

# Epithelial Tissues

# 4 Types of Tissue

- Epithelial
  - Connective
  - Muscle
  - Neural
- 
- Can you come up with 2-3 basic functions for each of these?

# Characteristics of Epithelia

1. Predominantly made of cells
  - all cells tightly bound by **cell junctions**
2. Polarity (**apical** and **basal** surfaces)
3. Attached to **basal lamina**
4. Avascular (**lack blood vessels**)
5. Regenerate via **stem cells**



# Where is Epithelia found?

- Covers exposed surfaces
  - Skin, digestive tube, reproductive tract, ureter, bladder, trachea, lungs
- Lines internal passageways
  - Blood vessels, lymph system
- Forms glands
  - Sebaceous (mammary), salivary, gastric, intestinal, mucous

# Functions of Epithelia

1. Provide Physical Protection
2. Control cell permeability
3. Provide sensation - **neuroepithelia**
4. Produce secretions via **glands**

# Functions of Epithelia

- **Physical Protection**
  - Protect all surfaces exposed to the environment (external & internal)
  - **Mechanical** (abrasion)
  - **Biological & chemical** (bacteria, viruses & their byproducts)
  - **Dehydration**

# Functions of Epithelia

- Control cell permeability - absorption
  - Anything entering or leaving body crosses epithelia
  - Sensitive to various stimuli
    - PTH - increase  $Ca^{2+}$  absorption across epithelial cells of small intestine
    - Aldosterone - increases  $Na^{+}$  absorption across epithelia of LOH
    - Vitamin C - promotes iron absorption in small intestine

# Functions of Epithelia

- Provide sensation - **neuroepithelia**
  - Large sensory nerve supply
  - **mechano, electro, chemoreceptors**
  - **All special senses provided by specialized epithelia**



# Functions of Epithelia

- Form glands (**glandular epithelia**) that produce secretions
  - **Exocrine** - released onto epithelial surface *via ducts*
    - sweat, tears, milk
  - **Endocrine** - released into blood or lymph for action elsewhere
    - Hormones
    - *ductless*
  - What is the difference between exocrine and endocrine glands & secretions?

