simple columnar epithelium and goblet cells of the mucosa (lamina epithelialis mucosae)
- lamina propria mucosae
- lymphoid follicles

- lamina muscularis mucosae
- submucosa – loose connective tissue
- muscularis externa – the inner circular and the outer longitudinal smooth muscle layer
- tunica serosa

11. Appendix
- simple columnar epithelium and goblet cells of the mucosa (lamina epithelialis mucosae)
- several lymphoid follicles
- lamina muscularis mucosae
- submucosa – loose connective tissue
- muscularis externa – the inner circular and the outer longitudinal smooth muscle layer
- tunica serosa

12. Liver – hepatic lobules (morphological units)
- interlobular vein and artery
- interlobular bile duct with simple cuboidal epithelium
- portal triad within the portal (portobiliary) space
- connective tissue delimiting the classic lobular units
- central vein
- hepatocytes arranged as anastomosing trabecular epithelium
- venous sinusoids

13. Liver – hepatic (portal) acini (functional units)
- central cein
- portal space with the portal triad
- terminal branches of hepatic arterioles and portal venules connecting the triads (circumlobular vessels)
- zone 1 (periportal) nearest to the terminal branches of afferent vessels,
- zone 2 intermediate zone, and
- zone 3 around the central venous drainage

14. Gall bladder
- simple columnar epithelium of the mucosa (lamina epithelialis mucosae)
- lamina propria mucosae (elevated into villi-like projections)
- smooth muscle layer with circular and oblique bundles
- tunica serosa

15. Pancreas
- serous acini with basophilic cells
- intralobular duct
- interlobular duct and blood vessels within the interlobular connective tissue
- islets of Langerhans with alpha, beta and delta cells and sinusoids

16. Parotid gland
- serous acini with basophilic cells
- intralobular duct
- striated duct with simple columnar cells
- interlobular connective tissue with blood vessels
- adipocytes

17. Sublingual and submandibular gland
- serous acini with basophilic cells (prevailing in the submandibular gland)
- mucous units (prevailing in the sublingual glands)
- serous demilunes (demilunes of Gianuzzi)
- intralobular and interlobular ducts
- interlobular connective tissue with blood vessels

B. Respiratory system

18. Trachea
- pseudostratified columnar ciliated epithelium and goblet cells
- thick basal membrane
- lamina propria mucosae with blood vessels
- tubulo-acinar, seromucous glands in the submucosa
- hyaline cartilage with perichondrium
- paries membranaceus with smooth trachealis muscle
- tunica adventitia with loose connective tissue

19. Epiglottis
- non-keratinized stratified squamous epithelium on the anterior surface
- pseudostratified columnar ciliated epithelium on the posterior surface
- lamina propria mucosae with loose connective tissue
- tubulo-acinar, seromucous glands in the submucosa
- elastic cartilage with perichondrium

20. Lungs
- bronchi with pseudostratified columnar ciliated epithelium, plates of hyaline cartilage, seromucous glands and circular smooth muscle cells
- bronchioles with simple cuboidal or low columnar epithelium and with smooth muscle cells

- alveolar ducts, alveolar sacs, alveoli
- interalveolar septa with capillaries
- type I pneumocytes (simple squamous)
- type II pneumocytes (simple cuboidal cells with secretory bodies)

C. Urinary system

21. Renal cortex
- fibrous capsule
- renal corpuscle – glomerulus and Bowman's capsule
- vascular pole of the glomerulus with afferent and efferent arteriole and macula densa
- juxtaglomerular cells
- urinary pole of the glomerulus with the proximal tubule
- urinary space
- Bowman's capsule - simple squamous epithelium on the outer (parietal) wall, podocytes on the juxtacapillary (visceral) wall
- mesangial cells among the glomerular capillaries
- proximal tubule
- distal tubule
- interstitial connective tissue

22. Renal medulla
- loop of Henle – thick limb with simple cuboidal epithelium, thin limb with simple squamous epithelium
- interstitial connective tissue
- collecting duct with simple cuboidal or low columnar epithelium

