# Epithelial Tissues

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## Introduction and Features of Epithelium

- Introduction to the concept of epithelium
- It lines the surfaces of the body and is mainly located between the external and internal environments.
- Plays a role in homeostasis.
- It is a tissue composed of cells, tightly-bound to each other, with no intercellular connective tissue.
- It is an avascular tissue.
- It develops in the embryo from all the three gern layers.



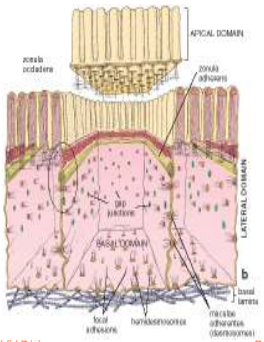
## Functions of Epithelium

- Many and varied, but can be conveniently be divided into two major categories
  - Protective or
  - Metabolic
- Protective Functions
  - Mechanical damage
  - Loss of fluid (desiccation)- water proofing and
  - Invasion of foreign bodies
- Metabolic Functions
  - Exchange of metabolites (absorption or secretion)
  - Glandular secretions and
  - Sensory reception



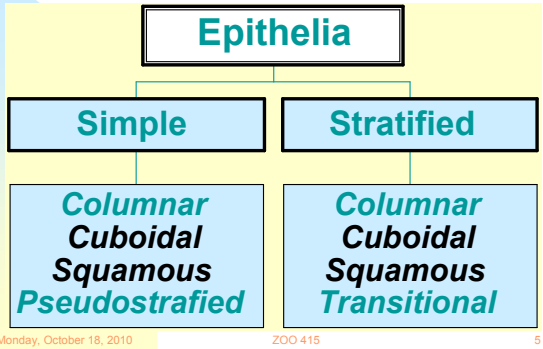
## Polarity

- Epithelial cells are polarized cells
- Apical surface: microvilli, stereocillia, cilia or flagella
- Lateral surfaces
  - Tight Junctions
  - Desmosome (adhering Junctions)
  - Gap Junctions (communicating junctions).
- Basal lamina





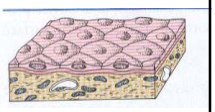

## Classification of Epithelial Cells



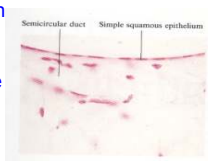



## 1. Simple Squamous Epithelium

- E.g. non-ciliated-tympanic cavity; posterior epithelium of cornea; lining of blood vessels and heart (endothelium); and portions of uriniferous tubules and rete testis.

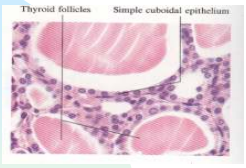


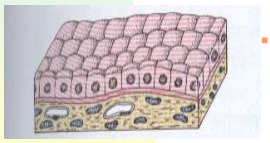
- In profile view, cells appear as thin plates of protoplasm, their middle portion, where the nucleus is located forming a prominent bulge on the free surface.




- Usually with one free flat surface.

## 2. Simple Cuboidal Epithelium



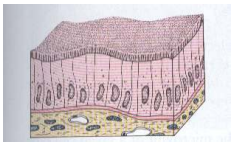



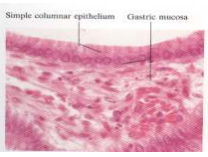
- E.g. non-ciliated-thyroid follicular cells and kidney tubules; ciliated-mouse uterus
- Nuclei are approximately equidistant from the cell membranes.
- In vertical section, the cells appear to be nearly square in shapes



## 3.Simple Columnar Epithelium

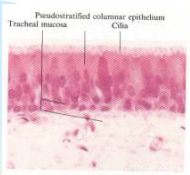
- E.g. nonciliated-intestine, mucosa of the stomach, ciliated -oviduct.
- Tall prismatic cells, whose basal nuclei in vertical sections are crowded and are all practically at the same level compared with cuboidal epithelium
- Striated border with terminal bars e. g intestine

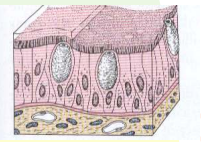







## 4. Pseudostratified epithelium



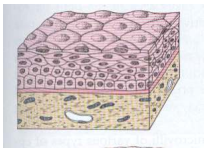



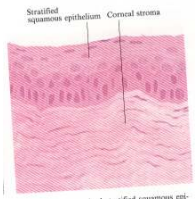
- Examples: nonciliated -male urethra and excretory ducts of parotid: ciliated-trachea and large bronchi
- Two to four layers of nuclei give a stratified appearance.
- Nuclei occupy approximately two-thirds of the epithelial layer compared with stratified columnar epithelium.
- Surface cells are columnar and always touch the relatively thick basement membrane of the epithelial sheet. Basal cells which are not columnar do not extend to the free surface. Thus in pseudostratified epithelium, all cells touch the basement membrane but not all reach the surface.
- Usually ciliated
- Nuclear are of several types depending on the level relative to the base of the tissue.



