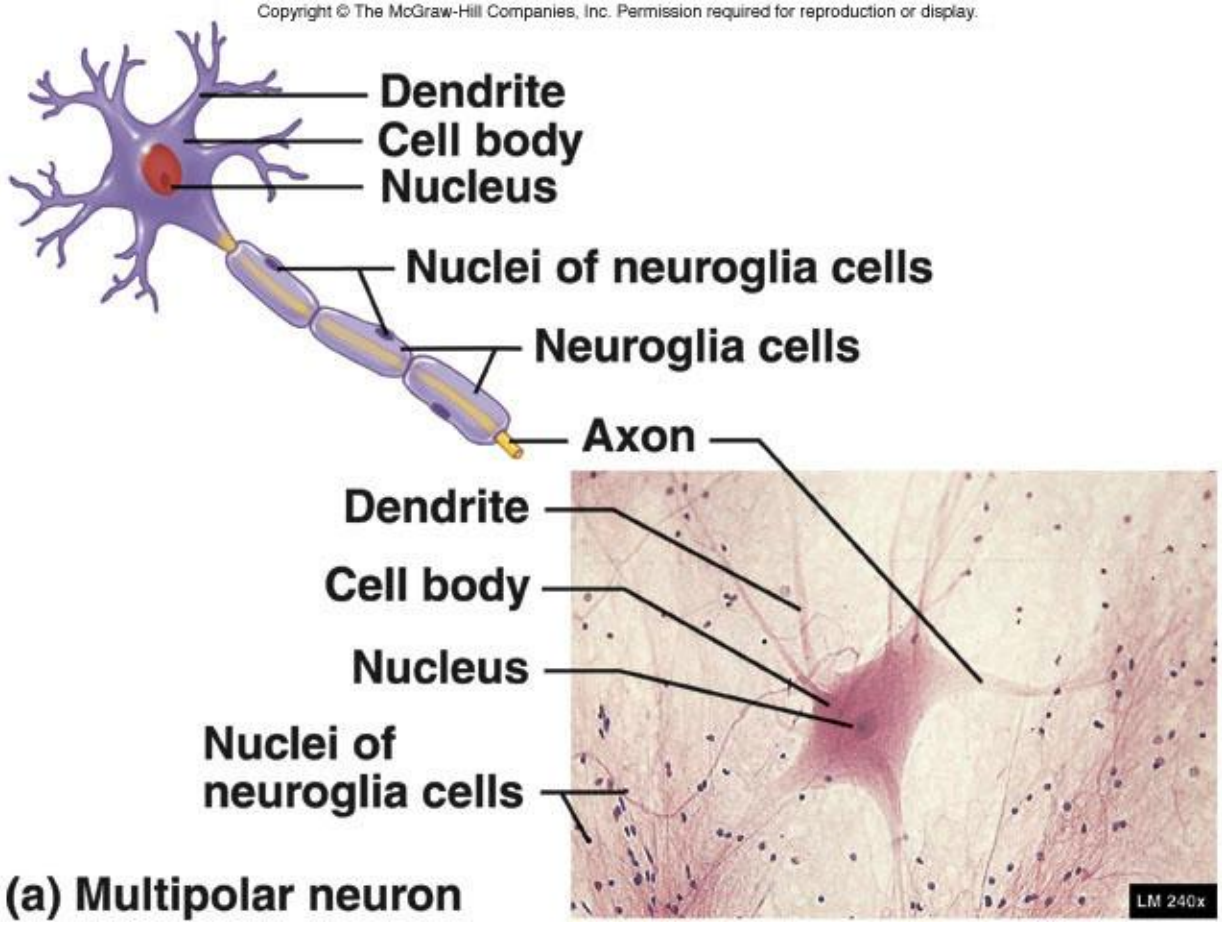
Structural Organization
Tissue I
Tissue—a group of closely associated cells performing a restricted range of functions.

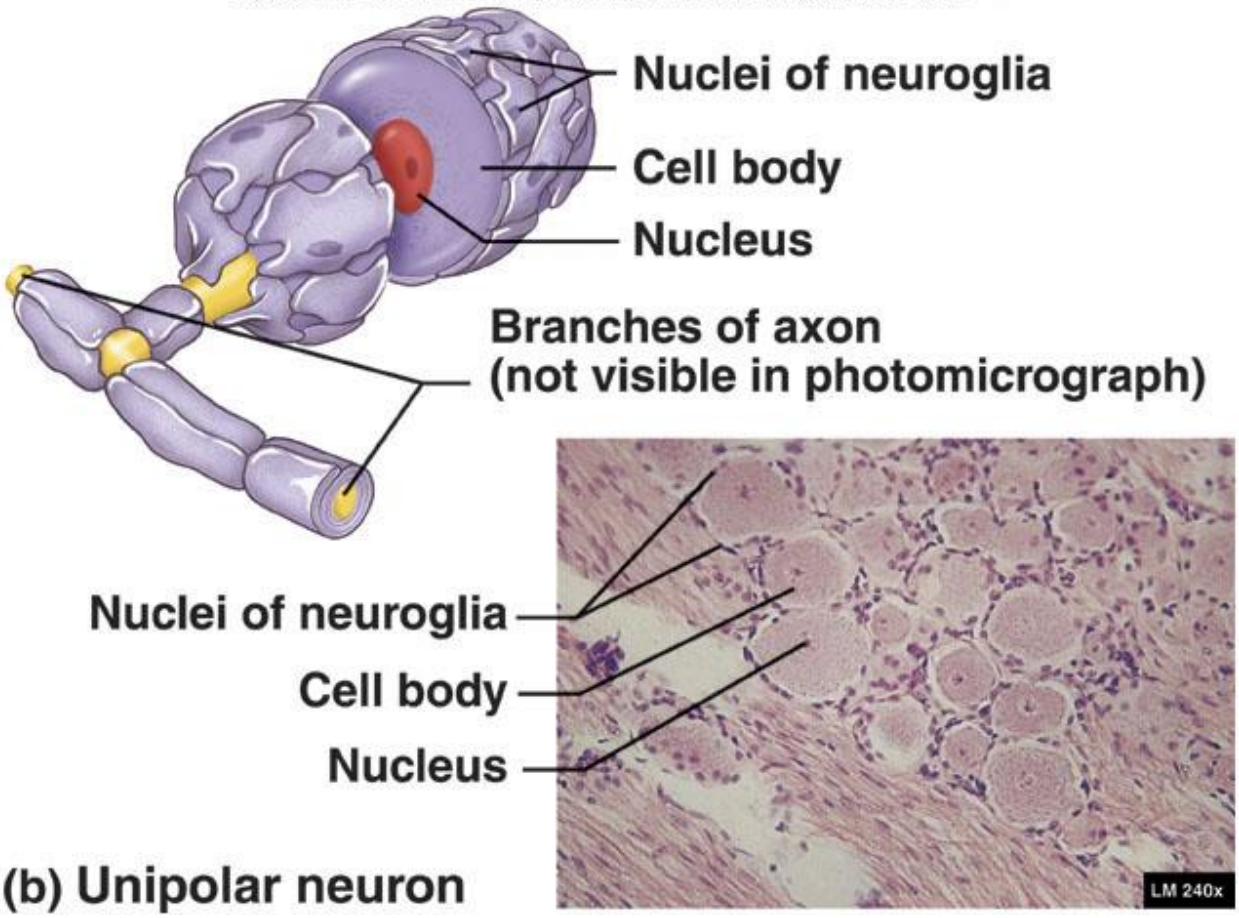
Overview of Tissues

	Tissue Type			
	Nervous	**Muscle**	**Epithelial**	**Connective**
Primary Function	**Information Processing**	**Contraction to Generate Force**	**Cover Exposed Surfaces**	**Structure and Support**
Cell Types	**Neurons Glia**	**Smooth Cardiac Skeletal**	**Squamous Cuboidal Columnar Transitional Glandular**	**Fibroblasts WBC's Mast Cells Plasma Cells Macrophages Adipocytes**
Fibers	**(Minimal)**	**(Minimal)**	**Basement Membrane**	**Collagen Reticular Elastic**
Fluids	**Nutrient-Rich, Aqueous**	**(Minimal)**	**(Limited)**	**Depends on Type of Connective Tissue**