Where and how they **DELIVER** those secretions

# Specialized for different functions

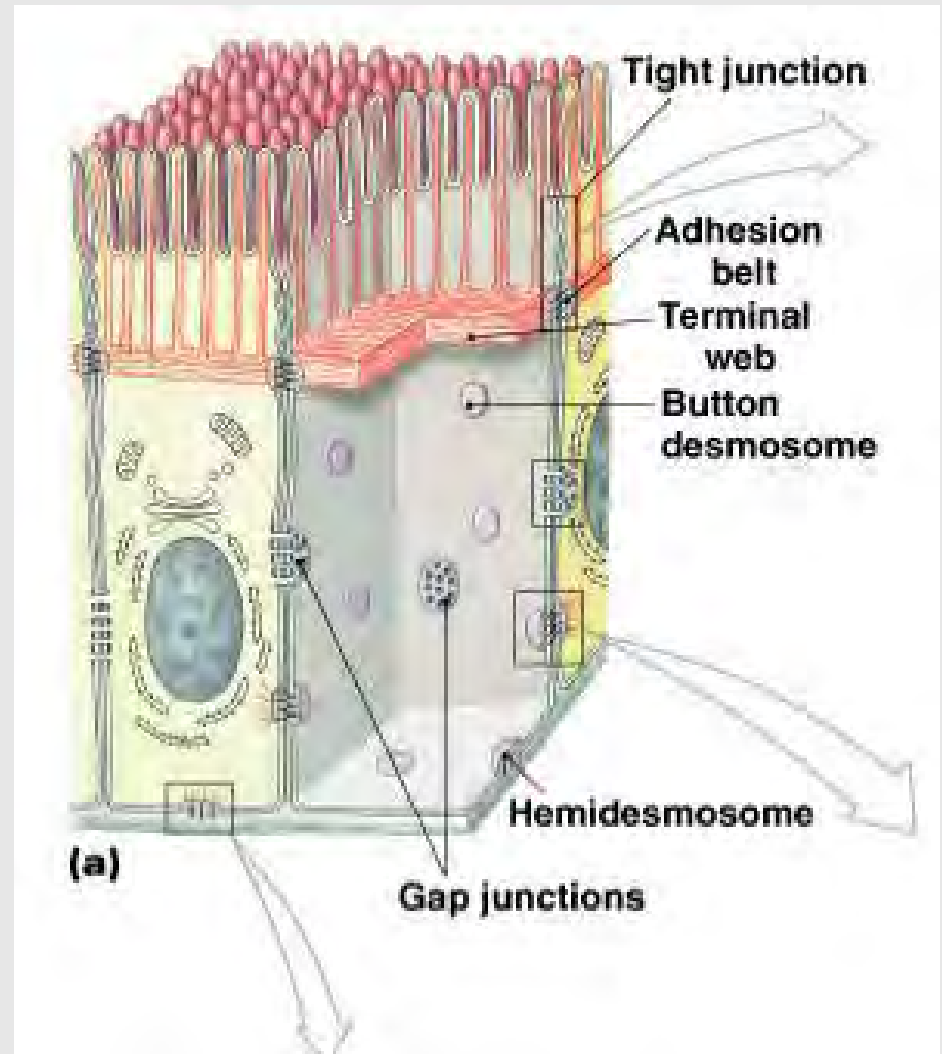
1. Move fluids *over* the epithelium
  - Protection & lubrication (**mucus**)
2. Move fluids *through* the epithelium
  - permeability
3. Produce **secretions**
  - Protection, messengers, waste removal, nutrient supply

# Mechanical & Chemical Barriers

- Physical integrity is maintained by:
  - intercellular connections
  - attachment to basal lamina
  - maintenance and repair

# Intercellular Connections

- Support
- Communication



# Large Connections

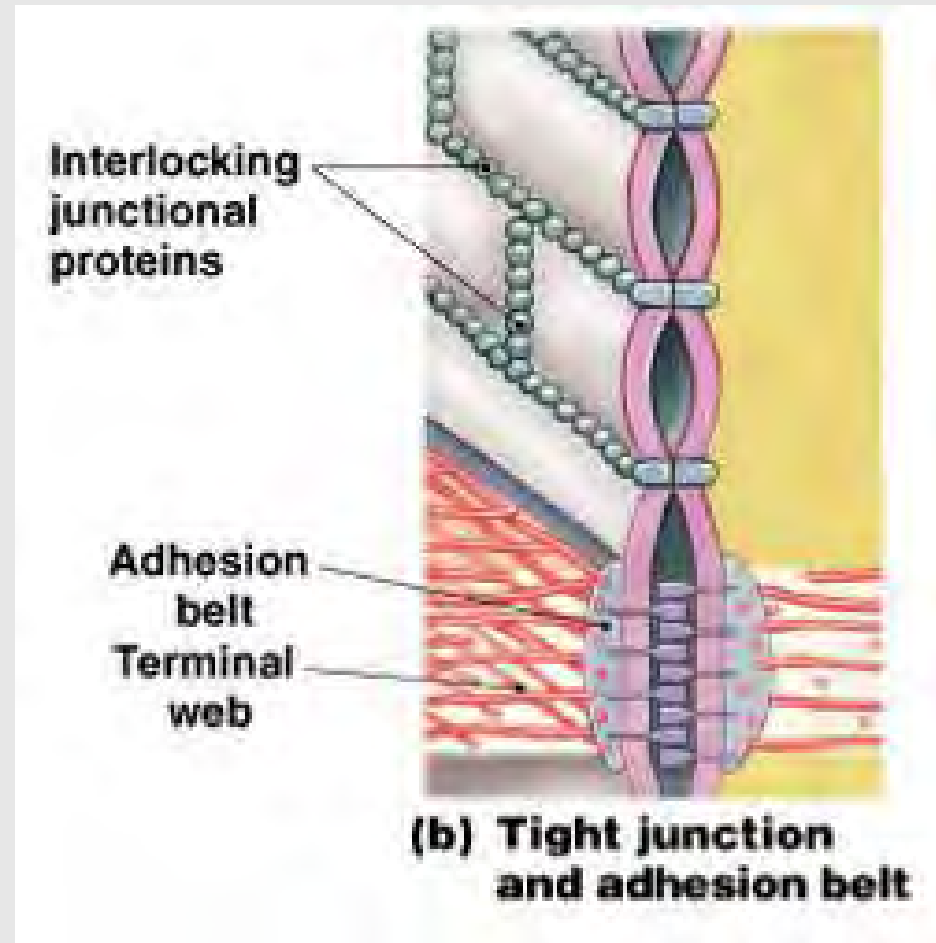
- **CAMs** (cell adhesion molecules):
  - Transmembrane proteins: cell membrane-cell membrane connections
- **Intercellular cement**:
  - Proteoglycans (extracellular polysaccharides linked by polypeptide chains)
    - Glycosaminoglycans
    - **Hyaluronan**

