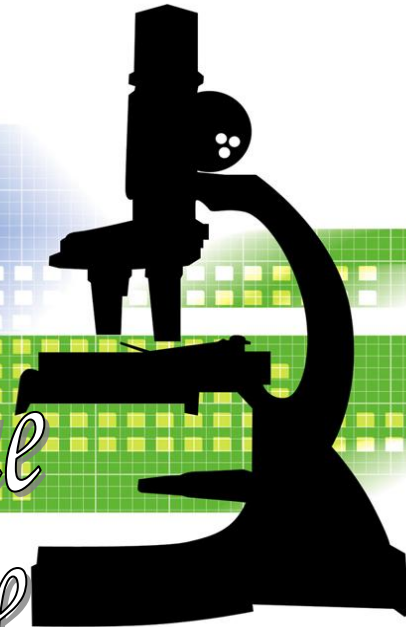


Histology

Epithelial Tissue Connective Tissue



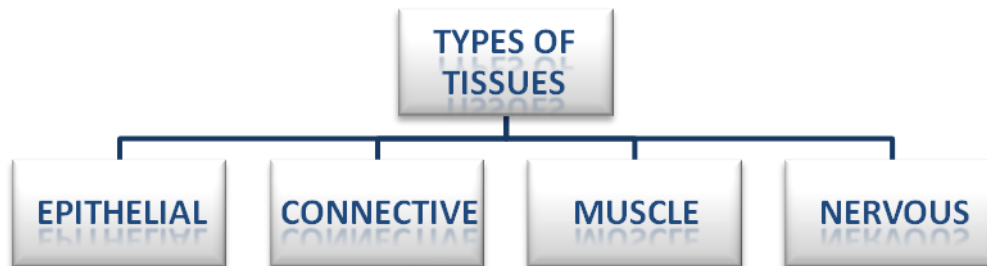
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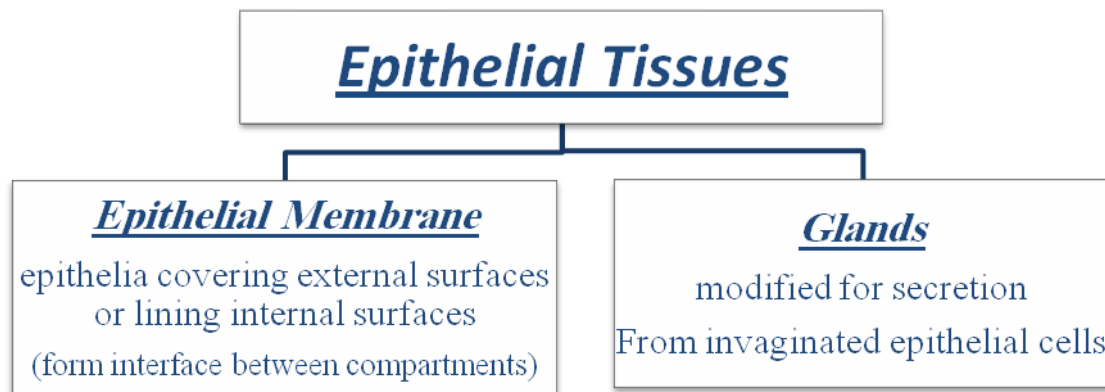
Histics Team

Special Thanks:

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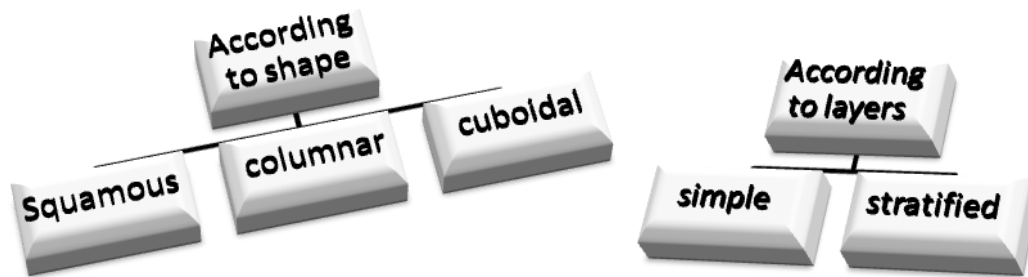
Function of epithelial tissue

