

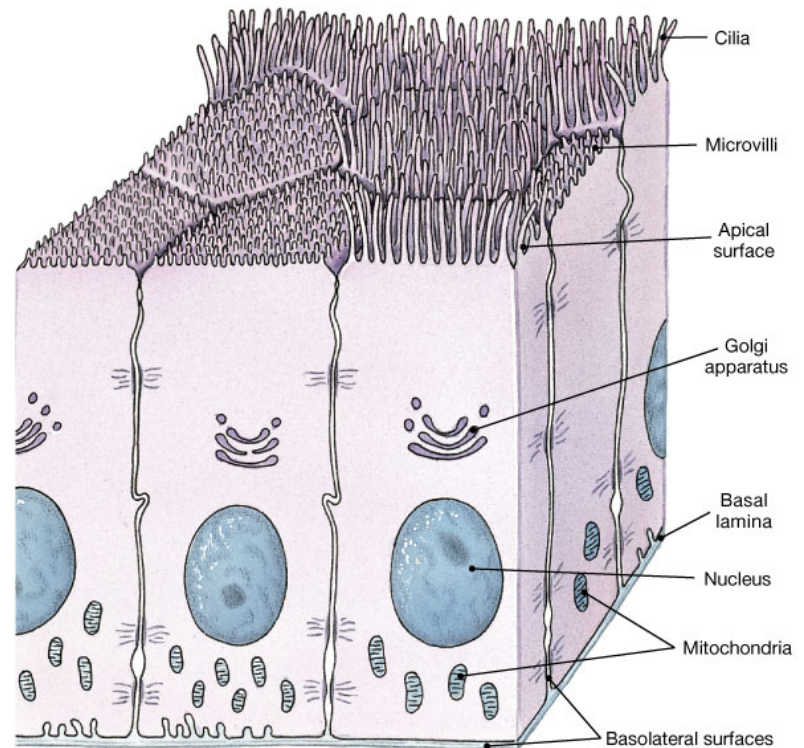
**BI204**

**CHAP 4**

**TISSUES OF THE BODY**

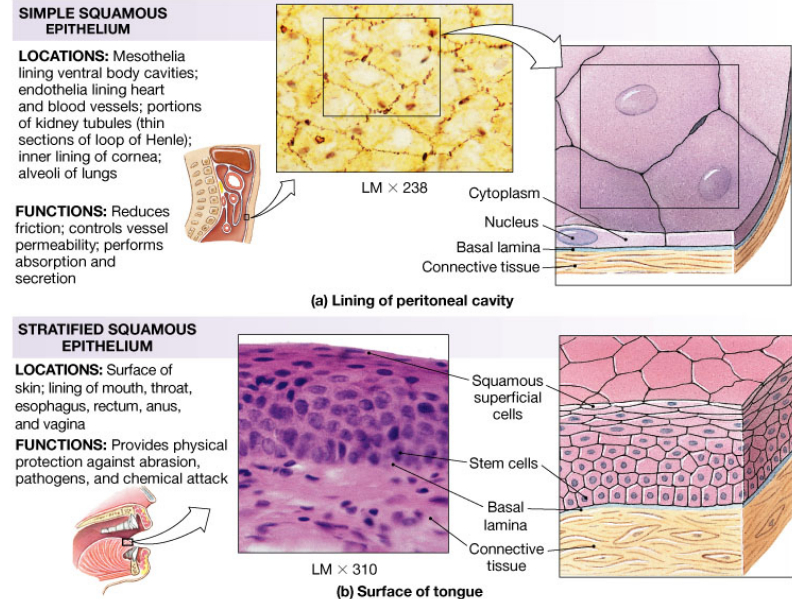
# Tissues - Introduction

- Tissue – group of similar cells having common embryonic origin and functions together to carry out specialized activities
- Histology – study of tissues



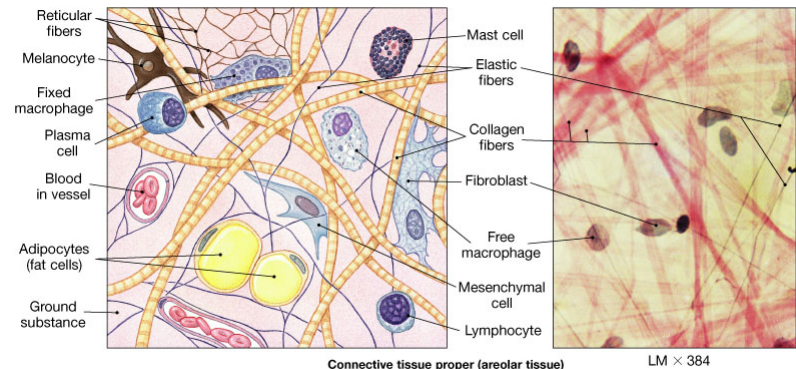
# Tissues – Types

- 4 basic tissue types in the body
- Epithelial tissue – covers and lines body surfaces and body cavities and forms glands
- Muscle tissue - movement



# Tissues – Types cont.

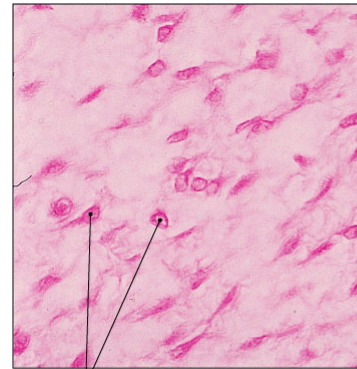
- Connective tissue – protects and supports the body and its organs, binds organs together, stores energy as fat, helps provide immunity to disease
- Nervous tissue – detects changes in the external and internal environment and responds



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# Embryonic Origin of Tissues

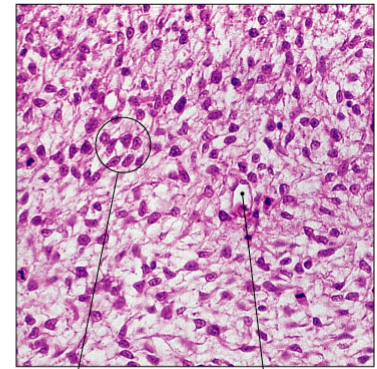
- 3 primary germ layers in the embryo are ectoderm, mesoderm, endoderm
- Epithelium comes from all 3 layers, all connective and most muscle comes from mesoderm and nervous tissue comes from ectoderm