23. Ureter
- transitional epithelium (urothelium) with umbrella cells on the surface
- lamina propria mucosae with loose connective tissue
- inner longitudinal smooth muscle bundles
- outer circular smooth muscle bundles
- external adventitia with loose connective tissue, nerves and blood vessels

24. Urinary bladder
- transitional epithelium (urothelium) with umbrella cells on the surface
- lamina propria mucosae with loose connective tissue
- inner longitudinal smooth muscle bundles
- middle circular smooth muscle bundles
- inner longitudinal smooth muscle bundles
- external adventitia with loose connective tissue, nerves and blood vessels (optionally: tunica serosa – peritoneal covering)

D. Male reproductive system

25. Testis
- tunica albuginea testis (dense collagenous connective tissue)
- septa partitioning the testis into lobules
- convoluted seminiferous tubules
- seminiferous epithelium with spermatogenic cells and supportive Sertoli cells
- steroid-producing interstitial Leydig cells, capillaries
- rete testis with simple cuboidal epithelium

26. Epididymis
- efferent ductules (ductuli efferentes) lined by a ciliated columnar epithelium and shorter non-ciliated cells, surrounded by smooth muscle cells
- duct of the epididymis with pseudostratified columnar epithelium and stereocilia, circular smooth muscle layer
- loose interstitial connective tissue among the ducts

27. Prostate
- fibrous capsule
- fibromuscular interstitial connective tissue with smooth muscle cells and blood vessels
- prostatic glands with follicles/canals lined with simple columnar epithelium
- amyloid bodies/prostatic concretions

28. Spermatic cord
- ductus deferens lined by pseudostratified columnar epithelium with stereocilia
- lamina propria mucosae
- smooth muscle bundles - external and internal longitudinal bundles and with a middle circular muscle sheet
- arterioles and venous plexus
- peripheral nerves
- skeletal muscle (m. cremaster)
- loose connective tissue connecting all the structures

E. Female reproductive system

29. Ovary
- simple cuboidal epithelium (thickened peritoneal mesothelium)
- tunica albuginea (dense collagenous connective tissue)
- ovarian cortex with follicles
- primordial, primary and secondary (antral) follicle
- tertiary (Graafian) follicle: oocyte, zona pellucida, membrana granulosa and its basal lamina, corona radiata, antrum folliculi filled with the liquor, theca folliculi interna et externa

- atretic follicle
- corpus luteum
- corpus albicans with hyaline connective tissue
- ovarian medulla with blood vessels

30. Uterine tube
- mucosa with folds, lined by simple columnar epithelium (ciliated and secretory cells)
- lamina propria mucosae with loose connective tissue
- inner circular smooth muscle layer
- outer longitudinal smooth muscle layer
- tunica serosa

31. Uterine wall
- endometrium (mucosa) with simple columnar epithelium, tubular endometrial glands
- connective tissue stroma between the glands with blood vessels
- myometrium composed of smooth muscle fasciculi and connective tissue
- perimetrium (serosa, i.e. mesothelium and loose connective tissue)

32. Proliferating endometrium
- functional layer
- basal layer adjacent to the myometrium
- straight and narrow uterine glands with mostly regular shape, columnar cells
- highly cellular endometrial stroma

33. Endometrium – late secretory phase or decidualized
- highly irregular and tortuous glands with secretion in the lumen
- spiral blood vessels of the functional layer
- stroma with oedema or navicular cells with light cytoplasm (glycogen, lipids)

34. Vagina
- stratified squamous non-keratinized epithelium, pale cytoplasm (glycogen)
- lamina propria mucosae with loose connective tissue
- smooth muscle layer
- adventitia - loose connective tissue with vascular plexuses and nerves

35. Labium majus
- epidermis - stratified squamous keratinized epithelium
- dermis
- hair follicles
- sweat merocrine glands, sebaceous holocrine glands, aromatic apocrine glands
- loose connective and adipose tissue in the middle

