

**HISTOLOGY:** (Greek: *Histo*~web; *-ology*~study):

**Levels of organization in the body:**

Chemical < Cellular < Tissue < Organ < Organism

**GENERIC CELL?**

1. Cell membrane: barrier, filter, interface
2. Cell Appendages:
  - flagellum = propulsion, i.e., sperm
  - cilia = "sweeping motion" that can move particles
  - villi = increased surface area: secrete/absorb
3. Cytoskeleton: microfilaments + microtubules
4. Cytoplasm: = cell contents (*Cytosol* + *Organelles*)
5. Mitochondria: Burns oxygen/sugar to produce ATP
6. Endoplasmic reticulum: synthesis of cell product(s)
7. Golgi apparatus: storage of cell product(s)
8. Secretory vesicles: expulsion of cell product(s)
9. Nucleus: Control center (DNA, RNA)

**Tissue:** Group of cells which are combined to perform a specific function(s).

**Preparation of tissues for viewing:**

- preservation, imbedding, sectioning
- mounting, tissue staining, viewing

**4 Basic types of tissue:**

1. Epithelium (cellular SHEET ~ protect, absorb, secrete)
2. Connective (fibrous, supportive)
3. Muscle (contractile proteins)
4. Neural (electrically conductive)

# EPITHELIA = SHEETS OF TISSUES

## Epithelia have 4 main functions:

1. Protection - ex: Skin
2. Absorption - ex: Intestines
3. Secretion - ex: Glands
4. Excretion - ex: Kidney

## Epithelial tissues: 5 main characteristics:

1. Cellular
2. Polarity
3. Basement membrane
4. Avascular
5. Regeneration

## Epithelia = membranes

- Mucous membrane: lines cavities/surfaces that are exposed to the external environment and keeps them moist (*Ex: GI, UG, and respiratory*).
- Serous membrane: covers organs/lines body cavities and produces a lubricant to aid the organs as they move (*Ex: Pleural, peritoneal, pericardial cavities*).
- Synovial membrane: lines joint cavities, and provides for exchange of fluids/solutes between the joint cavity and the adjacent tissues.
- Cutaneous membrane (skin): covers the body: thick, relatively waterproof, abrasion resistant.

## Terms that help identify epithelial tissue

- Number/arrangement of layers (~ *function*)
  - a) Simple
  - b) Stratified
  - c) Pseudostratified
  
- Shape of cells: (*cell volume ~ complexity*)
  - a) Squamous
  - b) Cuboidal
  - c) Columnar
  
- Surface features:
  - a) Stereocilia - sensory (cochlea of the ear)
  - b) Villi/Microvilli - increase SA for secrete/absorb
  - c) Cilia - "sweeping motion" moves exterior particles

### **Additional classification of cell/tissue types:**

- Cell shape: flat, cube-shaped, columns, irregular
- Lamination: number of layers
- Ornamentation: projections (cilia, flagella, microvilli)
- Other: Innervation, Vascularity, Regenerative ability?

## Examples of epithelial tissues:

Simple squamous epithelium - sheet of flattened, irregular-shaped cells across which secretion or absorption may occur (*Ex: alveoli in the lung*).

Stratified squamous epithelium - laminated sheets designed to resist abrasion, mechanical/chemical insult (*Ex: skin on bottom of foot, mouth*).

Simple cuboidal epithelium - sheet of cube-shaped cells through which secretion or absorption may occur (*Ex: tubules throughout the kidney*).

Simple columnar epithelium - sheet of tall cells that are often absorptive or secretive (*Ex: stomach, intestines*).

Pseudostratified ciliated columnar epithelium - sheet of tall cells. The relative "height" of the nuclei above the BM may vary to give the impression of several layers of cells (@ low magnification). Cells are often ciliated, hence the long name (*Ex: nasal passages, windpipe*).

## **Epithelia = Glands - *YOUR BODY IS A DONUT!***

– epithelia often roll up into tubular cell masses that specialize in the secretion of their cell products (gland).

**Endocrine** (duct-less) **glands**: release cell products directly into surrounding intercellular fluid and/or blood supply. (Ex's: digestive tract, pancreas, thyroid, thymus, pituitary).

**Exocrine** (ducted) **glands**: secretions are released from the epithelial surface into small **ducts** that empty to the digestive tract or skin surface (Ex: sweat, tears, saliva).

### **Three modes of glandular secretion:**

#### 1. **Merocrine** glands - (common)

Cell products do not accumulate, but are immediately released to the outside of the gland.

*(Ex: Salivary glands, Sweat glands).*

#### 2. **Holocrine** glands - Cells, cell fragments and cell products are released together from the gland.

Cells are quickly replaced by mitosis.

*(Ex: Sebaceous (oil) glands).*

#### 3. **Apocrine** glands - Cell products accumulate at the distal end of the cell and are released together with small amounts of the cell itself. *(Ex: Mammary glands).*