# 3 Cell Junctions

- Form bonds with other cells or extracellular material:
  - tight junctions
  - gap junctions
  - desmosomes

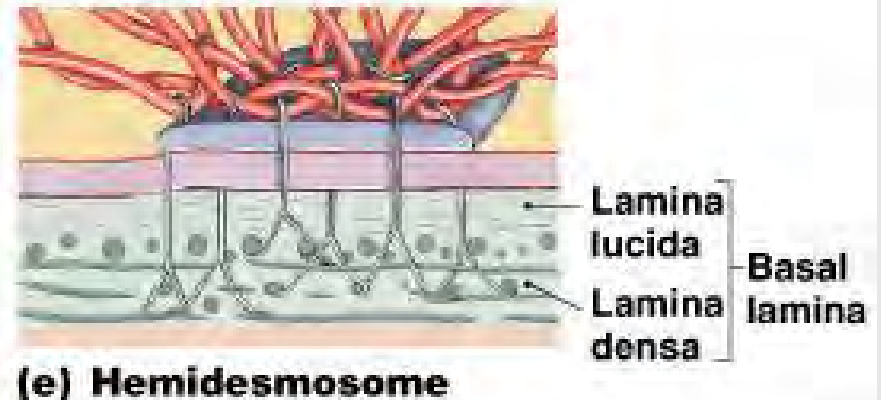
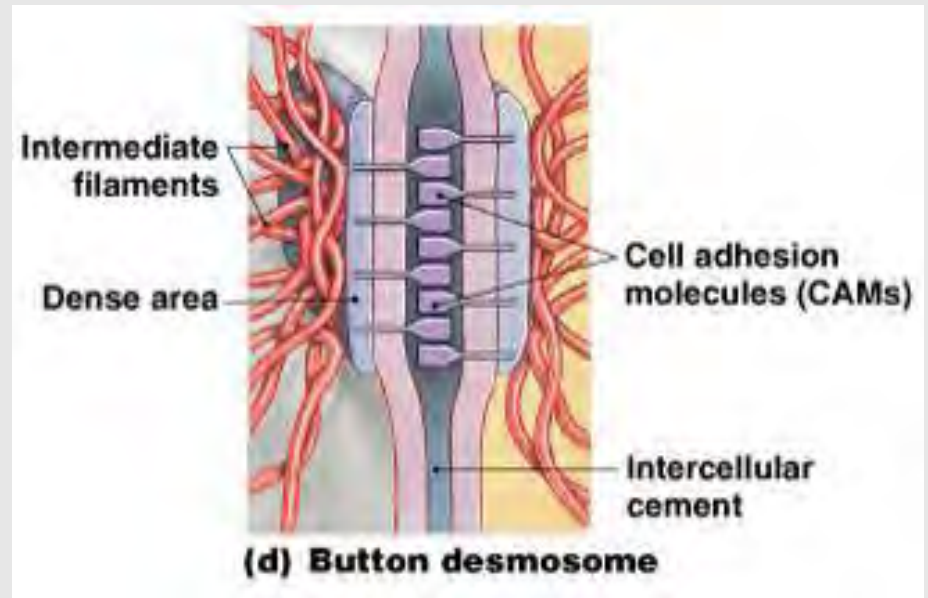
# Tight Junctions