36. Labium minus
- stratified squamous epithelium with or without thin keratinized layer
- connective tissue with blood vessels and holocrine sebaceous glands

37. Breast - resting state
- small secretory acini and tubules with simple cuboidal epithelium
- intralobular duct, interlobular duct (lactiferous duct and sinus)
- myoepithelial cells surrounding the ducts
- dense connective tissue stroma surrounding the lobules
- loose adipose connective tissue among the lobules

38. Breast - lactating
- well developed secretory acini with apocrine secretion pattern, lined by simple cuboidal to columnar epithelium
- lactiferous ducts and sinuses dilated by the presence of milk
- narrow bands of interlobular connective tissue stroma

39. Placenta
- branching chorionic villous tree
- intervillous space (filled by maternal blood in vivo)
- syncytial trophoblast cells (multinucleated)
- cytotrophoblast layer or Langhans' cells
- core of villi containing extraembryonic mesenchyme and capillaries of the extracorporal embryonic/fetal circulation

40. Umbilical cord
- simple squamous to cuboidal amniotic epithelium on the surface
- loose connective tissue with widely spaced fibroblasts – Wharton's jelly
- two umbilical arteries
- left umbilical vein

F. Endocrine glands

41. Pituitary gland
- fibrous capsule
- adenohypophysis with epithelium arranged in cords or follicles, chromophobe cells, acidophilic and basophilic cells, blood sinusoids in the interstitial tissue (optionally, somatotrophs, lactotrophs, gonadotrophs, thyreotrophs, and corticotrophs may be described)
- neurohypophysis with neurosecretory fibres, neuroglial pituicytes
- pars intermedia

42. Thyroid gland
- endocrine follicles lined by simple cuboidal or low columnar epithelium
- central colloid with thyreoglobulin
- parafollicular C-cells
- interstitial connective tissue with capillaries

43. Suprarenal gland
- perirenal adipose connective tissue
- fibrous capsule
- suprarenal cortex with zona glomerulosa, zona fasciculata and zona reticularis
- suprarenal medulla with chromaffin cells, neurones and venous sinusoids

G. Blood vessels and heart

44. Aorta (large elastic artery)
- tunica intima – endothelium and subendothelial connective tissue
- tunica media with fenestrated elastic lamellae, collagen and smooth muscle cells
- tunica adventitia with collagenous connective tissue, vasa vasorum and nervi vasorum

45. Muscular artery
- tunica intima – endothelium and subendothelial connective tissue
- tunica media with lamina elastica interna, collagen and smooth muscle cells (optionally also lamina elastica externa)
- tunica adventitia with collagenous connective tissue, vasa vasorum and nervi vasorum

46. Muscular vein
- tunica intima – endothelium and subendothelial connective tissue, valve
- tunica media with collagenous connective tissue, smooth muscle cells
- thicker tunica adventitia with smooth muscle cells, collagenous connective tissue, vasa vasorum and nervi vasorum

47. Wall of heart
- visceral layer of serosal epicardium – mesothelium and submesothelial connective tissue
- subepicardial adipose tissue with major coronary vessels
- myocardium with cardiac myocytes - centrally positioned nuclei, intercalar discs, lipofuscin near the poles of nuclei
- endomysium with capillary bed
- endocardium and subendocardial connective tissue, Purkyně's fibres with clear sarcoplasm

H. Lymphatic vessels and organs

48. Lymph node
- fibrous capsule with dense collagenous connective tissue
- afferent lymphatic vessels
- peripheral subcapsular sinus
- connective tissue trabeculae extending from the capsule
- cortex with lymphoid follicles, germinal centres
- deep cortex (paracortex)
- medulla, medullary sinuses
- hilum with efferent lymphatics and blood supply

49. Palatine tonsil
- non-keratinized stratified squamous epithelium on the oropharyngeal surface
- patches of thinner reticulated epithelium with lymphocytes
- tonsillar crypts with epithelia, lymphocytes, bacteria
- lymphoid follicles in the lamina propria, germinal centres of follicles
- fibrous hemicapsule
- skeletal muscle (m. palatoglossus/m. palatopharyngeus)