- ◆ Protection
- ◆ Transcellular transport
- ◆ Secretion of mucus, hormones and enzymes
- ◆ Absorption
- ◆ Detection of sensation (as taste buds and retina)
- ◆ Selective permeability

Characteristics

- ◆ **Tightly bound together** by junctional complex. Very little extracellular matrix and very little intracellular space (between cells).
- ◆ **Avascular** (no blood vessels). Nourishment (+ getting O₂) via diffusion from CT (connective tissue) through basal lamina
- ◆ Separated from connective tissue by **basal lamina** (made by epithelial cells).
 - 3-....hemidesmosome : type of junctions to fix (like glue) the cell the underline lamina to the C.T..
- ◆ Derived from all three embryological germ layers:
 - ectoderm, endoderm, mesoderm
- ◆ **Constant cell renewal** for a particular epithelium. (It has a specific lifespan).

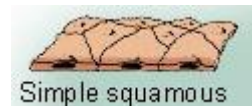
Classification



Simple Epithelium *(single layer)*

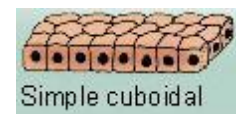
Simple Squamous Epithelium

- ◆ Flattened polygonal cells with central flat nuclei.
- ◆ **Found in:** pulmonary **alveoli**, loop of Henle (kidney) , endothelium of blood vessels, pleura and peritoneal cavities.



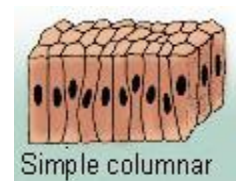
Simple Cuboidal Epithelium

- ◆ Cuboidal polygonal cells with central round nuclei.
- ◆ **Found in:** ducts of many glands, covering of the ovary, follicular cells of thyroid follicles and some kidney tubules.



Simple Columnar Epithelium

- ◆ Tall rectangular cells with oval nuclei usually at the basal half.
- ◆ **Found in:** lining of stomach, gall bladder and large ducts of glands.

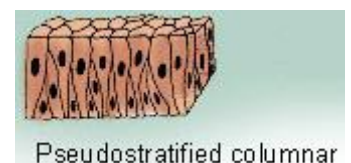


Some have **Cilia**: e.g. uterus, oviducts, small bronchi (lungs)

Some exhibit **goblet cells** or **Microvilli**. E.g. intestines

Pseudostratified Columnar Epithelium

- ◆ Single layered cells that appear to be stratified. Every cell touches the basal lamina but not all reach the surface. Nuclei are located at different layers
 - Cells that don't reach the surface have a broad base and narrow at the apical end. While those which reach the surface have narrow base and broad at the apical end.
- ◆ **Found in:** male urethra, epididymis.
- ◆ **Ciliated** (most common): have cilia on the apical surface.
 - ✓ **Has goblet cells** (that release mucus), e.g. respiratory tract epithelium.
 - ✓ **No goblet cells** e.g. auditory tube and lacrimal sac.



Stratified Epithelium *(multi-layer)*

Stratified squamous epithelium

- ◆ most basal layer rests on basal lamina and it is cuboidal cells
- ◆ the intermediate layers are polyhedral or polymorphous.
- ◆ The most superficial layer is formed of flat squamous cells.

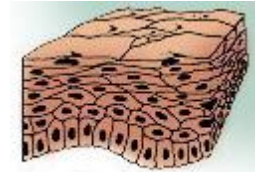
It can be:-

Non-keratinized: superficial layer not covered by keratin (*dead tissue*).

E.g. lining of mouth, oral pharynx, esophagus, true vocal cords and vagina

Keratinized: superficial layer covered by keratin.

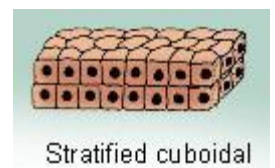
E.g. epidermis of skin especially in soles and palms.