- Between 2 cell membranes
- Adhesion belt attaches to terminal web
- Prevents passage of water & its solutes
  - Acids
  - ingested Bacteria
  - EX: Isolates waste & metabolic byproduct throughout lumen



# Desmosomes

- CAMs, dense areas, and intercellular cement
- **Button desmosomes**
  - Ties cells together
  - Supported internally by intermediate filaments; Allow bending and twisting
- **Hemidesmosomes**
  - Ties cell to basal lamina





# Attachment to Basal Lamina

- **Lamina lucida** (closer to ET):
  - thin layer
  - secreted by epithelia
  - barrier to proteins
- **Lamina densa** (closer to CT):
  - thick fibers
  - Secreted by connective tissue
  - strength and filtration



# Repairing & Replacing Epithelia




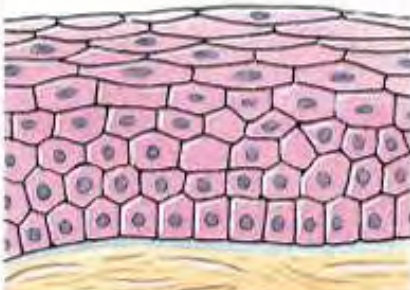


- Epithelial cells are replaced by division of **germ cells** (stem cells)
- Lie just superior to **basal lamina**

# Cell Arrangements

- **Simple:** [http://a-s.clayton.edu/biology/biol1151L/lab03/lab\\_3.htm](http://a-s.clayton.edu/biology/biol1151L/lab03/lab_3.htm)
  - Single layer of cells = **fragile**
  - Often used for filtration = **secretions & absorption**
- **Stratified**
  - 2 or more layers of cells
  - Use top layer to identify (as squamous, cuboidal etc.)
  - Often seen in 'wear and tear' areas (high mechanical or chemical stress)
- **Pseudostratified**
  - One layer that looks like many layers
  - Seen in areas needing to stretch (bladder walls)

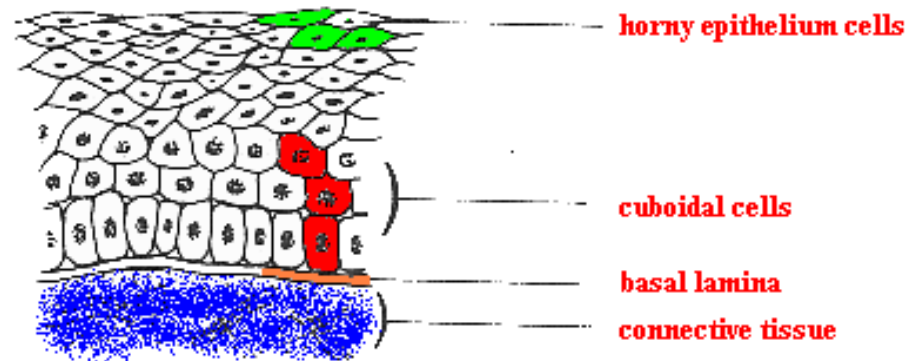
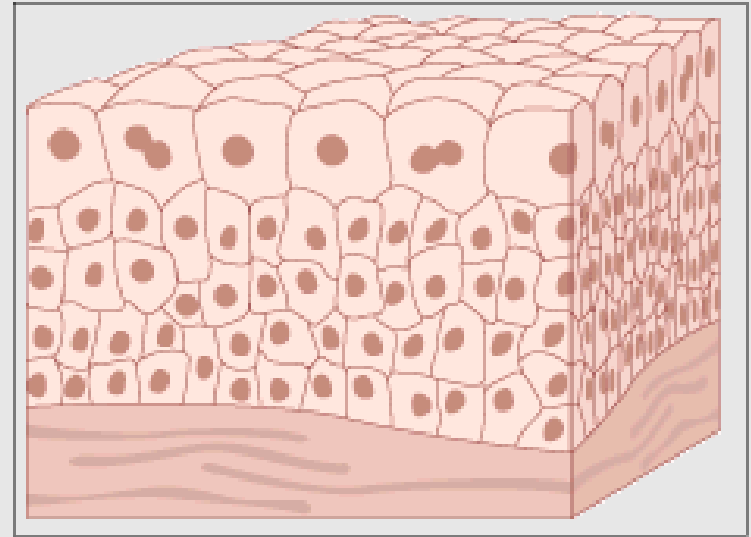
# Classes of Epithelia