I. Classes of Tissue
A. Nervous Tissue



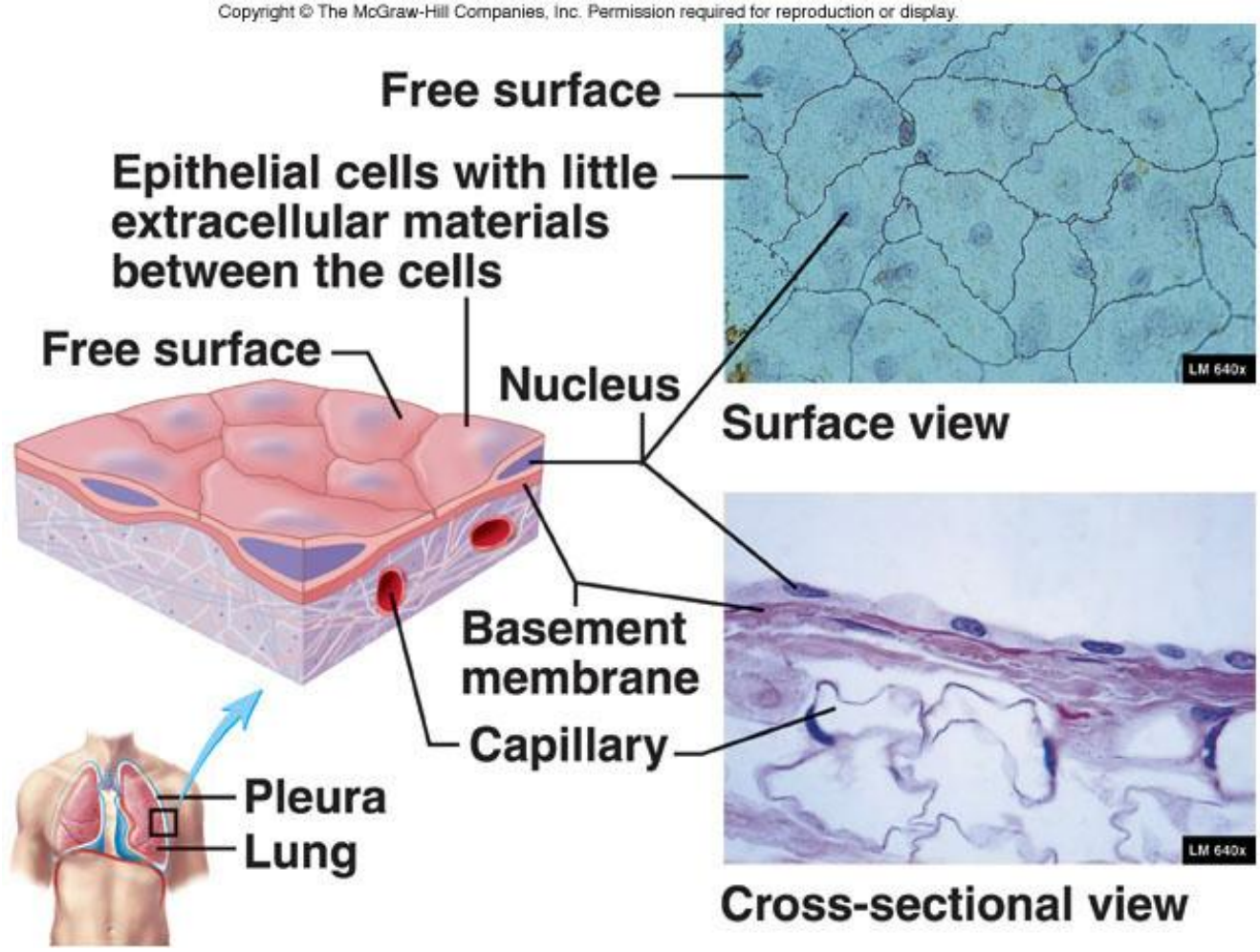
1. Neurons
    a. Chemical and electrical transmission of information
2. Glia



a. Support and repair

B. Muscle
1. Function: Contracts to generate force
2. Types
    a. Skeletal
        i. Striated
        ii. Multinucleated
        iii. Voluntary control
    b. Smooth
        i. Non-striated
        ii. Uninucleated
        iii. No voluntary control
    c. Cardiac
        i. Striated
        ii. Intercalated disks
        iii. No voluntary control

