General Histology Slide Info

**GI Tract** (esophagus, stomach, duodenum, jejenum/ileum, colon, gall bladder)

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| **Tissue** | **Epithelium** | **Glands** | **Muscularis Externa** | **Other** |
| Esophagus  upper third | Stratified squamous non-keratinized | Esophageal glands proper (submucosa) | **Skeletal** m |  |
| Esophagus  middle third | Stratified squamous non-keratinized |  | **Skeletal** and **smooth** m |  |
| Esophagus  lower third | Stratified squamous non-keratinized | Esophageal cardiac glands (lamina propria) | **Smooth m** |  |
| Stomach | Simple columnar | Gastric **glands** deeper in fundus, gastric **pits** deeper in pylorus | 3 layers smooth m: inner oblique, middle circular, outer longitudinal |  |
| Duodenum | Simple columnar | **Goblet cells**; **Brunner’s** submucosal glands |  | **Villi** and **crypts** |
| Jejenum / Ileum | Columnar enterocytes | **Goblet cells** | 2 layers smooth m: inner circular, outer longitudinal | **Villi** and **crypts**; Peyer’s patches |
| Colon | Columnar enterocytes | Many **goblet cells** | 2 layers smooth m: inner circular, outer longitudinal | **Crypts** |
| Appendix | Columnar enterocytes |  | 2 layers smooth m: inner circular, outer longitudinal |  |
| Gallbladder | Simple columnar | - | 3 layers smooth m | Looks like villi |
| Urinary bladder | Urothelium | - | 3 layers of smooth m: inner longitudinal, middle circular and outer longitudinal |  |
| Uterus | Simple columnar with few cilia, few secretory cells | Uterine mucosal glands | Myometrium | Highly cellular CT |
| Seminal vesicle | Pseudostratified columnar (no keratin or cilia) | Single tubular coiled gland | 2 layer smooth m: inner circular, outer longitudinal |  |

**Layers**:

1) Mucosa

a)epithelium

b)lamina propria

c)muscularis mucosa

2)Submucosa

3)Muscularis externa

4) Serosa / Adventia

**Tissues with this structure**: GI tract, gallbladder, urinary bladder, seminal vesicle

**Basic Structure of a Blood Vessel**

1. Tunic **intima**: innermost layer; endothelium + basement membrane and some CT

2. Tunica **media**: middle layer; smooth muscle tissue: **thick in arteries, thinner in veins**

3. Tunica **adventitia**: outer coat; CT: **thin in arteries, thicker in veins**

**Glands**

Pure serous: lacrimal, parotid (adipose) and pancreas (islets of Langerhans)

Mixed: submandibular (though more serous) and sublingual (though more mucous)

**Acronyms**

MALT: palatine tonsil; mucosa associated lymphoid tissue

DMALT: diffuse mucosa-associated lymphoid tissue: different types of lymph cells between enterocytes and CT → forms immunological barrier against foreign antigens

PALS: periarteriolar lymphatic sheath

**Barriers**

Blood-**thymus**: made by epithelioreticular cells

Blood-**air**: made by endothelium in alveoli in lung

Blood-**testis**: made by seminiferous tubules by Sertoli cells

Blood-**brain**: tight junctions along endothelial capillaries with astroglial feet (glia limitans)

Parts not covered: **circumventricular organs**

**Sensory**: area postrema, subfornical organ, organum vasculosum of lamina terminalis

**Secretory**: subcommissural organ, intermediate lobe and posterior pituitary (neurohypophysis), pineal gland, median eminence

Blood-urine: Bowman’s capsule

Blood-**placenta**

Blood-nerve: made of perineurium: regulates microenvironment within fascicles in peripheral nerves

Blood-**retinal**: made up of photosensitive retina 1st layer: pigmented epithelium on Bruch’s membrane

**Terms**

**Brown adipose tissue**: due to iron in mitochondria (trachea)

**Lipofuscin** in liver, kidney, seminal vesicle, heart muscle, adrenal glands, nerve cells, ganglion cells

**Metachromasia** in luxol fast blue + cresyl violet staining (spinal cord / dorsal root ganglion) where blue to purple change

Also, toluidine blue to pink in cartilage

**Pyknotic**: dark stained nucleus show signs of shrinkage

**Reticular cells**: fibroblast → reticular fibers in spleen, lymph node, intervertebral disc

**Lobulated glands**: (partially) pancreas, pineal gland, thyroid gland…

**Tissues with capsules**: spleen, lymph node, thymus, pancreas, hypophysis, thyroid gland, adrenal gland, dorsal root ganglion, pharyngeal tonsil, palatine tonsil, pineal gland, parathyroid gland

**Myoepithelial cells:** found in sweat glands, mammary glands, lacrimal glands and salivary glands

**Lymphatic cells**: lymph node, spleen, palatine tonsil, thymus, pharyngeal tonsil

**Tissues with highly cellular CT**: endometrium of uterus

**Epithelium**: the lining of glands, bowel, skin, and some organs like the liver, lung, and kidney

**Endothelium**: the lining of blood and lymphatic vessels

**Mesothelium**: the lining of pleural and pericardial spaces

**Mesenchyme**: the cells filling the spaces between the organs, including fat, muscle, bone, cartilage, and tendon cells

**Differences**

|  |  |  |
| --- | --- | --- |
| **Microvilli** | **Stereocilia** | **Kinocilia** |
| Kidney (proximal tubule), gall bladder, small intestine, spermatic cord (non motile), thyroid (follicles) → forms brush border | Epididymis (principle cells of ductus deferens + generally), inner ear | Uterine tube, trachea |
| Absorption, secretion, cellular adhesion, mechanotransduction |  |  |
| Covered in plasma membrane  Inside: cytoplasm + microfilaments  20-30 tightly bundled actin filaments cross linked | Lack of motility  Have actin filaments | Motile  9x2 microtubles +2 in center |

Basophilic: blue

Eosinophilic: pink

**Epithelium**

**Simple squamous**

Flattened cells, with thin cytoplasm and flattened, bulging nuclei.