- Based on **shape** and **# of layers**

TABLE 4-1 Classifying Epithelia			
	Squamous	Cuboidal	Columnar
Simple	 <p>Simple squamous epithelium</p>	 <p>Simple cuboidal epithelium</p>	 <p>Simple columnar epithelium</p>
Stratified	 <p>Stratified squamous epithelium</p>	 <p>Stratified cuboidal epithelium</p>	 <p>Stratified columnar epithelium</p>

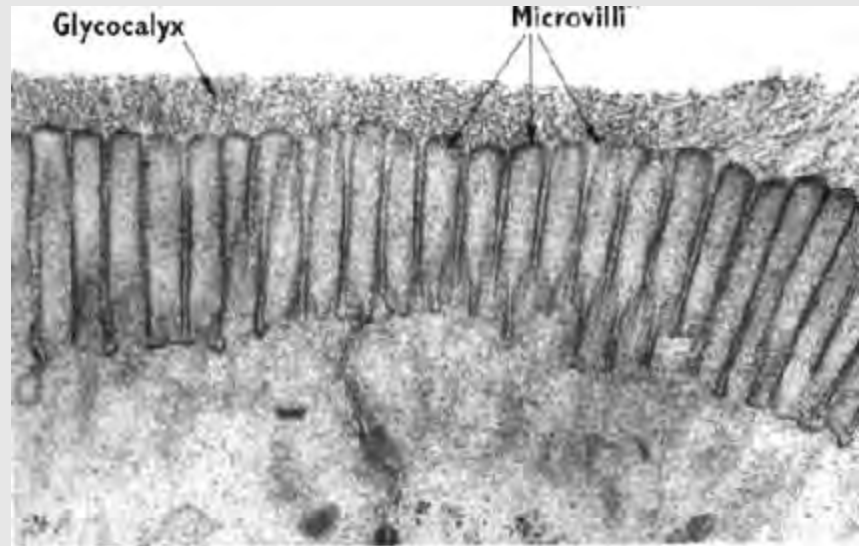
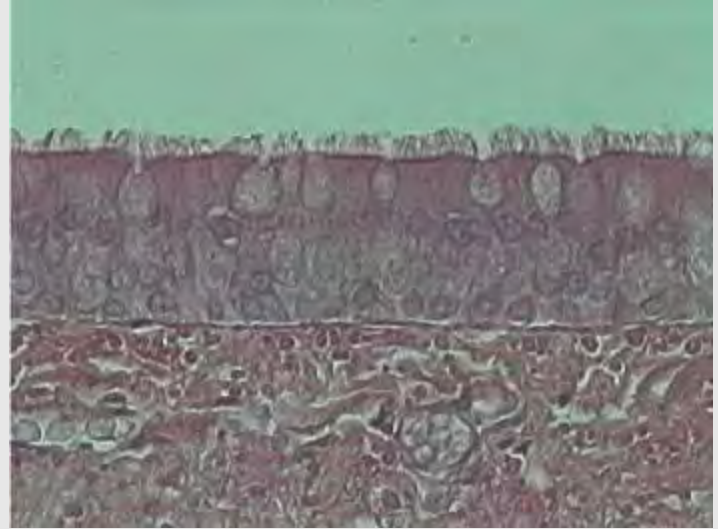
# Surfaces