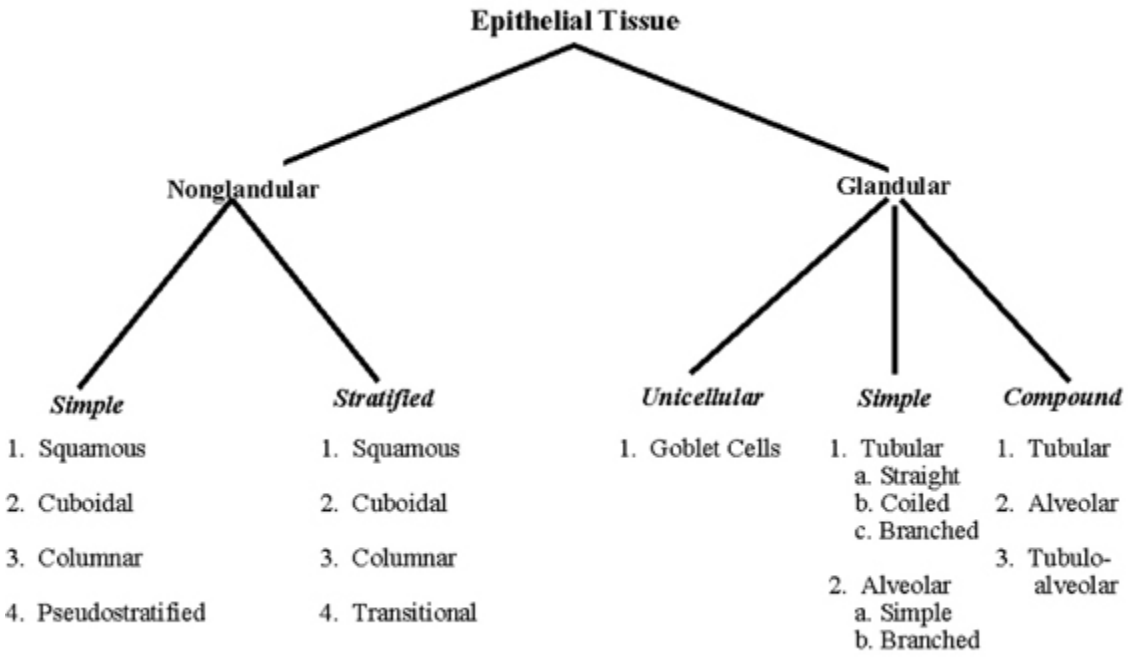
C. Epithelial



1. Functions:
    a. Protection
    b. Absorption
    c. Filtration
    d. Secretion
2. Characteristics
    a. Cellularity: close-packed cells with limited extracellular material
    b. Cellular connections
        i. Tight junctions
        ii. Desmosomes
    c. Cellular organization
        i. Apical surface in contact with fluid or air
        ii. Basal cell layer in contact with basement membrane (lamina)
    d. Connective tissue support
        i. All epithelial sheets are supported by connective tissue
        ii. Deep to the basement lamina is a layer of connective tissue—reticular lamina
        iii. Basement lamina + reticular lamina = basement membrane
    e. Innervated—receives nervous innervation
    f. Avascular—contains no blood vessels
    g. Highly regenerative

i. Cells are replaced rapidly by cell division
ii. Cell loss due to friction and contact with hostile environments

3. Classification

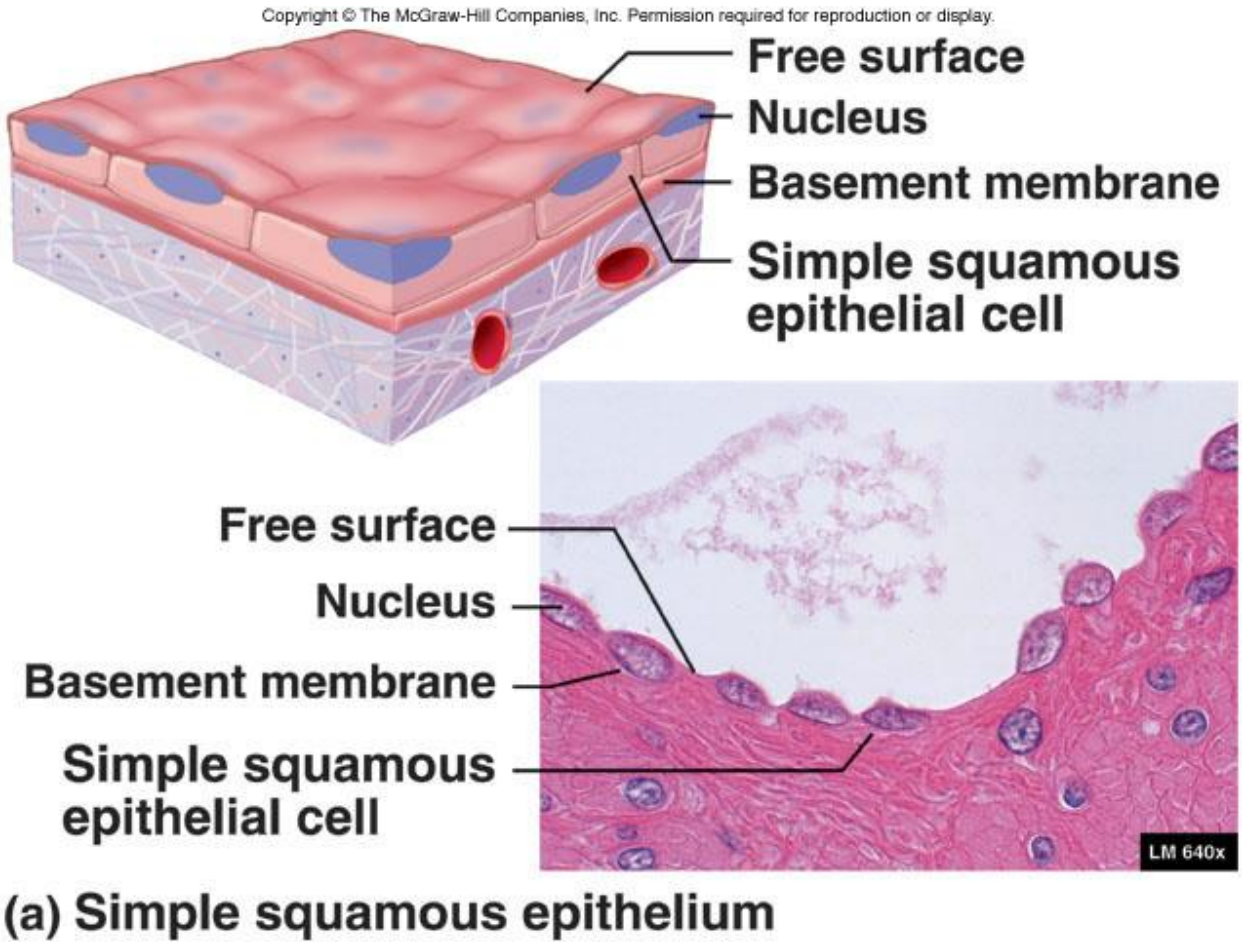


4. Nomenclature
    a. Two names
        i. First indicates number of cell layers
        ii. Second indicates cell shape
    b. All cells in a given layer will have the same shape
5. Epithelial layers
    a. Simple
        i. Single cell layer
        ii. Areas of absorption and filtration
    b. Stratified
        i. Two or more cell layers
        ii. Areas of high abrasion
6. Cell shape: all cells have six irregular sides that differ in height
    a. Squamous
        i. Flattened
        ii. Scale-like
    b. Cuboidal
        i. Boxlike
        ii. As tall as wide
    c. Columnar
        i. Tall
7. Shape of nucleus
    a. Conforms to cell shape
        i. Squamous—disc shaped
        ii. Cuboidal—spherical