Stratified squamous

Stratified cuboidal epithelium

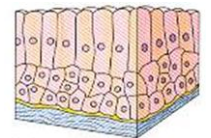
- ◆ Two layers of cuboidal cells.
- ◆ most basal layer rests on basal lamina.
- ◆ E.g. Ducts of sweat glands



Stratified cuboidal

Stratified columnar epithelium

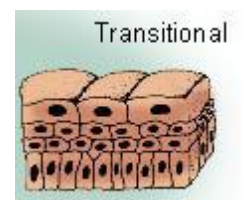
- ◆ superficial layer composed of columnar cells.
- ◆ Basal cells are polyhedral to cuboidal.
- ◆ E.g. conjunctiva of the eye, large excretory ducts and regions of male urethra



stratified columnar

Transitional epithelium

- ◆ Many (3-6) layers of cells.
- ◆ Basal layer: low columnar or cuboidal
- ◆ Superficial layer: large dome-shaped binucleated cells
- ◆ E.g. bladder
 - In full bladder, the dome-shaped cells become flattened and the epithelium becomes thinner



Transitional

Basement Membrane:

- ◆ Cellular region that interface between epithelial and connective tissue.
- ◆ Visible by L/M.
- ◆ Has two constituents:
 - 1-basal lamina (see below): elaborated by epithelial cells.
 - 2-lamina reticularis: (seen by L/M) manufactured by cells of the connective tissue.

Basal surface specializations:

Include:

- ◆ Basal lamina.
- ◆ Plasma membrane enfolding.
- ◆ Hemidesmosomes.

Basal lamina:

- ◆ Only visible by E/M (20-100 nm thick)
- ◆ Extracellular supporting structure.
- ◆ Located at the boundary between the epithelium and the underlying connective tissue.
- ◆ Has two regions:
 1. lamina lucida (lamina rara)
 - electron lucent region beneath the epithelium.
 - consists of extracellular glycoproteins laminin and entactin.
 2. lamina densa
 - electron dense region.
 - Meshwork of type IV collagen.

Plasma membrane enfoldings:

- ◆ Basal surface possesses finger-like enfoldings of the basal plasma membrane.
- ◆ Functions: increase the surface area.
- ◆ Formed by basal cytoplasm and mitochondria.
- ◆ They are involved in ion transport and are found in striated ducts of salivary glands (visible by L/M)

Hemidesmosomes:

- ◆ Half desmosomes.
- ◆ Function: attach basal cell membrane to basal lamina.
- ◆ Attachment plaque present on the cytoplasmic aspect of the plasma membrane.
- ◆ Keratin tonofilaments insert into these plaques.

External lamina

- ❖ similar to basement membrane and surrounds smooth muscle, skeletal muscle, adipocytes and Schwann cells.

Lamina reticularis

- ❖ composed of type I & III collagen that manufacture by fibroblasts of underlying CT. It is thick in skin and very thin around alveoli.

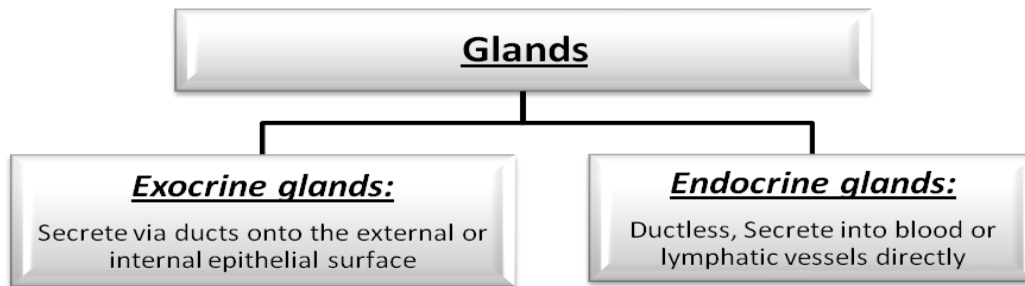
Polarity and cell-surface specialization

- ◆ Apical domain. As microvilli, cilia, stereocilia and flagella.
- ◆ Basolateral domain:
 - a. Lateral plasma membrane specializations, as junctional complexes and intercellular interdigitations.
 - b. Basal plasma membrane specializations, as enfolding and hemidesmosomes.

N.B.

- * Stratified epithelium dose **NOT** have goblet cells, cilia or microvilli.
- * Keratin is found in str. sq. epith. only.