Mesenchymal cells

**(a) Mesenchyme** (LM  $\times$  136)

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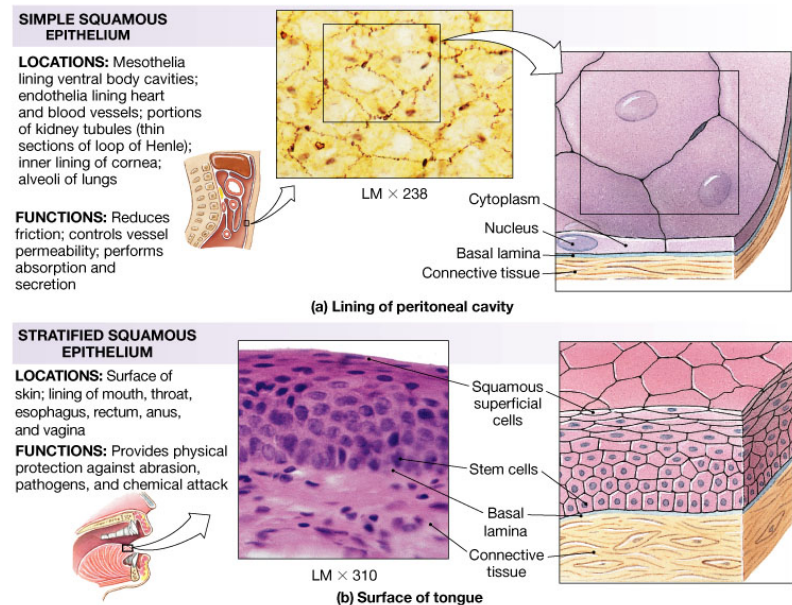
Mesenchymal cells

Blood vessel

**(b) Mucous connective tissue** (LM  $\times$  136)

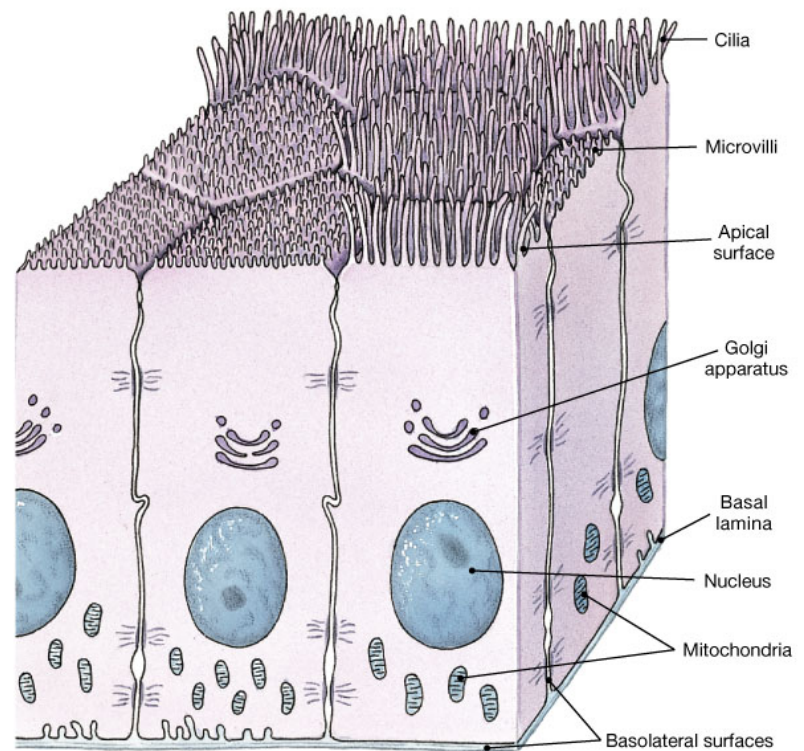
# Epithelium - Characteristics

- Epithelium – layers of cells that cover internal or external surfaces
- Glands – structures attached to or derived from epithelium that produce fluid secretions



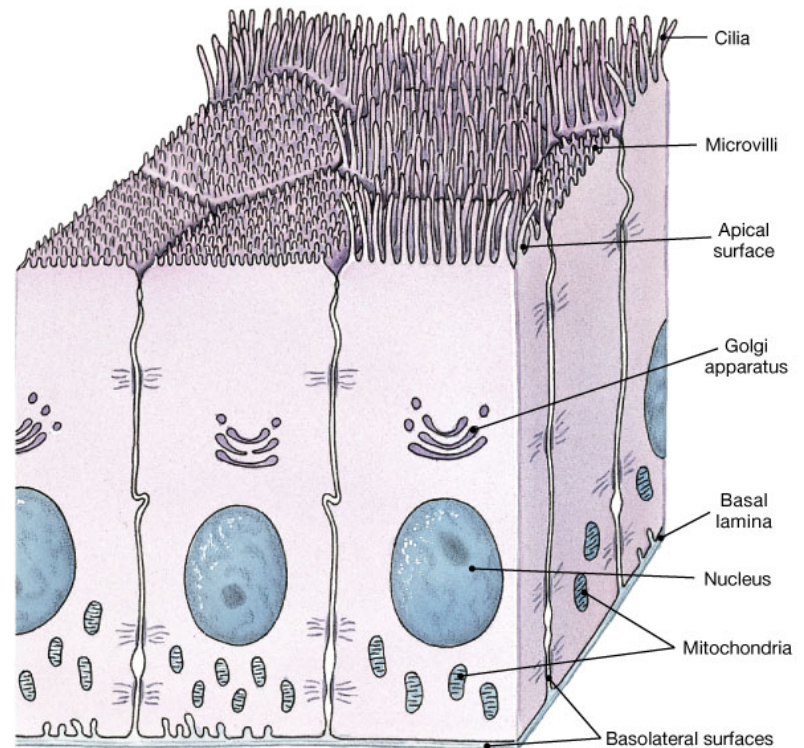
# Epithelium – Characteristics cont.

- Cellularity – composed of tightly packed cells connected by cell junctions with little space between cells
- Polarity – epithelium has surface exposed to external or internal surface and basal surface attached to adjacent tissues



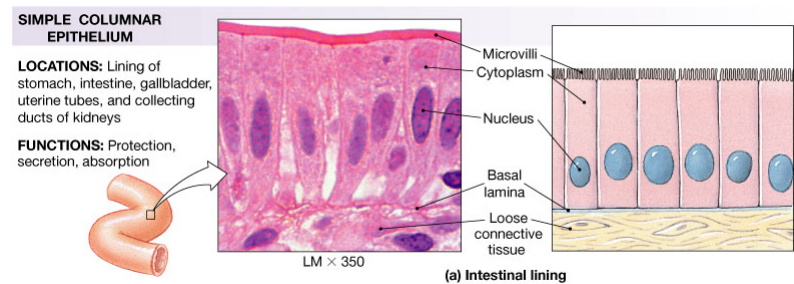
# Epithelium – Characteristics cont.