iii. Columnar—elongated from top to bottom

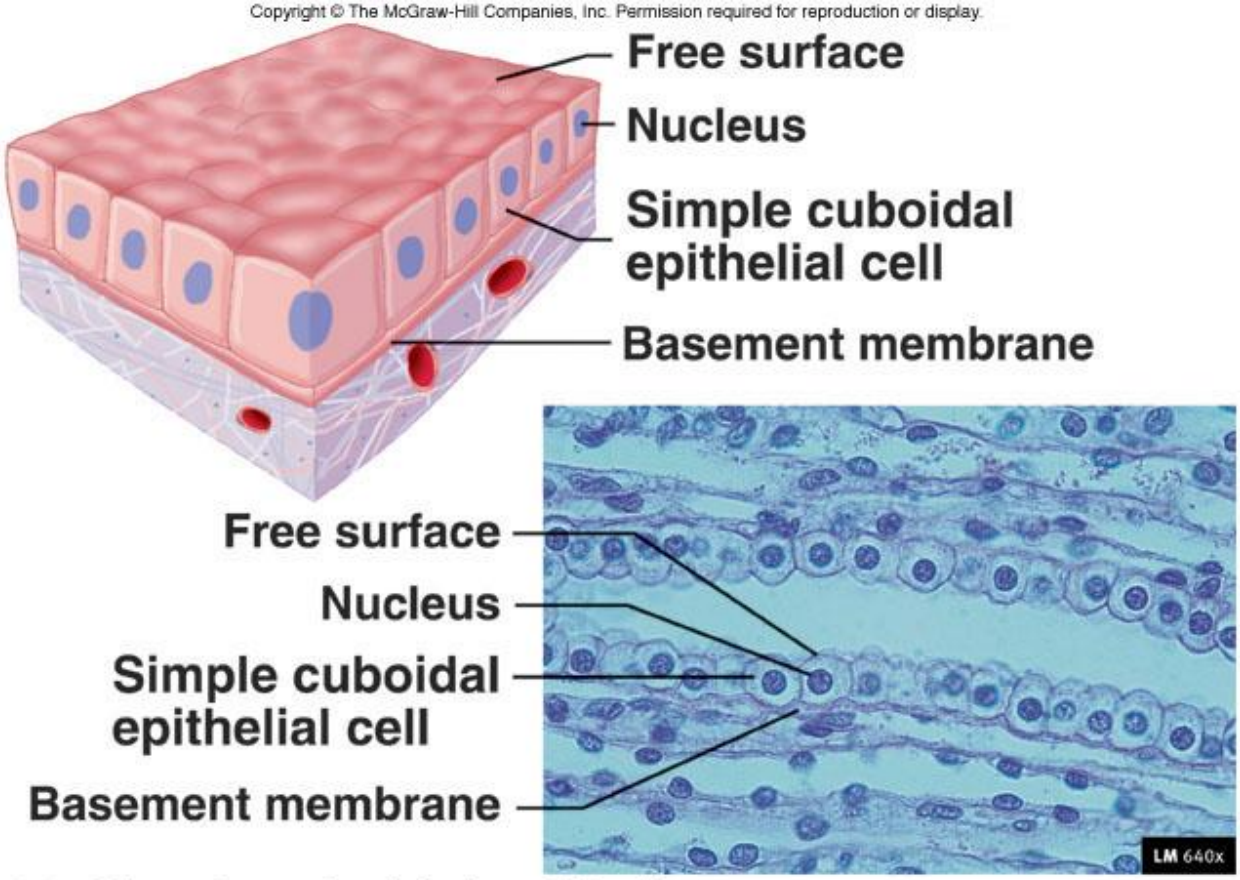
8. Types of Simple Epithelia

a. Simple squamous



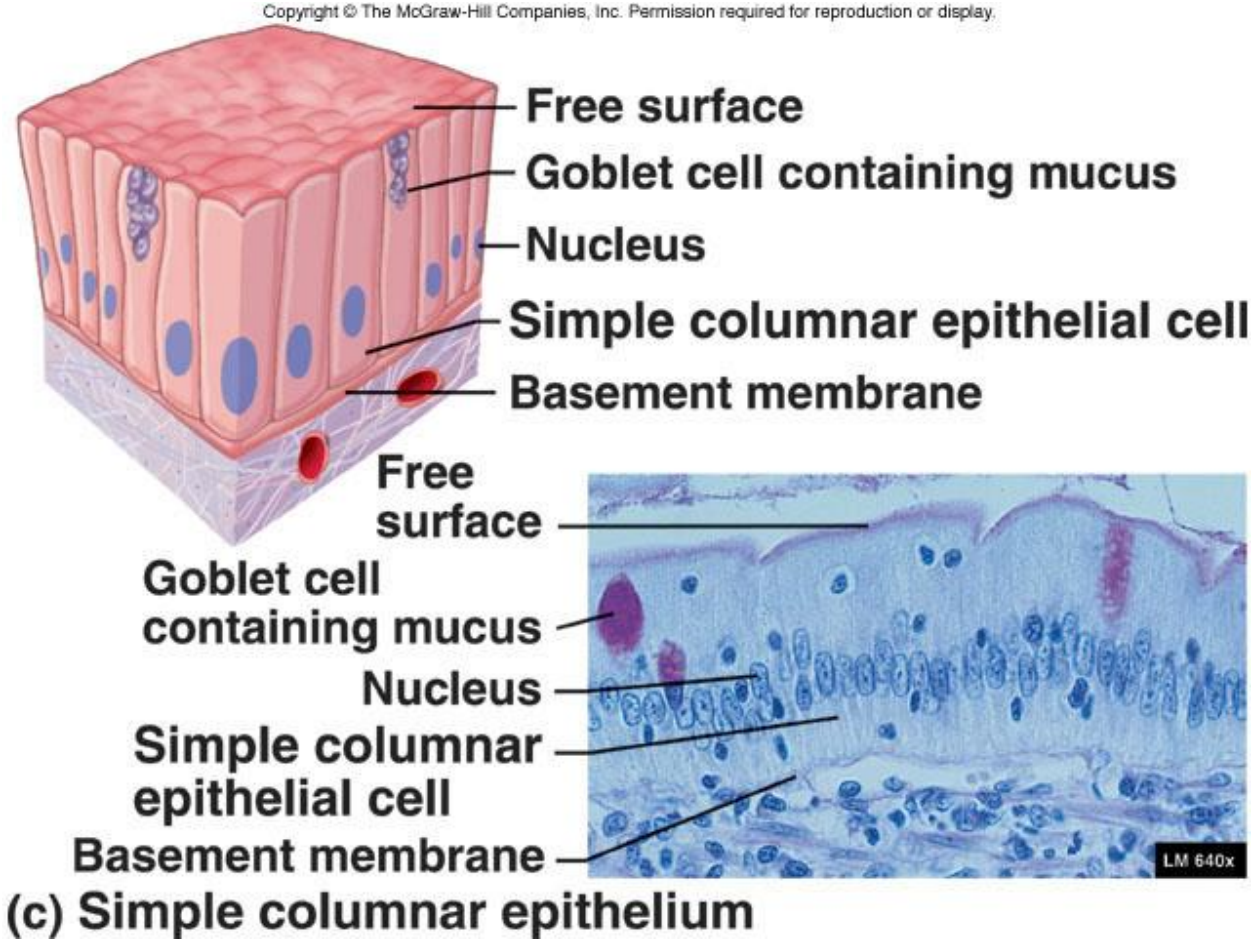
(a) Simple squamous epithelium

b. Simple cuboidal