50. Thymus
- fibrous capsule with dense collagenous connective tissue
- septa extending from the capsule, separating individual thymic lobules
- cortex with densely packed thymocytes and reticular epithelium
- medulla with thymocytes, reticular epithelium, and Hassal's corpuscles

51. Spleen
- fibrous capsule with dense collagenous connective tissue
- connective tissue trabeculae extending from the capsule, trabecular blood vessels
- lymphoid follicles of the white pulp (Malpighian bodies), central arterioles within the follicles
- red pulp with reticular fibroblasts, cords of Billroth, venous sinusoids and macrophages

I. Nervous system

52. Spinal cord
- pia mater
- spinal white matter, dorsal, lateral and ventral funiculi
- spinal grey matter, dorsal and ventral horns, dorsal and ventral grey commissure around the central canal (optionally: lateral horn in the thoracic and upper lumbar region)
- motoric neurons in the ventral horns

53. Cerebellum
- convoluted cerebellar cortex (grey matter) with three layers, namely I. the molecular layer, II. the Purkyně cell layer (dendrites extending towards the molecular layer, axons running to the white matter), III. the granular layer
- cerebral white matter

54. Cerebral neocortex
- (optionally: pia mater on the surface)
- I. the molecular (plexiform) lamina
- II. the external granular lamina
- III. the external pyramidal lamina
- IV. the internal granular lamina
- V. the internal pyramidal (ganglionic) lamina
- VI. the multiform lamina
- blood vessels, neuroglia

55. Peripheral nerve
- fibrous coat on the surface – the epineurium
- perineurium covering the nerve bundles
- reticular connective tissue – the endoneurium among the individual nerve fibres
- nuclei of Schwann cells
- myelin sheaths
- vasa nervorum

J. Integumentary system

56. Thick (hairless) skin – planta pedis
- epidermis with stratified squamous keratinized epithelium
- stratum corneum (keratinized layer)
- stratum lucidum (clear layer)
- stratum granulosum (granular layer)
- stratum spinosum (spinous or pricke cell layer)
- stratum basale (basal layer)
- dermis with collagenous connective tissue, a superficial papillary layer and a deeper reticular layer, blood vessels
- sweat glands (simple tubular coiled)

57. Skin – axilla
- epidermis with stratified squamous keratinized epithelium
- stratum corneum (keratinized layer)
- stratum granulosum (granular layer)
- stratum spinosum (spinous or pricke cell layer)
- stratum basale (basal layer)

- dermis with collagenous connective tissue, blood vessels
- hair follicles, holocrine sebaceous glands, merocrine sweat glands, apocrine aromatic glands

58. Eyelid
- epidermis with stratified squamous keratinized epithelium (stratum corneum, granulosum, spinosum, basale)
- dermis with collagenous connective tissue, blood vessels
- hair follicles and holocrine sebaceous glands
- sweat glands
- skeletal muscle (m. orbicularis oculi)
- tarsal plate with dense collagenous connective tissue and Meibomian holocrine sebaceous glands
- palpebral tunica conjunctiva with 2-3 layers of cuboidal or columnar epihelium

59. Pinna (auricle)
- epidermis with stratified squamous keratinized epithelium (stratum corneum, granulosum, spinosum, basale)
- dermis with collagenous connective tissue, blood vessels
- hair follicles and holocrine sebaceous glands
- elastic cartilage with perichondrium
- (optional: adipose tissue)

60. Scrotum
- epidermis with stratified squamous keratinized epithelium (stratum corneum, granulosum, spinosum, basale)
- dermis with collagenous connective tissue, blood vessels
- hair follicles, holocrine sebaceous glands, merocrine sweat glands, apocrine aromatic glands
- tunica dartos (the dartos fascia) – smooth muscle
- (optionally: the external spermatic fascia, musculus cremaster and cremasteric fascia, the internal spermatic fascia; epiorchium and periorchium (serous membranes))