Glands



Consists of:

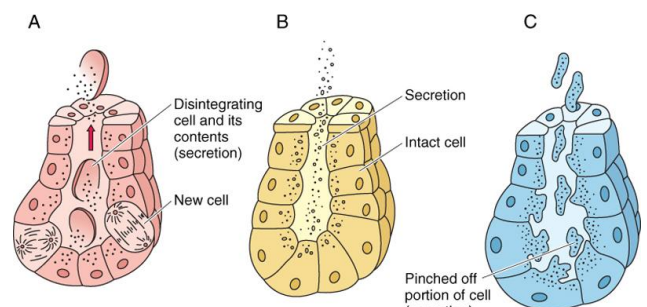
1. **parenchyma:** formed of secretory units and ducts.
2. **stroma:** elements of the connective tissue that invade and support the parenchyma (formed of capsule, septa, supporting background)

Classification of Exocrine Glands

✚ **ACCORDING TO NUMBER OF CELLS:** → Unicellular (goblet cells) → Multicellular.

✚ **ACCORDING TO MECHANISM OF RELEASE OF SECRETION:**

- ◆ **Holocrine:** Complete destruction of secretory cells. They die and become products. *E.g.* sebaceous glands.
- ◆ **Merocrine:** Excretion via exocytosis, without loss of any part.
 - *E.g.* salivary glands.
- ◆ **Apocrine:** Apical part (tip) of the gland is lost with the secretion.
 - *E.g.* mammary glands.



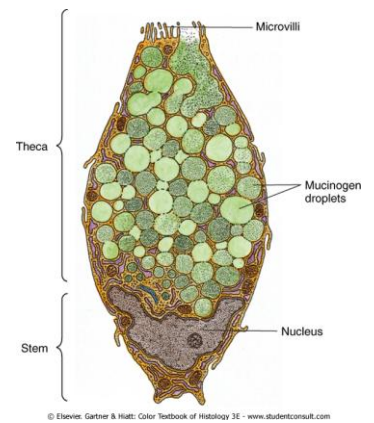
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✚ **ACCORDING TO NATURE OF SECRETION:**

- ◆ **Mucous glands:** mucous acini *E.g.* minor salivary glands of tongue and palate.
 - Secrete *mucinogens*, large glycoproteins that swell to become *mucin*, a thick lubricant which is a major component of mucus.
 - Small, Flattened, basal nuclei; Few mitochondria; less RER.
 - the apical part is rich in secretory carbohydrate granules.
 - acinus (pl. acini) = termination of a gland, where secretion is produced.
- ◆ **Serous glands:** serous acini *E.g.* pancreas.
 - Pyramidal with large, rounded, basal nuclei
 - ER and Golgi complex has numerous basal mitochondria and abundant apical secretory granules.
 - Secrete an enzyme-rich watery fluid.
- ◆ **Mixed (mucoserous) glands:** mucous acini and serous acini.
 - Some mucous acini possess **serous semilunes**, a group of cells that secrete a serous fluid.
 - *E.g.* submandibular and sublingual glands.

Goblet Cells (Unicellular gland)

- ❖ Mucous glands that are dispersed individually in the epithelia lining the digestive and portions of the respiratory tract
- ❖ Thin basal region lies on basal lamina. Apical portion, **theca**, faces the lumen of the tract.



Multicellular Exocrine Glands

- ❖ Group of secretory cells and ducts surrounded by a collagenous connective tissue **capsule**, which sends **septae** (strands of connective tissue) into the gland, subdividing it into **lobes** and **lobules**.
- ❖ Classified according to the duct shape into:-
 - **Simple:** non-branching ducts.
 - **Compound:** branching ducts.
- ❖ Classified according to the morphology of secretory units into:-
 - **Tubular**
 - **Acinar (alveolar)**
 - **Tubuloalveolar**

Endocrine Gland

- ❖ Secrete hormones that pass directly into the blood or lymph without ducts.
- ❖ Hormones may be polypeptides as that of ant. Pituitary, proteins as thyroid or steroid as adrenal hormones.
- ❖ Hormones are stored within the endocrine cells or the lumen of the follicles.
- ❖ Their cells are arranged either in cords as in pituitary gland or as follicles as in thyroid glands.
- ❖ Diffuse neuroendocrine system (DNES), are widespread throughout the digestive tract and respiratory system.

Myoepithelial cells

- ❖ They share the basal lamina of acinar cells and small ducts of many multicellular exocrine glands such as sweat and major salivary glands.
- ❖ They are epithelial in origin, but have some characteristics of smooth muscle cells (contractility).
- ❖ They have small nuclei and fibrillar cytoplasm radiating from the body wrapping around the acini and small ducts.
- ❖ help squeezing and expressing secretions from the acini and small ducts.