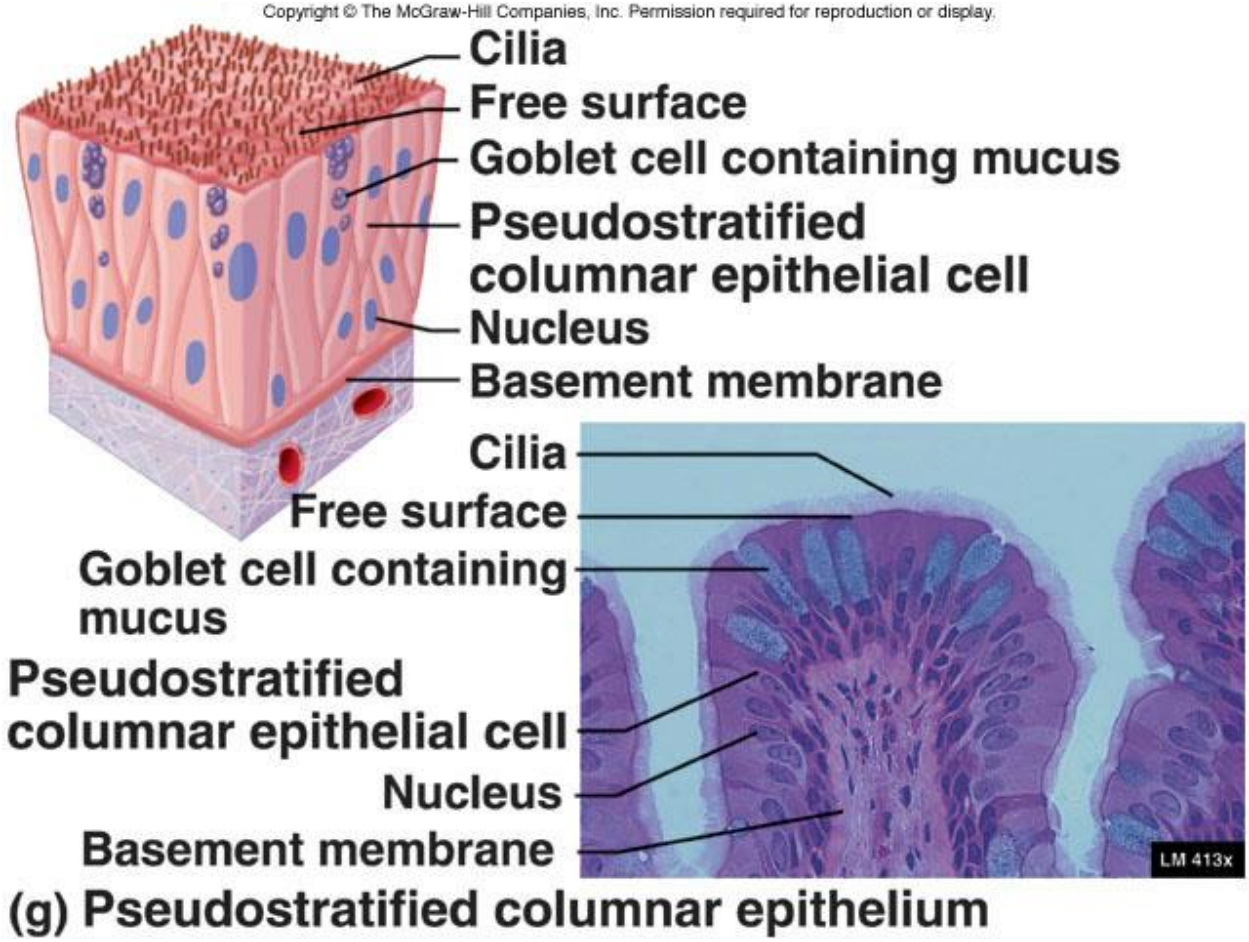


(b) Simple cuboidal epithelium

c. Simple columnar

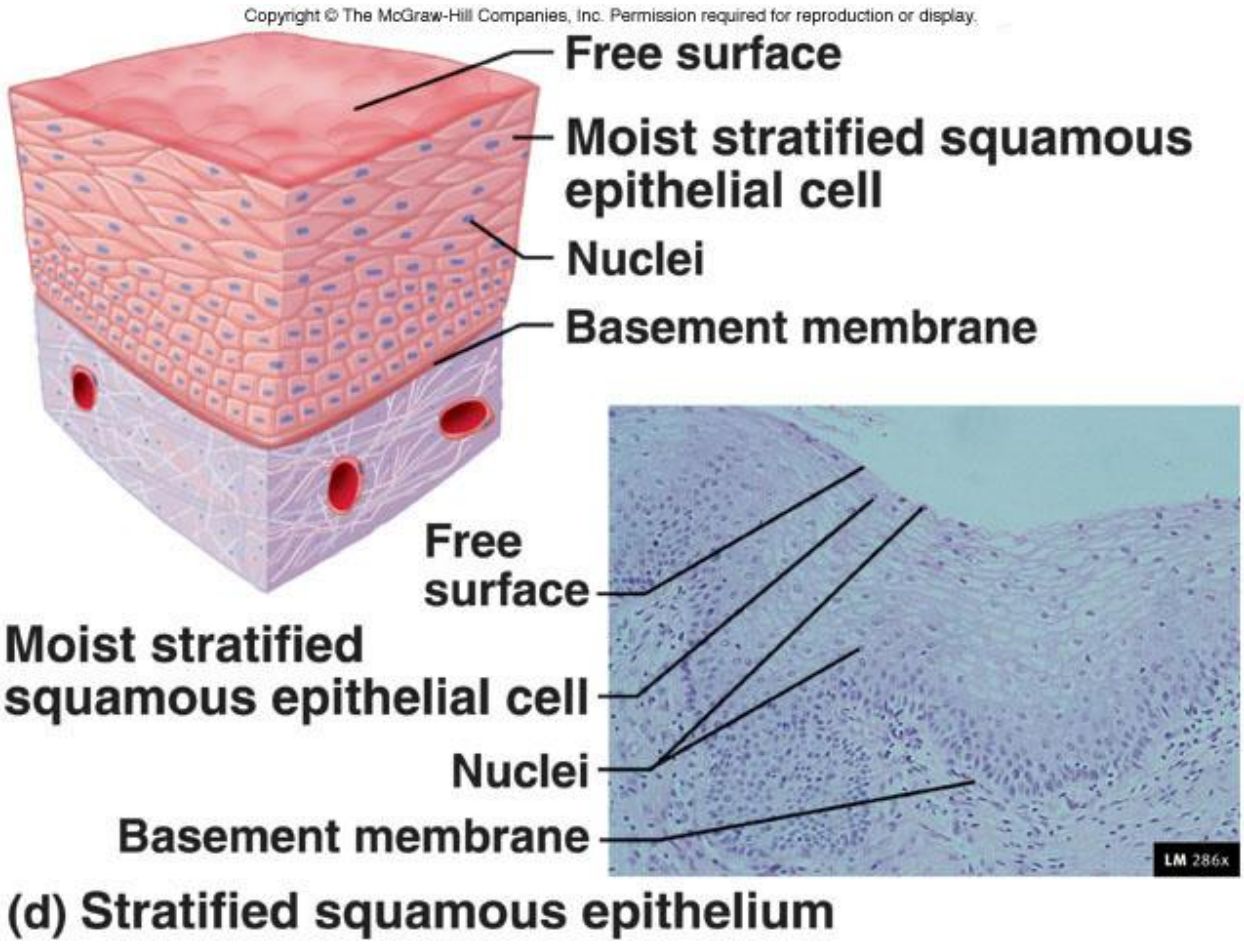


d. Pseudostratified columnar



(g) Pseudostratified columnar epithelium

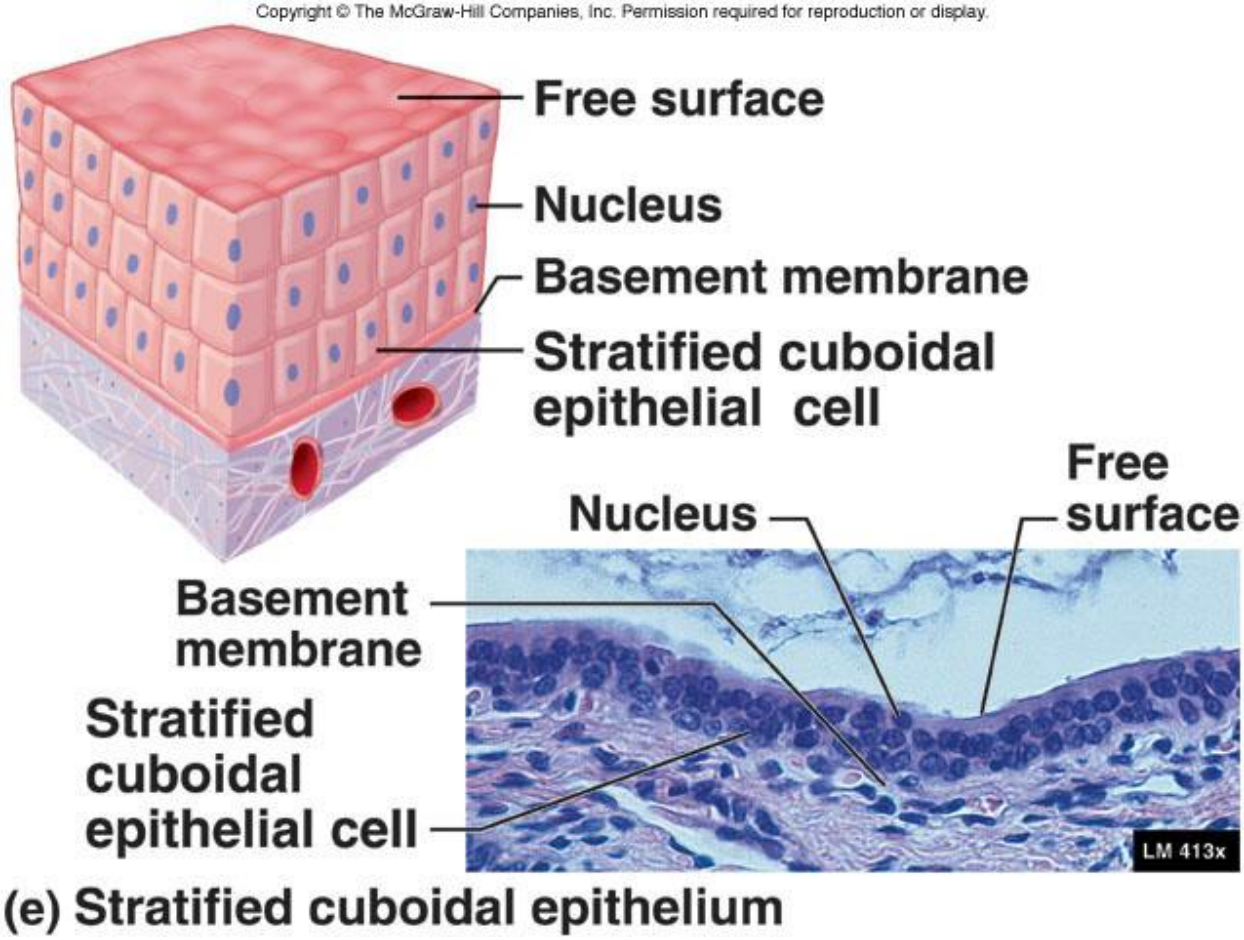