- Polarity cont. – apical or exposed surface and basal or attached surface called basal lamina differ in membrane structure and function
- Cytoplasmic organelles distributed differentially along the 2 surfaces



# Epithelium – Characteristics cont.

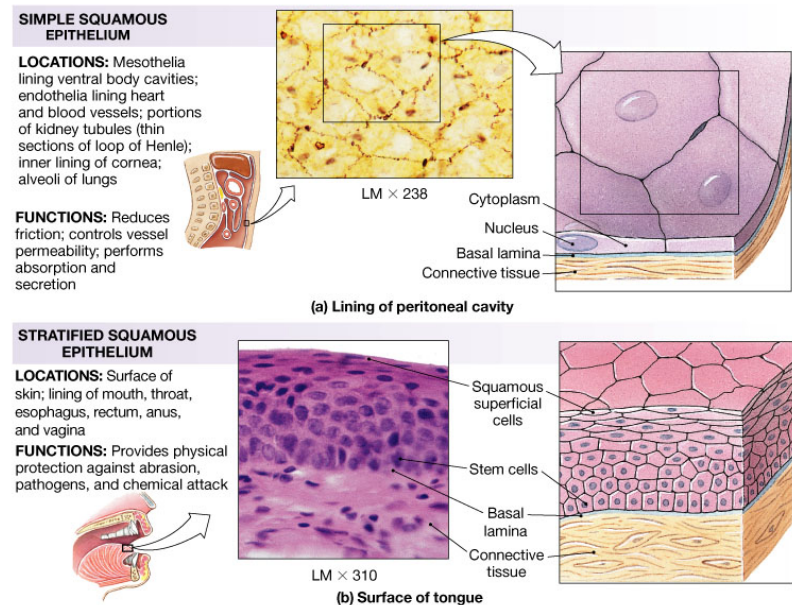
- Attachment – base of epithelium is bound to thin basal lamina or basement membrane
- Basal lamina is complex structure forms by basal surface of epithelium and underlying connective tissue



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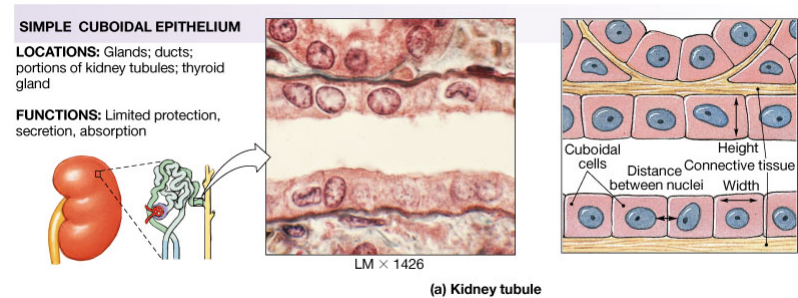
# Epithelium – Characteristics cont.

- Avascularity – no blood vessels so cell nutrients obtained by diffusion or absorption from the exposed or attached surfaces
- Regeneration – rates of cell division and replacement typically much higher in epithelia than in other tissues



# Epithelium – Functions

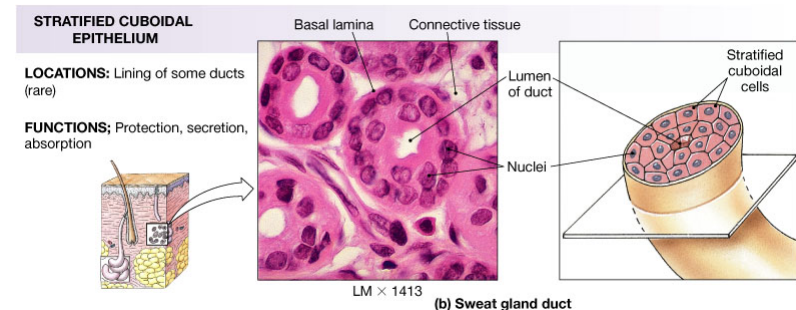
- Provide physical protection – abrasion, dehydration, destruction by chemical and biological agents
- Control Permeability – epithelium act as barriers for entry of chemicals and different epithelia are impermeable to selectively permeable and can be modified in response to stimuli



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# Epithelium – Functions cont.

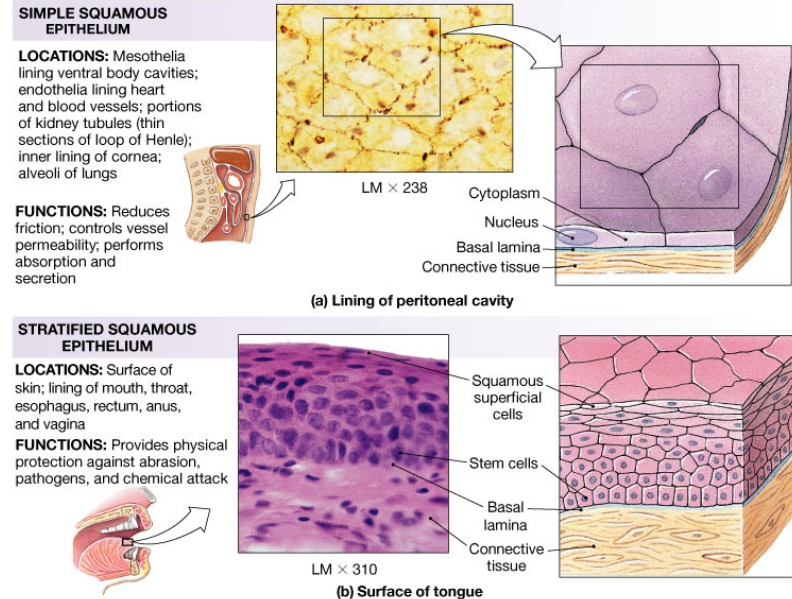
- Provide sensation – most epithelium are extremely sensitive to stimulation due to large sensory nerve supply present
- Produce specialized secretions – gland cells scattered among other epithelial cells and discharge onto a surface or into interstitial fluid



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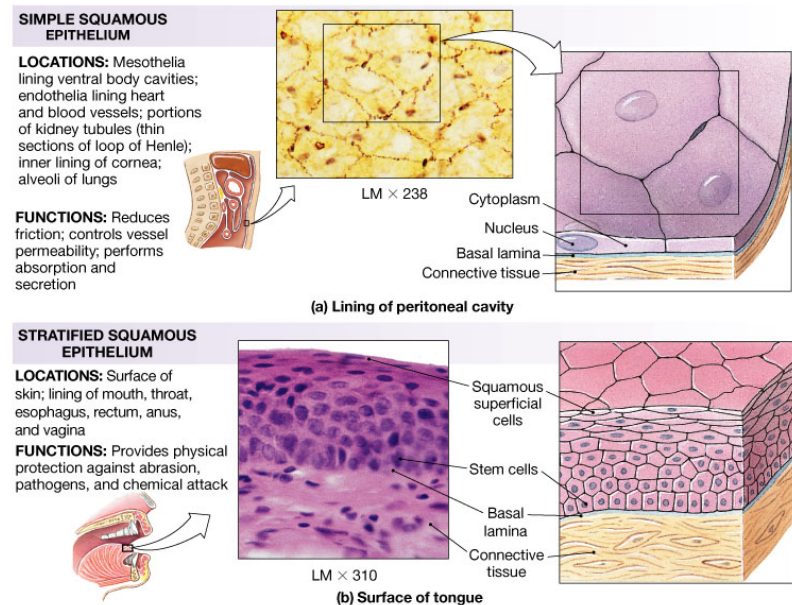
# Epithelium – Covering and Lining Type