- Apical
- Basal
- Basement Membrane
  - basal lamina: collagen, laminin, proteoglycans
    - *Epithelial secretions*
  - reticular lamina: reticular fibers, fibronectin, glycoproteins
    - *connective tissue secretions*



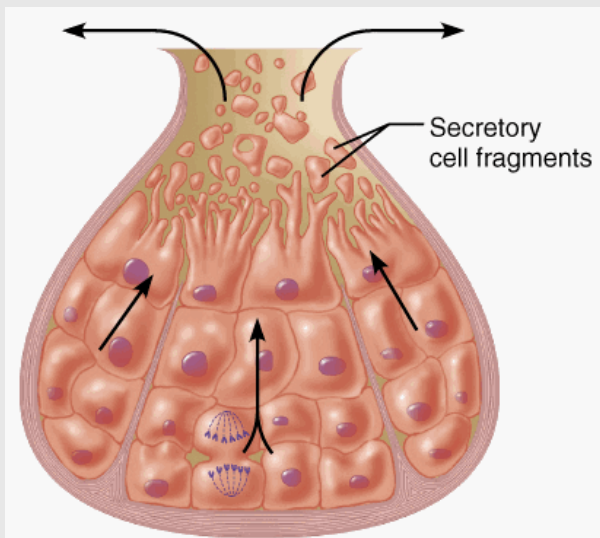
# Surface Variations

- Plain
- Cilia
  - Propel substances over surfaces
- Microvilli
  - Increase exposed surface area
  - Often in columnar epithelia



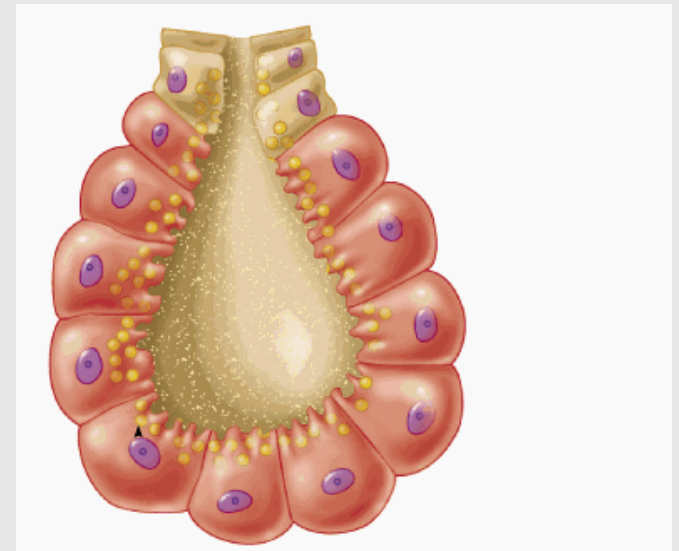
# Modes of Glandular Secretion

- What is lost during secretion?
- Apocrine
- Merocrine
- Holocrine



(b)