9. Types of Stratified Epithelia
    a. Stratified squamous



(d) Stratified squamous epithelium

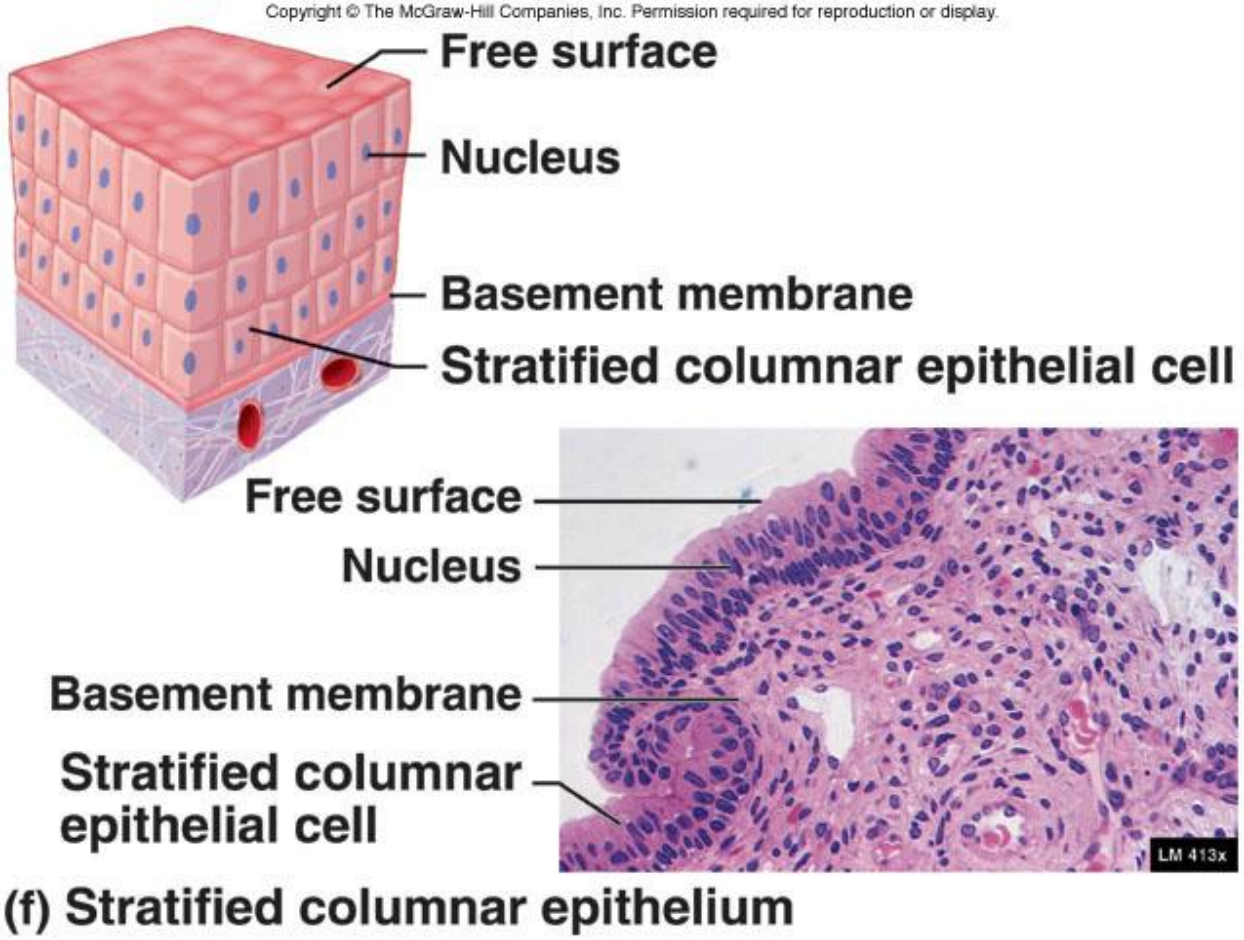
i. Cell shape varies according to layer
ii. Name is based on shape of apical surface