- Skin, outer covering of some internal organs, inner lining of blood vessels, ducts and body cavities and interior of some body cavities



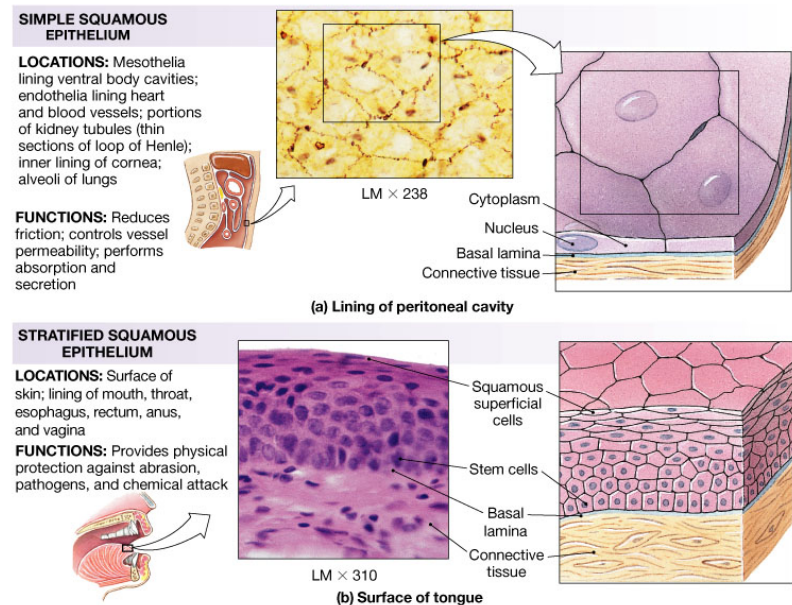
# Epithelium – Covering and Lining cont.

- Classification based on 2 criteria – 1<sup>st</sup> - number of cell layers – 1 layer = simple and >1 layer = stratified & 2<sup>nd</sup> - cell shape – squamous – flattened and scale like – then cuboidal – like cubes & columnar - longer than wider and transitional where shape changes



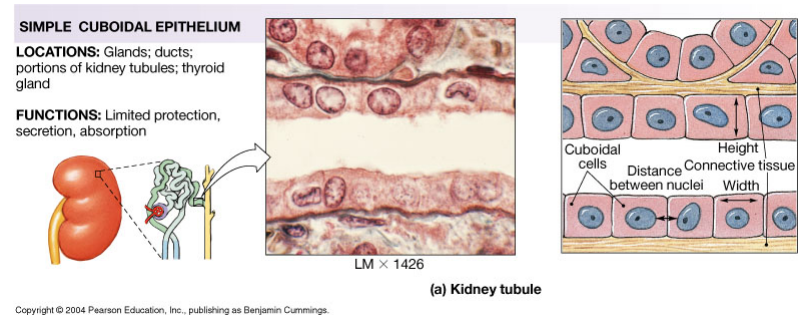
# Epithelium – Covering and Lining cont.

- Simple squamous – single layer of flat cells function in filtration, diffusion, osmosis and secretion in serous membranes
- Found lining blood vessels, heart, lymphatic vessels, air sacs of lung, kidney glomerulus, epithelial layer of serous membranes



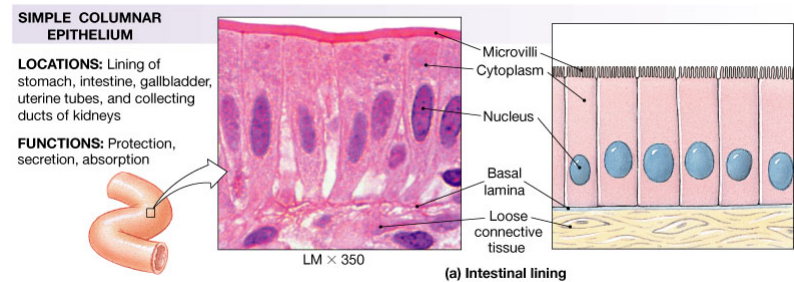
# Epithelium – Covering and Lining cont.

- Simple cuboidal – cube like – wide as long – function in secretion and absorption
- Found on surface of ovary, kidney tubules, thyroid gland, small ducts of many glands



# Epithelium – Covering and Lining cont.

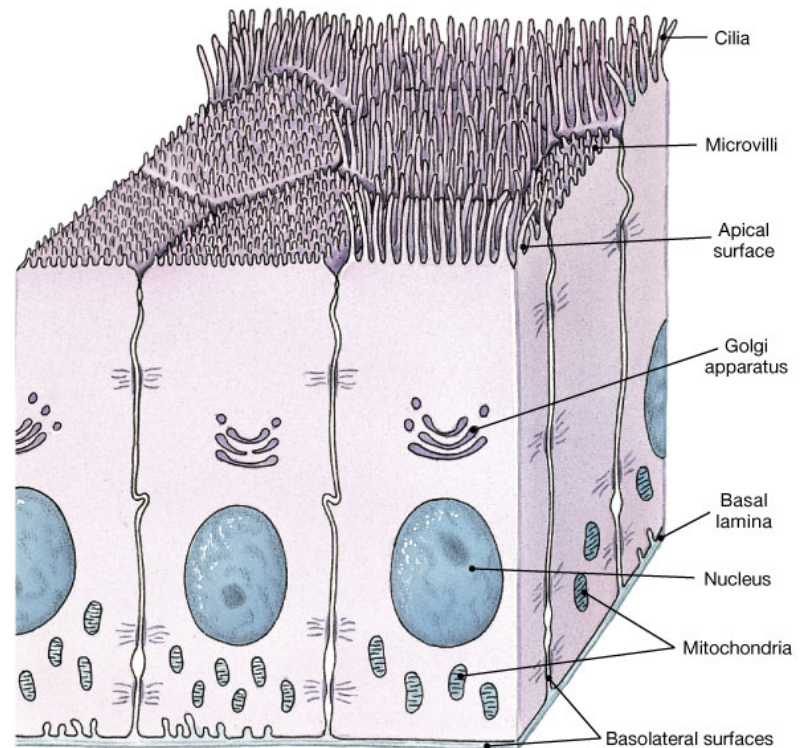
- Simple nonciliated columnar – single layer of rectangular cells – function in secretion and absorption
- Found lining the GI tract, ducts of many glands, gallbladder



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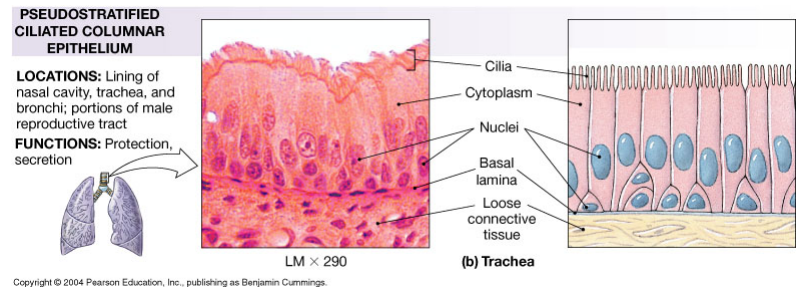
# Epithelium – Covering and Lining cont.