## 1. Stratified (Many-layered) Squamous epithelia

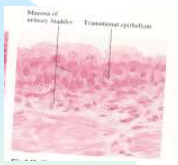
- E.g. Cornea, part of conjunctiva, epidermis of the skin. Mouth, esophagus, vagina and part of the female urethra.
- Surface cells usually flat or scale-like.
- Often with papillated lower border
- Basal nuclear layer pronounced
- Arrangement is such that the deepest cells are soft and delicate and one -layered. Intermediate cells are polygonal in outline, larger. Intercellular bridges of cytoplasm bind them together. Superficial layers are flattened by pressure.








## 2. Transitional Epithelium

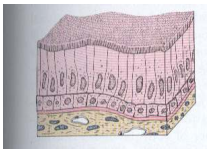


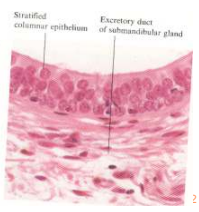

- Examples: pelvis of kidney, ureter, urinary bladder and prostate portion of male urethra. This epithelium is limited in distribution to the urinary tract.
- Surface cells are thicker and superficial scaly cells of stratified squamous epithelium.
- Nuclei surface cells tend to be more spherical than in stratified squamous epithelium.
- Transitional, usually not more than three to ten cells deep.
- No keratin formation and more regular basal line.



## 3. Stratified Columnar Epithelium

- Examples: part of the pharynx, excretory ducts of submandibular gland
- Outer cells always columnar; inner cells may appear cuboidal.
- Nuclear portion comprises three-fourths to four-fifths of the entire epithelial layer.
- Numerous nuclei, compact and ovoid.
- Basal nuclei forms a regular array.
- Globlet cells may or may no be present.
- Mucosa not papillated.





## Basal Lamina

- Formally basement membrane
- Underlying connective tissue (lamina propia)
- Provide structural support
- Act partially as selective barrier for epithelial layer
- Formed by epithelial cells themselves.
- Composed of non-fibrous collagen, heparan sulfate surrounded by a layer of glycoprotein, laminin



## Proliferation and Regeneration

- Epithelia are present in the vulnerable sites of the body.
- This makes them continually exposed to hazards of the external environment thus subjected to mechanical damage, destroyed, or slough off.
- Have high proliferation properties by mitosis.
- This heal wounds, repair lining tissue and prevent damage to underlying tissue.

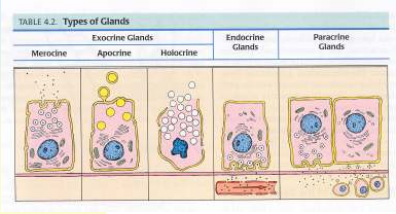


## Glandular Epithelium

- One of the specialized function of the epithelium is secretion
- Glands consist of the epithelial cells modified to synthesize and secrete.
- Glands are classified as
  - Exocrine
  - Endocrine glands and
  - Mixed glands
- Secretion of exocrine glands is classified as
  - Merocrine (or eccrine) secretion
  - Apocrine secretion and
  - Holocrine secretion



## Types of Glands





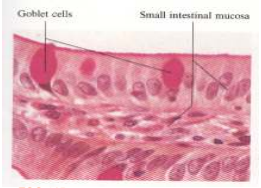

## Classification of Exocrine Glands

Exocrine glands are classified into two groups

1. Unicellular glands &
2. Multicellular Glands

1. Unicellular Glands

- Goblet cells: Example; Intestine, especially of colon

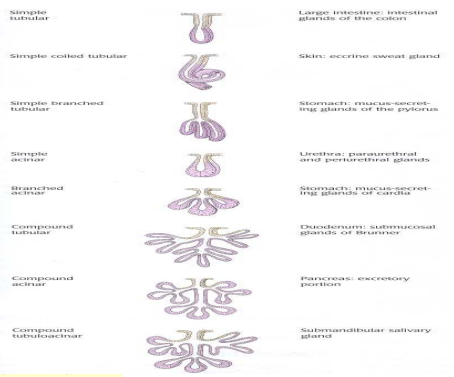





## Multicellular exocrine glands

- Develop by proliferation and invagination of epithelial cells into underlying connective tissue.
- The initial portion develops into the secretory duct, while the terminal portion develop into the secretory units
- Multicellular exocrine glands are classified as simple or compound.
- Simple exocrine glands have unbranched secretory ducts and
- Compound umbranched glands have branched secretory ducts.

## Classification of Multicellular Glands






## Components of Exocrine glands

- Parenchyma
- Stroma
- Capsule
- Lobe and lobules

- The secretory cells of exocrine glands are:
  - Mucous cells
  - Serous cells &
  - Myepithelial cells.



## Endocrine glands

- Ductless glands
- Secrete hormones
- May be classified into two groups
- Polypeptide (or protein)-secreting cells &
- Steroid-secreting cells.
- Localized and diffused endocrine system
- Diffused neuroendocrine system.



## Other Epithelia

1. Pigmented Epithelium e.g. external epithelium of retina, ciliary body, and to some extend the basal layer of the stratum germinativum.

Cells contain large amounts of pigments granules.

2. Neuroepithelia e.g. taste buds of the tongue and auditory sense cells. Various localized sensory regions in the epithelium consisting of cells of special types not represented in the taste buds or auditory sense cells