Endothelium is this type, lining blood and lymphatic vessels.

**Simple cuboidal**

Square, with round or flat nuclei

**Simple columnar**

Tall cells, usually with vertically elongated nuclei towards based of cell (though look round if not perpendicular plane of axis)

**Pseudostratified cliated columnar**

Looks to be multilayered (nuclei lie at different levels) but all cells connect to basal membrane, just don’t extend to the surface.

Has unusually thick basement membrane

**Stratified squamous non-keratinized**

Lining e.g. lumen of esophagus

Has 3 layers:

1. **Stratum basale**: layer of columnar or cuboidal cells supported by a basal membrane (keep up renewal of superficial cells)

2. **Stratum spinosum**: many layers of large polygonal cells

3. **Stratum planocellulare**: most superficial layer of flattened cells, nucleated, show signs of progressive degeneration; pyknotic nuclei (show signs of shrinking)

**Stratified squamous keratinized** (or non, as seen in oral cavity part of lip)

5 layers:

1. **stratum basale / germinativum**: basal cells – cuboidal / columnar; mitotic figures often seen; cells anchored to basement membrane

2. **stratum spinosum / polygonale**: cells moving up change shape to polyhedral; many cells thick; spiny appearance of cells due to desmosomes and fixatives (shrinks cells where not attached).

3. **stratum granulosum / granular layer**: cells begin to flatten and staining more basophilic; granules are apparent (are keratohyalin); 1-5 layers

4. **stratum lucidum**: flattened cells lose their nuclei, become homogenous and compressed; eosinophillic (only found in very thick sink)

5. **stratum corneum**: most superficial layer; extremely thick in thick skin; desmosomes and organelles of dead flat cells completely disintegrate = desquamation of keratinized cells.

**Stratified cuboidal**

Found in excretory duct of merocrine sweat gland.

Formed of 2 layers of small cuboidal cells around duct lumen (towards skin surface) in dermis.

**Stratified columnar**

Found in urethra of the penis.

Is wavy; 2-4 layers; cells in superficial layer have columnar shape. Basal layer: high cuboidal / columnar cells.

**Urothelium**

Lining lumen of urinary bladder. It is stratified in 3-6 layers, but shape and number of layers change with distension and relaxation (stretching decreases, relaxing increases layers)

Umbrella cells: superficial layer; often binucleated

Pear shaped cells: just underneath, smaller, have pear shape.

Basal layer: cuboidal or columnar cells; are smallest

**Glandular Epithelium**

**Unicellular gland**

Goblet cells: mucus secreting modified epithelial cells; distended apical part with mucoid granules; condense ‘y-shaped’ nucleus. HE does not stain the mucous. Stained greenish blue with alcian blue-h-picrosirusred – stains GAGs and proteoglycans.

**Mucous gland** – most of sublingual

Mucus secreting. Has mucigen granules (glycoprotein containing). Are only very lightly stained with HE. Some mucous secretory units have a cap of serous cells: Demilune of Gianuzzi. Mucous acini lumen is wider than that of serous.

**Serous gland** – parotid, lacrimal, pancreas (part), most of submandibular

Protein secreting. Has serous acini with tiny central lumen. Cells are triangular in shape with rounded nuclei basally located. Basal cytosplasm is basophilic due to lots of RER. Apices of cells are acidophilic due to secretory granules (zymogen).

**Duct System**

Initial segment: intercalated duct (low cuboidal epithelium) → larger striated duct (high cuboidal or columnar epithelium). Striations seen near basal membrane are due to many mitochondria.

Between gland lobules: see interlobular duct (stratified cuboidal- or columnar epithelium).

**Mixed gland**

Shown with PAS on submandibular to show polysaccharides – magenta. Especially basement membrane, mucins and glycogen.

Foamy cytoplasm of mucous cells is bright magenta.

Serous cells have some granular magenta (serous product has some carbohydrates).

Excretory ducts have no color except few goblet cells.

**Apocrine sweat gland**

Located deep in dermis of skin. Excretory portion of gland has narrow lumen (stratified cuboidal) with straight course to hair follicle.

Wide secretory portions (eosinophillic secretory cells, low cuboidal to columnar). Filled with granules and bleb-like protrusions on luminal surface.

Detached cytoplasmic protrusions seen in lumen → loss of apical cytoplasm and cell membrane. (Technically this is also holocrine secretion, since the whole cell is destroyed at the end, and merocrine secretion, since granules are first off secreted.)

Are coiled tubular glands with pyramidal shaped secretory cells.

**Holocrine sebaceous gland**

Located in dermis of skin. Always associated with hair follicle (unless Meibomian gland in eyelid, prepuce, lip, nipple and areola). Are simple branched acinar → empties into short duct to pilosebaceous canal.

Periphery of acini, small basal cells divide and move away from basal lamina. Cytoplasm fills with lipid droplets, and nuclei become pyknotic. Then the cell degenerates and disintegrates from center.

Is mixture of oily secretory product and cell debris → sebum to excretion.

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| **Merocrine / Eccrine** | **Apocrine** | **Holocrine** |
| Sweat gland (coiled tubular with secretory part deep and duct to surface of skin), unicellular gland, mucous and serous glands | Apocrine sweat gland | Sebaceous gland |
| No loss of cytoplasm or cell membrane | Cytoplasm and cell membrane detach | The whole cell degenerates |
| Ileum, duodenum, submandibular, lacrimal, sublingual and parotid glands | Skin of axilla, prostate | Hairy skin |