- Simple ciliated columnar – single layer of ciliated rectangular cells that function to move mucus & other substances by ciliary action
- Found in part of upper respiratory tract and uterine tubes and uterus and central canal of spinal cord



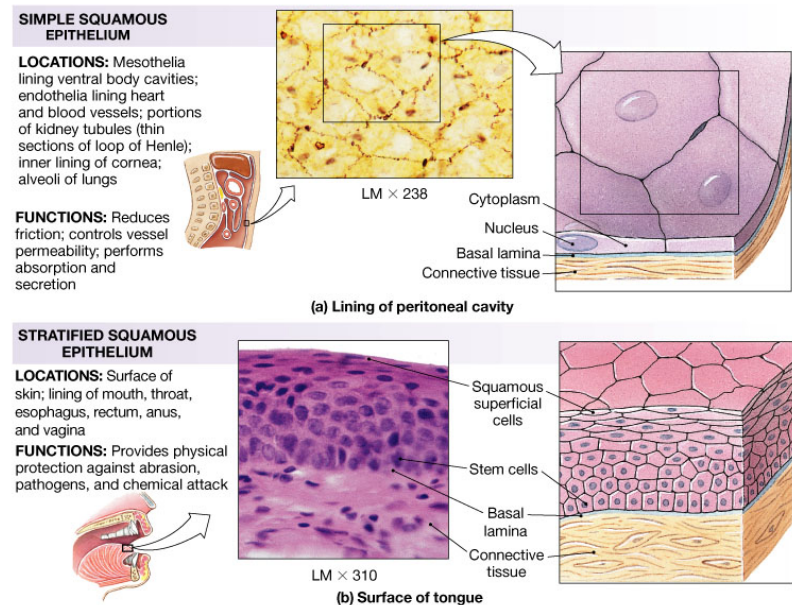
# Epithelium – Covering and Lining cont.

- Pseudostratified ciliated columnar – all cells attached to basement membrane but not all cells reach the surface so appearance is of many layers as nuclei are at different levels



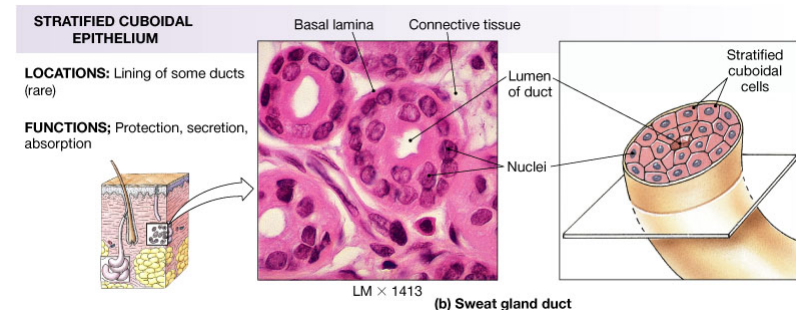
# Epithelium – Covering and Lining cont.

- Stratified squamous – several layers of cells, cuboidal to columnar deep and squamous or flat superficially that function in protection
- Found in superficial layers of skin, lining the mouth, esophagus, vagina, part of epiglottis, covering the tongue



# Epithelium – Covering and Lining cont.

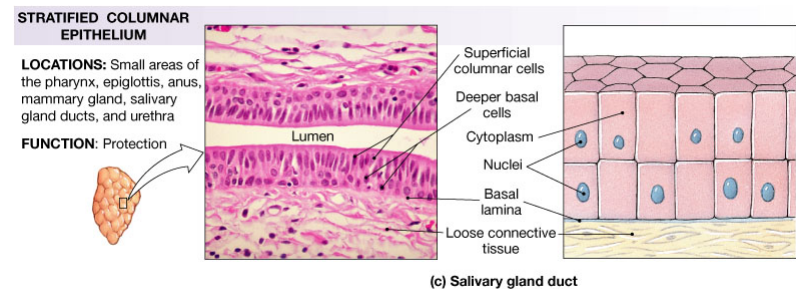
- Stratified cuboidal – 2 or more cell layers where surface cells are cube like and function is protection and limited secretion and absorption
- Found only in ducts of adult sweat glands and part of male urethra



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# Epithelium – Covering and Lining cont.

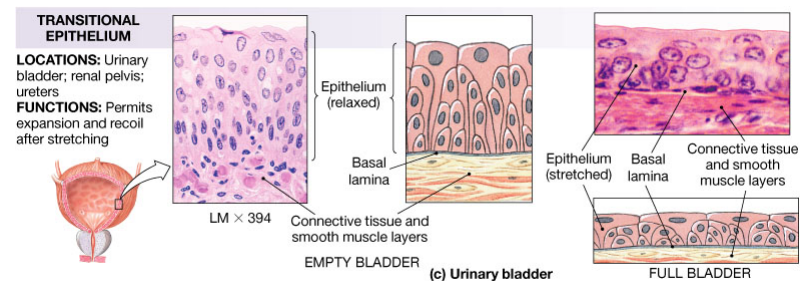
- Stratified columnar – several layers of polyhedral cells columnar only in the apical layer functioning in protection and secretion
- Found in part of urethra, large excretory ducts of glands, part of conjunctiva of eye



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# Epithelium – Covering and Lining cont.