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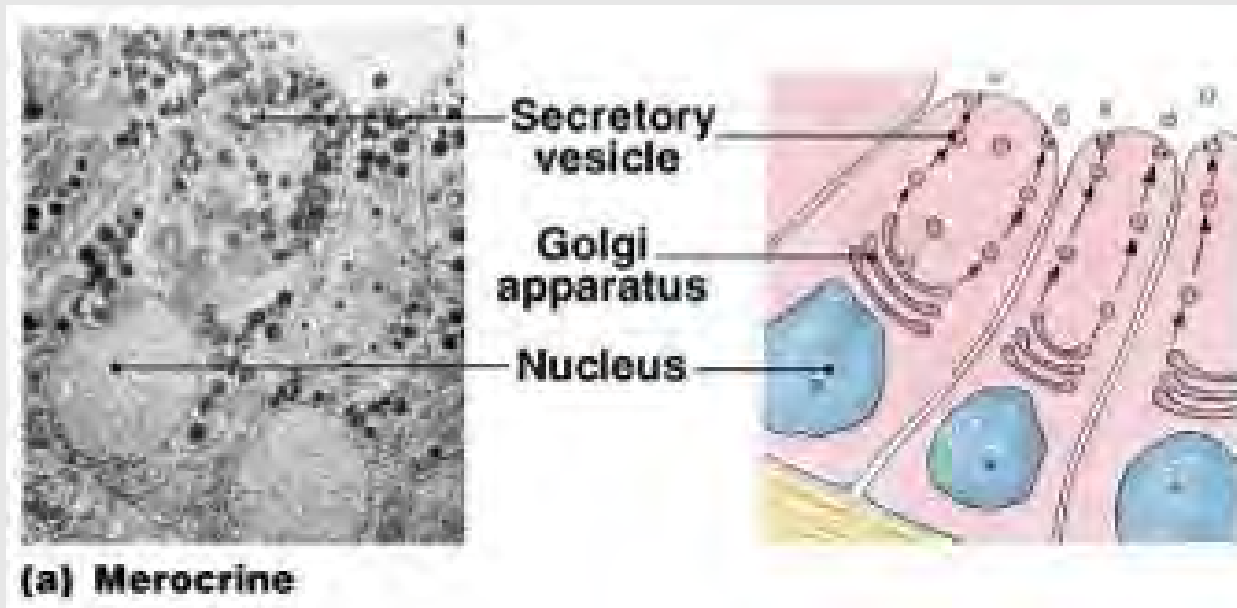


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# Merocrine Secretion

- Secretory products secreted via **vesicular exocytosis**
  - Most common form of secretion - often continuous
  - Ex: Pancreatic cells, sweat, saliva





# Apocrine Secretion

- **Cytoplasm & secretion** are excreted
  - milk & underarm perspiration



Figure 4-6b

# Holocrine Secretion

- Entire cell lost with secretion.
  - Stem cells divide to replace lost cells
  - Ex: Sebaceous glands