b. Stratified cuboidal



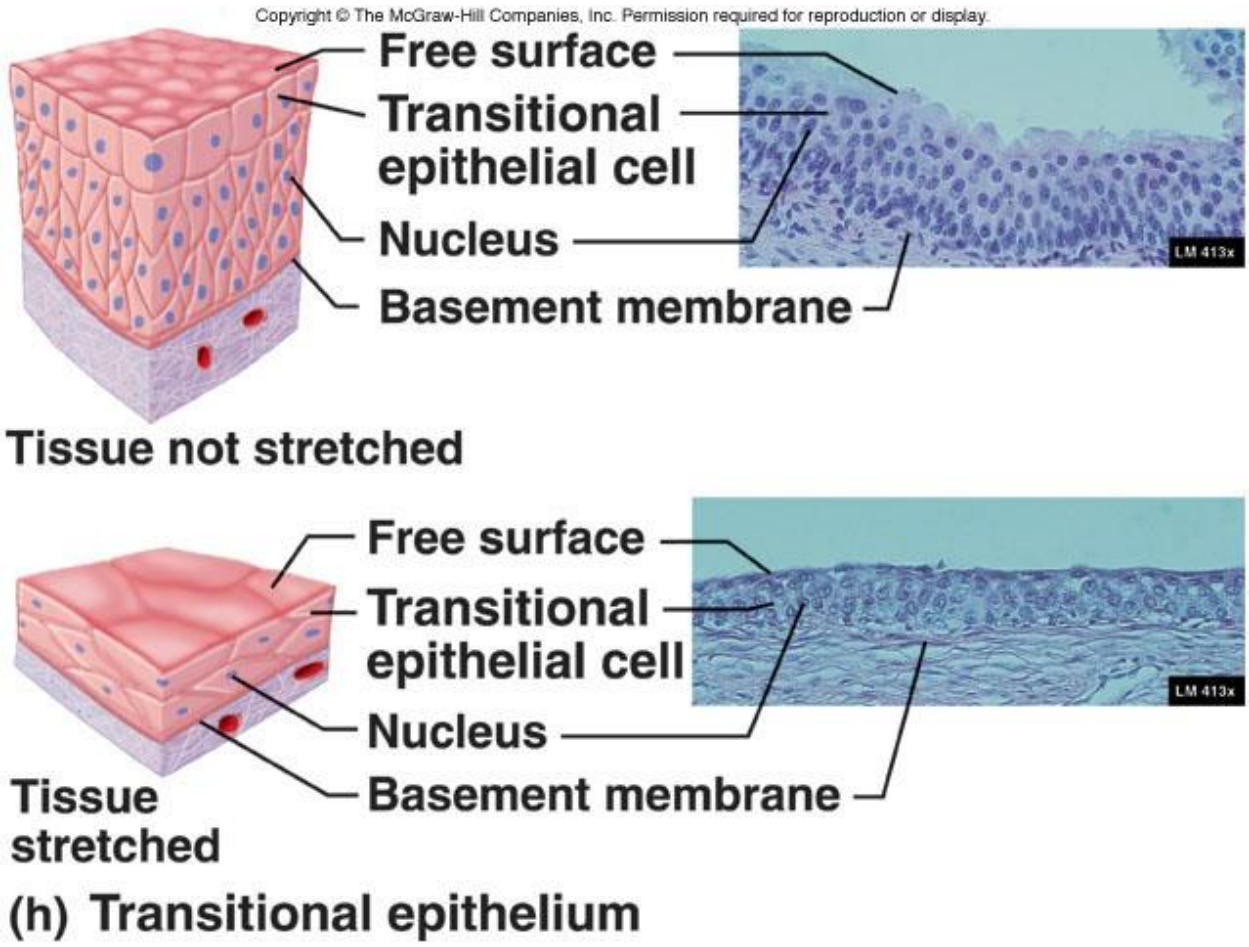
(e) Stratified cuboidal epithelium

c. Stratified columnar



(f) Stratified columnar epithelium

d. Transitional epithelia



Nonglandular Epithelia

I. Simple

A. Simple squamous

1. Function
    a. Diffusion and filtration
2. Location
    a. Endothelium
        i. Lining of lymphatic system
        ii. Lining of all organs in cardiovascular system
    b. Mesothelium
        i. Serous membrane linings of ventral body cavity

B. Simple cuboidal

1. Function
    a. Secretion and absorption

C. Simple columnar

1. Function
    a. Absorption and secretion
2. Location
    a. Digestive tract
3. Modifications

a. Dense microvilli on apical surface
b. Goblet cells that secrete protective lubricant

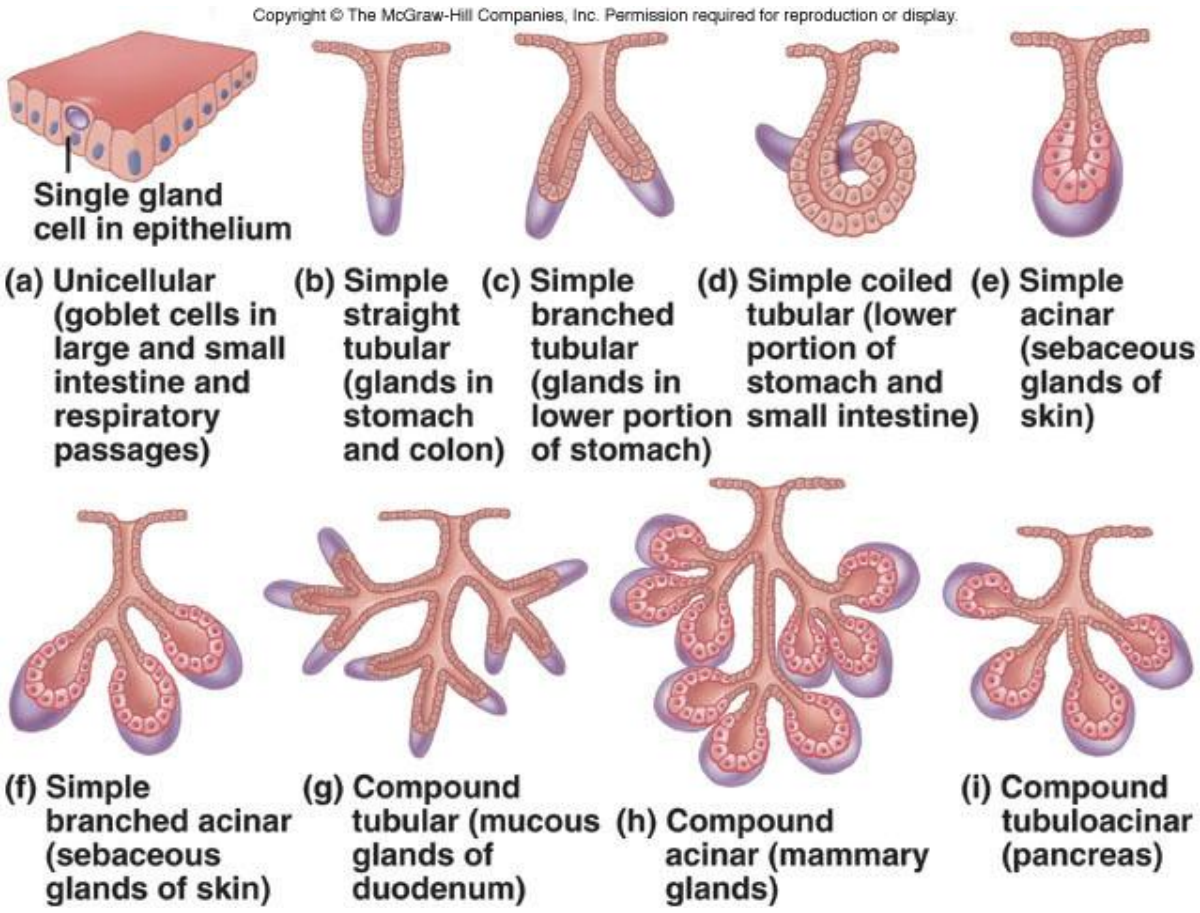
D. Pseudostratified columnar
1. Single layer of cells that vary in height
2. Only tallest reach apical surface
3. Nuclei are located at different heights
4. Function
a. Absorption and secretion
5. Modifications
a. Ciliated with mucous cells
i. Mucous traps particulate matter
ii. Cilia propel trapped matter out