- Transitional – several layers of cells where shape is variable – squamous when stretched and cuboidal when relaxed so function – permits distention
- Found – urinary bladder and parts of ureter and urethra



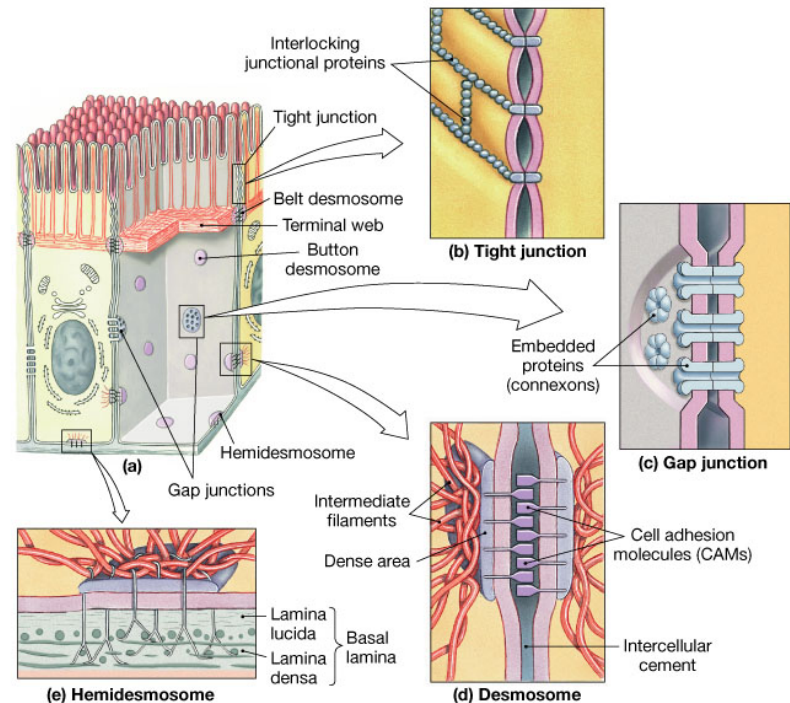
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# Epithelium – Intercellular Connections

- Epithelial cells firmly attached to each other by junctions
- Large areas of opposing cell membranes interconnected by cell adhesion molecules called CAMs
- Adjacent cell membranes bonded by intercellular cement – thin layer of proteoglycans containing glycosaminoglycans such as hyaluronic acid

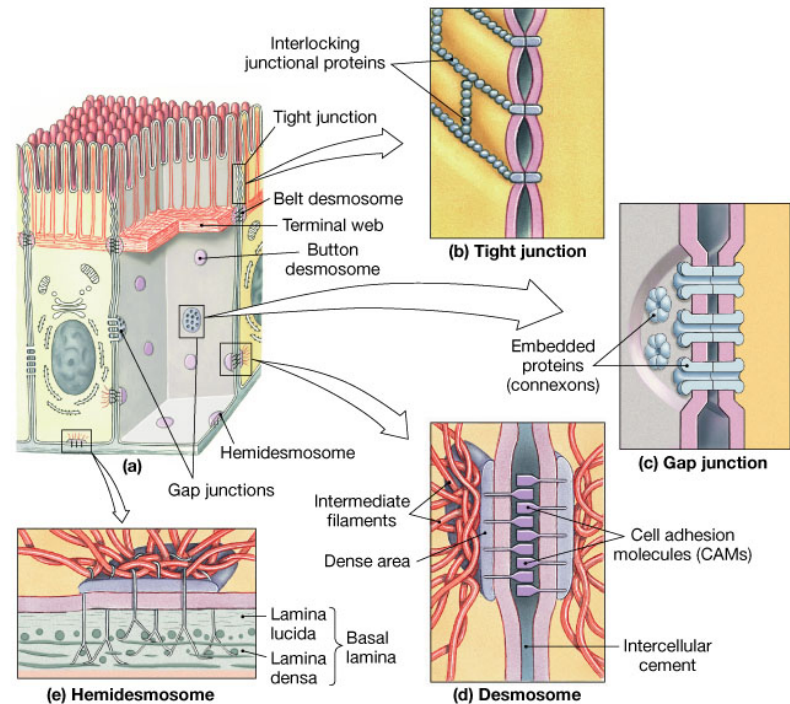
# Epithelium – Intercellular Connections cont.

- Cell junctions – specialized areas of cell membrane that attach 1 cell to other cells
- 3 main types – tight and gap junctions and desmosomes



# Epithelium – Intercellular Connections cont.

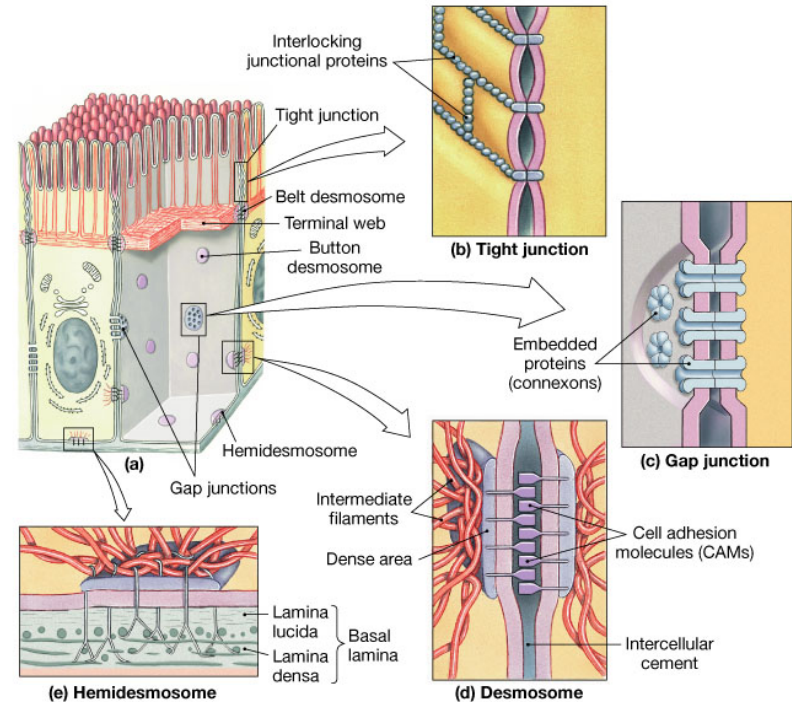
- Tight junctions – connect the cells of tissues that line the surface of organs and body cavities very tightly so water and other solutes cannot pass between cells due to the lipid portions of the cell membranes being locked together by membrane proteins



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# Epithelium – Intercellular Connections cont.