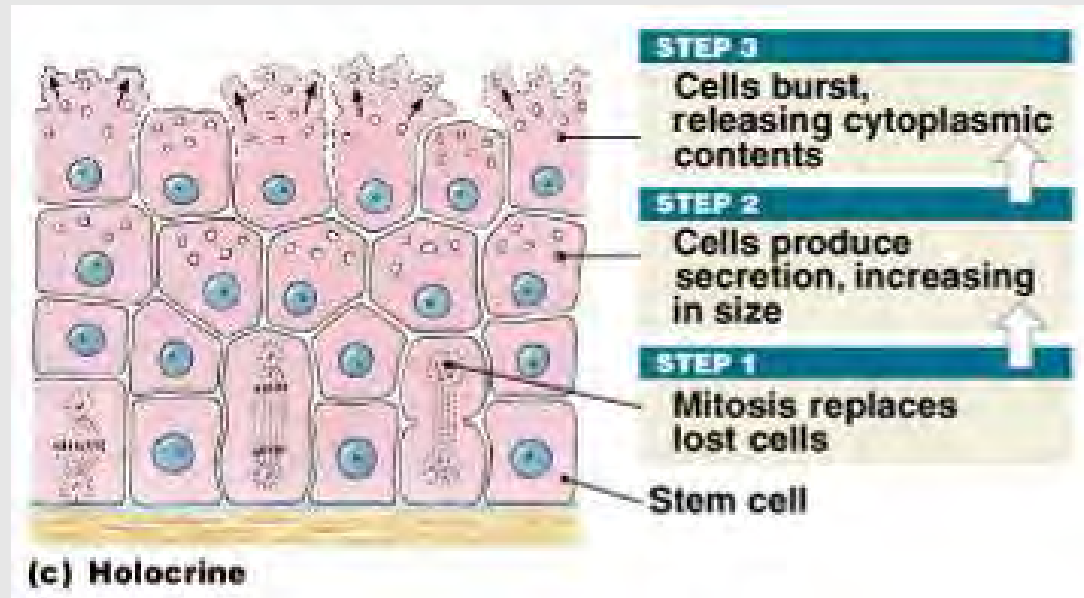
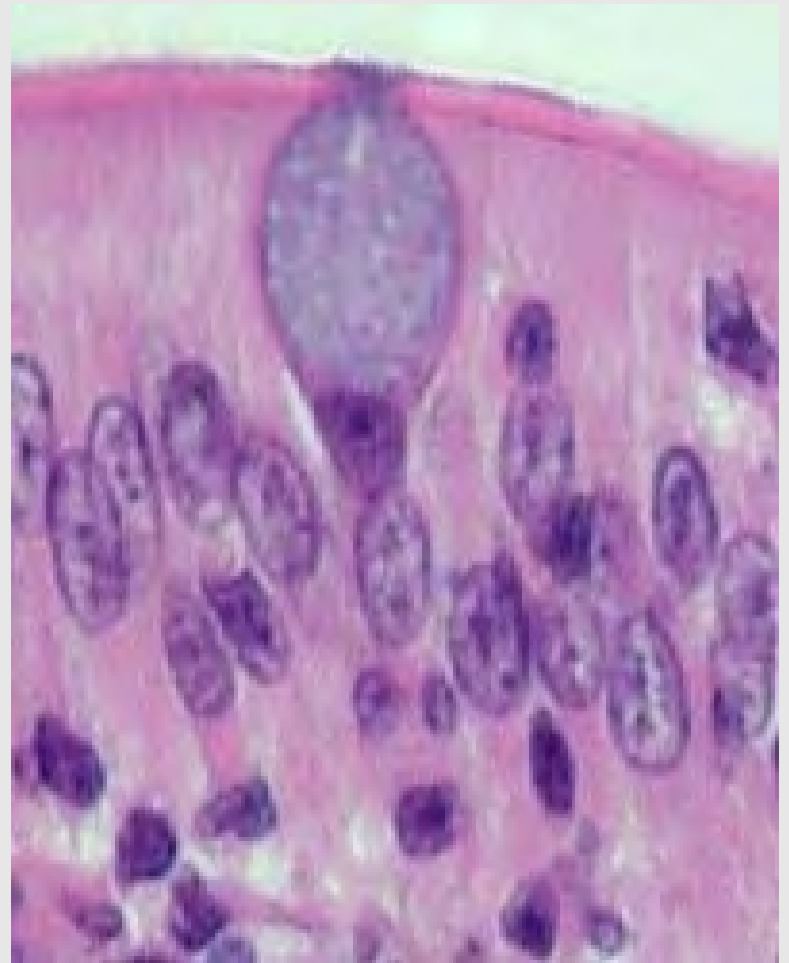


Figure 4-6c

# Glands: Arrangement of cells

- **Unicellular:**
  - Goblet cells
- **Multicellular:**
  - Tubular - Brunner's gland in duodenum
  - Alveolar - Sebaceous/Oil glands
  - Combination - Salivary glands
- **Mucous = mucin:**
  - A glycoprotein that combines with water



# Secretory Glands: General Types

- **Serous**
  - Secrete a watery substance containing enzymes
    - Saliva with alpha-amylase
- **Mucous**
  - Secrete mucin
    - hydrates to form mucus
- **Mixed Exocrine**