II. Stratified epithelia
A. Characteristics
1. Two or more cell layers
2. Regenerate from below via mitotic division
a. Basal cell divide
b. Move apically to replace older surface cells
3. Durable
4. Protection
B. Stratified squamous
1. Surface cells are squamous
2. Deep layers consist most often of cuboidal
3. Location
a. Areas of abrasion
b. Forms external surface of the body
i. Extends into all body openings
ii. Outer layer (epidermis) is keratinized
4. Surface cells are flattened and atrophied
C. Stratified cuboidal and columnar are rare
D. Transitional
1. Location
a. Lining of urinary organs
i. Need to stretch (undergo a transition)
2. Cell organization
a. Basal surface—cuboidal or columnar
b. Apical surface
i. Unstretched—rounded and dome-like
ii. Stretched—flattened; squamous-like
c. Cell layers
i. Unstretched—six layers
ii. Stretched—three layers

Glandular Epithelia
A. Terms:

1. Gland: consist of one or more cells that make and secrete a particular product
2. Secretion: refers to both the aqueous product of glandular cells and the process of making that product
    a. Formation involves active processes
        i. Made in ER, packaged in Golgi (secretory vesicles), secreted by exocytosis

B. Classification



1. Route of secretion
    a. Exocrine
        i. Secrete via ducts
        Secrete onto body surface or cavities
    b. Endocrine (Discussed later)
        i. Ductless
        ii. Secrete directly into extracellular space
2. Cell number
    a. Unicellular
    b. Multicellular

C. Multicellular exocrine glands

1. Common elements
    a. Duct derived from epithelium
    b. Secretory unit consisting of secretory cells
    c. Supportive connective tissue

i. Supplies blood and nervous fibers

d. Fibrous capsule

i. May penetrate gland and divide it into lobes

2. Classification based on duct structures

a. Simple

i. Single unbranched duct

b. Compound

i. Branched duct

3. Classification based on secretory parts

a. Tubular

i. Secretory cells form a tube

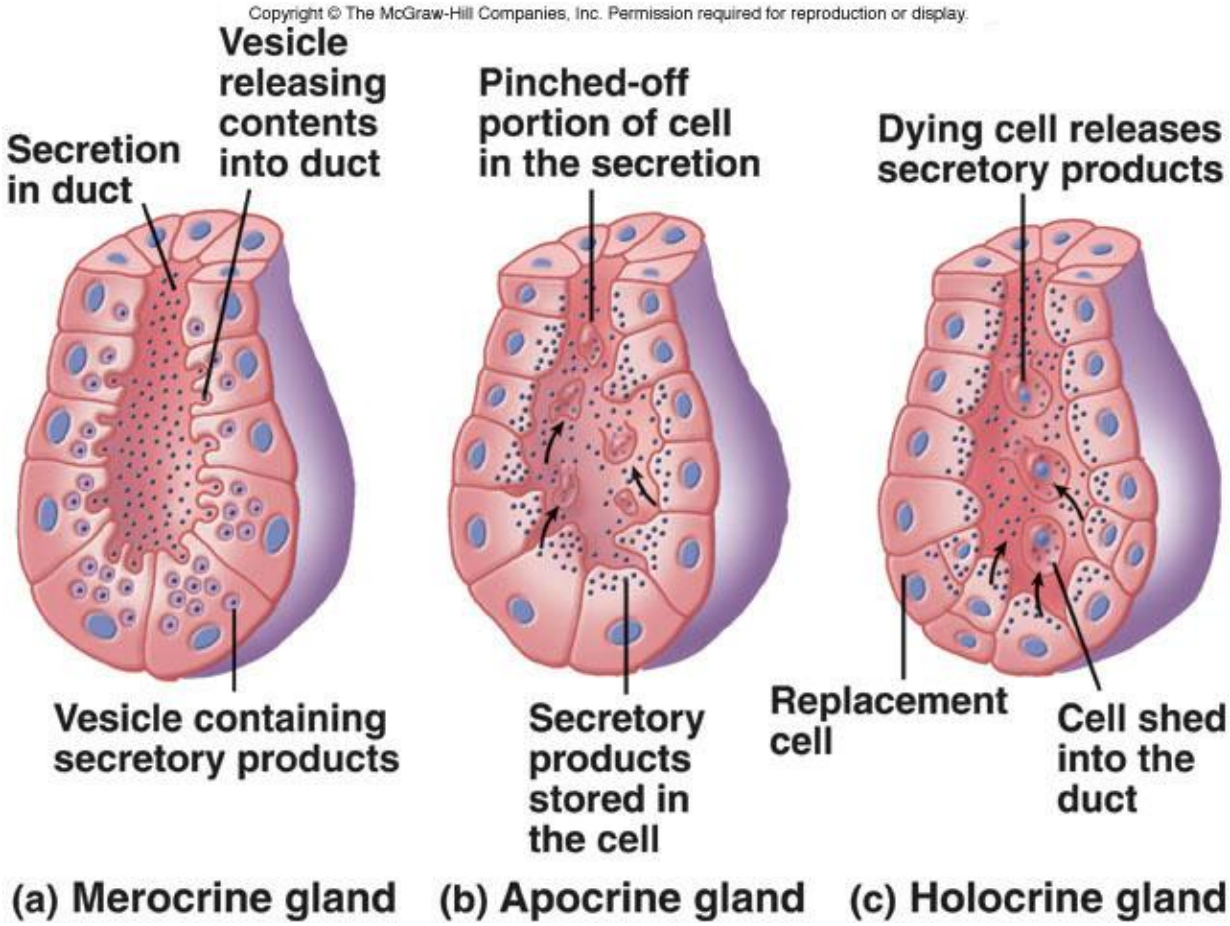
b. Alveolar

i. Secretory cells form a flask-like sac

c. Tubuloalveolar

i. Contain both

4. Classification based on how product is secreted



a. Merocrine glands

i. Secrete via exocytosis without altering secretory cell

b. Holocrine glands

i. Accumulate products until cell bursts, releasing secretory products, then dies

c. Apocine glands
    i. Accumulate products just beneath free surface
    ii. Top of cell is removed and products are released
    iii. Cell is repaired

D. Unicellular exocrine glands

1. Single cells scattered in epithelial sheet
2. Ductless
3. Goblet cells
    a. Produce mucin
    b. Protects and lubricates surfaces