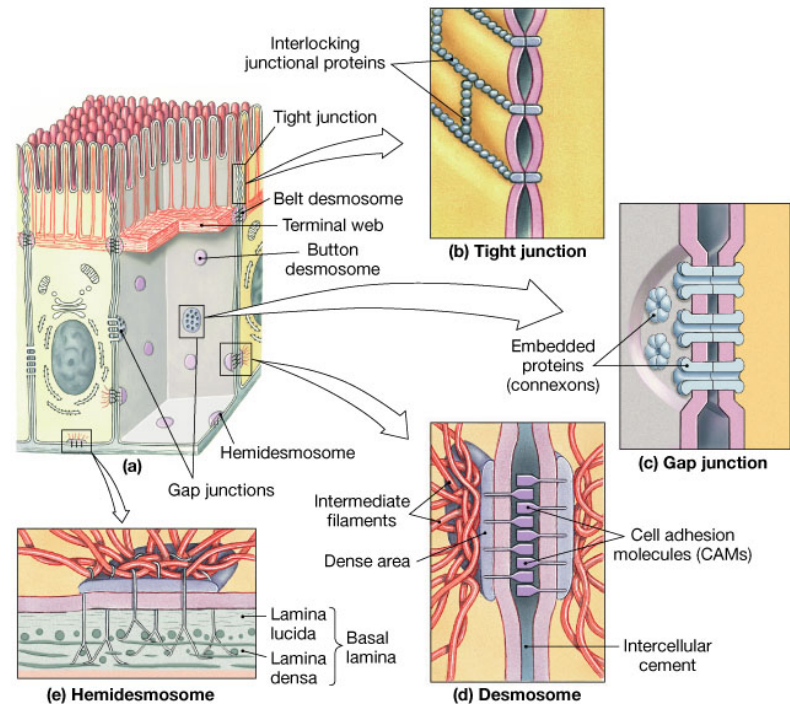
- Gap junctions – outer layers of adjacent cells converge but leave tiny intercellular gaps which is bridged by a connexon, a transmembrane channel allowing passage of small ions and molecules



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# Epithelium – Intercellular Connections cont.

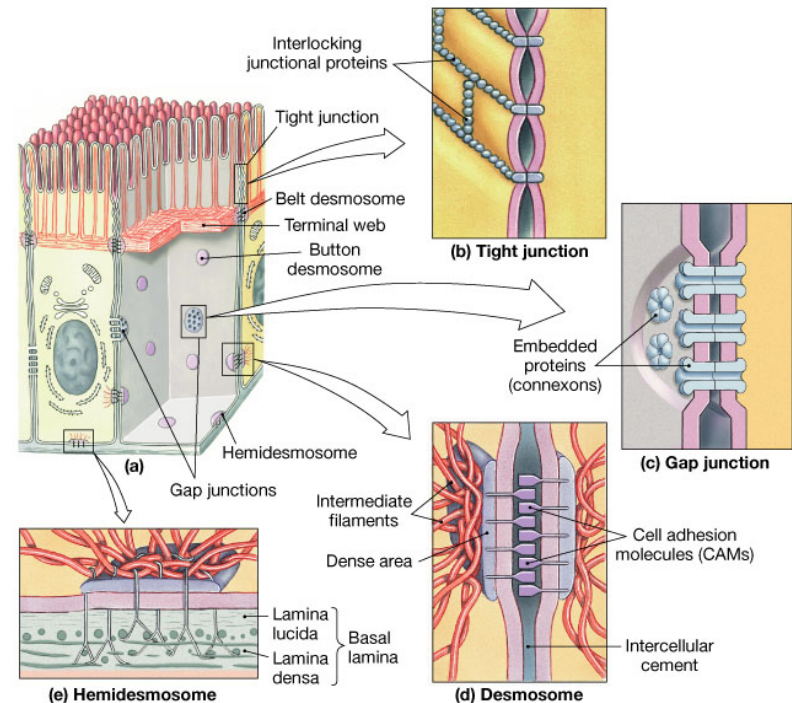
- Desmosomes – used where epithelial cells subject to mechanical stress
- CAMs and proteoglycans link opposing cell membranes and in each cell is a dense area which is connected to the cytoskeleton thus giving strength



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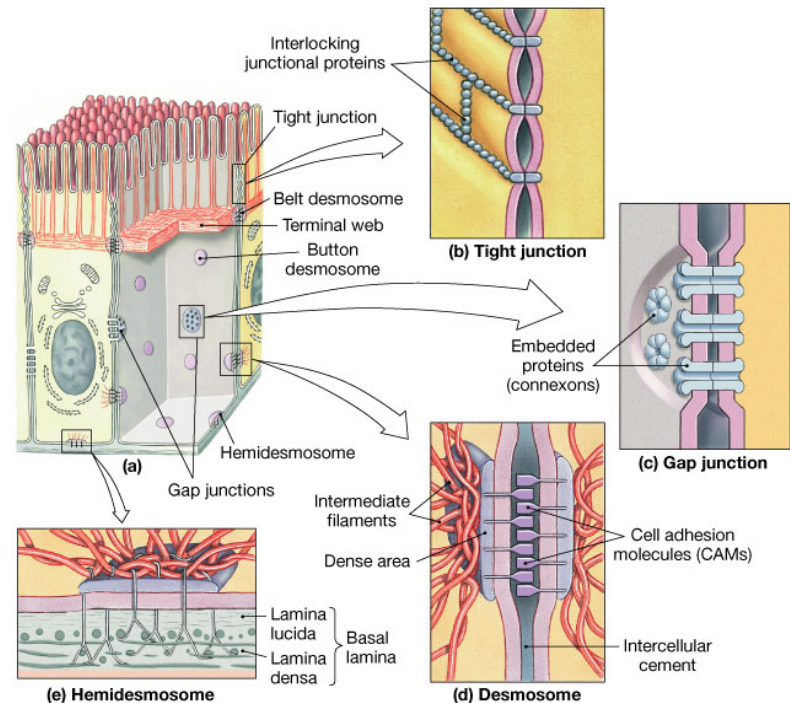
# Epithelium – Intercellular Connections cont.

- Types of desmosomes – belt – form continuous bands that encircle cells and the bands are attached to the terminal web
- Button – small discs connected to bands of intermediate filaments which act as cross-bridges to stabilize the cells



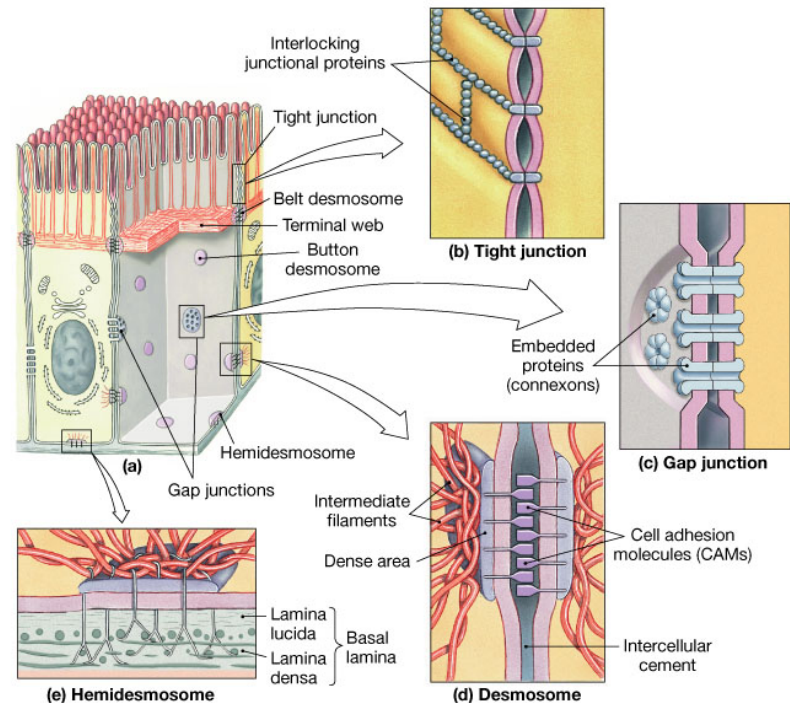
# Epithelium – Intercellular Connections cont.

- Hemidesmosomes – attach cells to extracellular filaments in basal lamina which anchors epithelium to underlying tissues



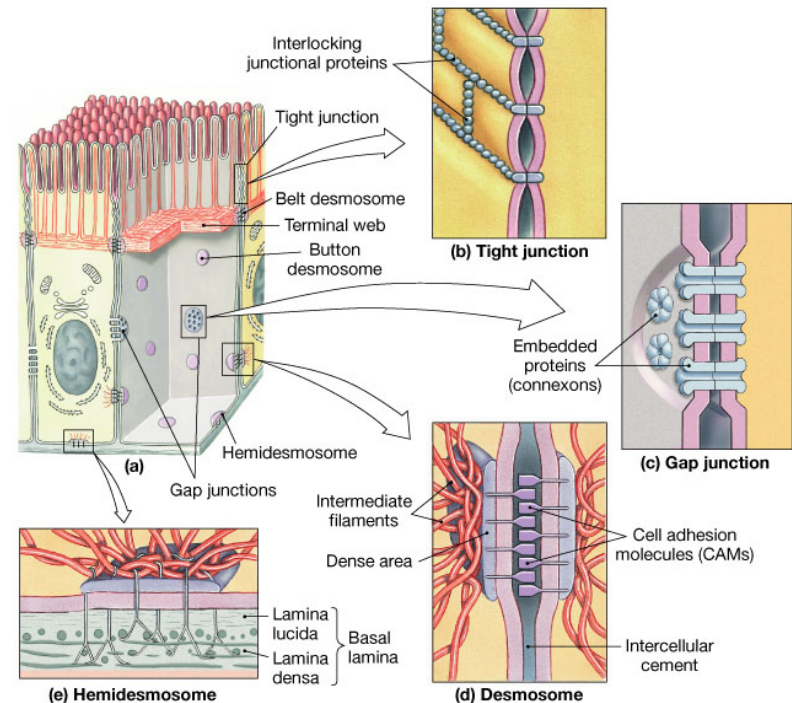
# Epithelium – Attachment to Basal Lamina

- Basal surface of epithelium attached to 2 part basal lamina – close to and secreted by epithelium is lamina lucida containing glycoproteins and network of fine protein filaments and acting to restrict movement of large molecules from underlying CT



# Epithelium – Attachment to Basal Lamina cont.

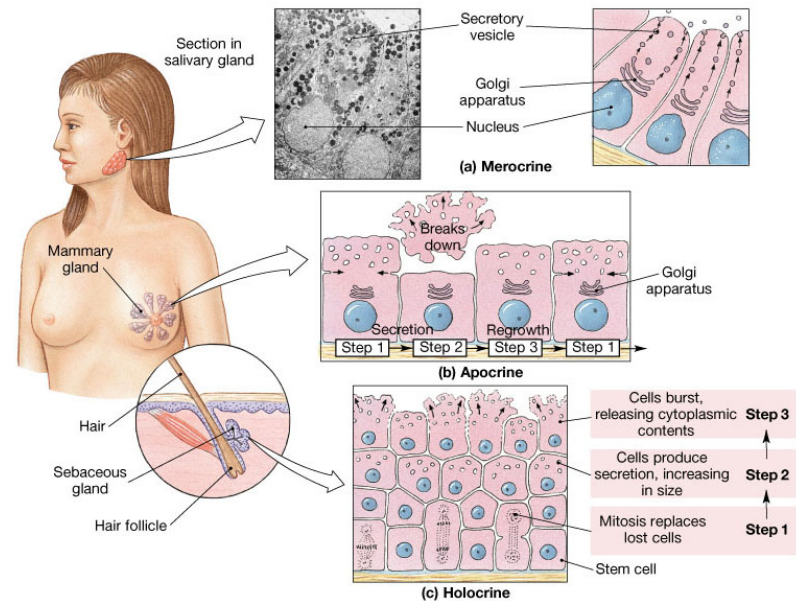
- Deeper layer of basal lamina is called lamina densa and contains bundles of coarse protein fibers produced by the connective tissue cells which attach to fibers of the reticular lamina and give it strength and act as a filter determining which substances can diffuse in



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# Epithelium - Glandular

- Function – secretion done by epithelial cells in clusters deep to the covering and lining epithelium
- Gland – 1 cell or group of highly specialized cells that secrete into ducts, onto a surface, or into blood

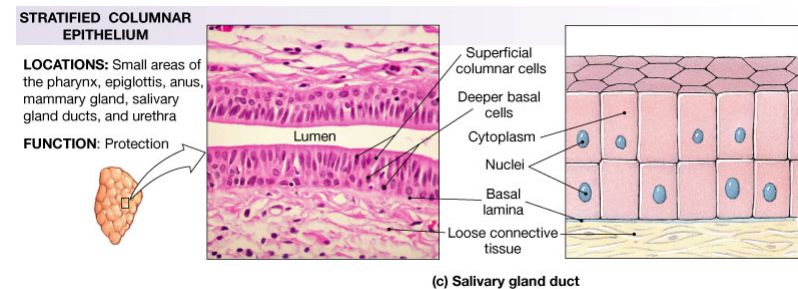


# Epithelium – Glandular cont.

- Classification –
  - endocrine – secretions enter extracellular fluid then the blood stream (do not enter a duct) – secretions called hormones regulate metabolic functions
  - Exocrine – secrete into a tube, or onto a surface – skin or hollow organ
- Structural classification of exocrine glands – unicellular or multicellular

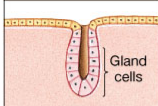
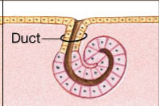
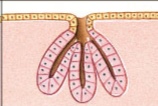
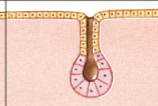
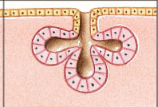
# Epithelium – Glandular cont.

- Unicellular – single cell – goblet cell – no duct but is a unicellular mucus secreting exocrine gland
- Multicellular – cells form distinct microscopic structure or macroscopic organ


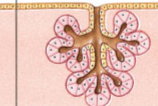



# Epithelium – Glandular cont.

- Structural classification of multicellular exocrine glands – use 2 criteria – shape of secretory portion and presence or absence of branches – simple – no branches – compound – duct branches

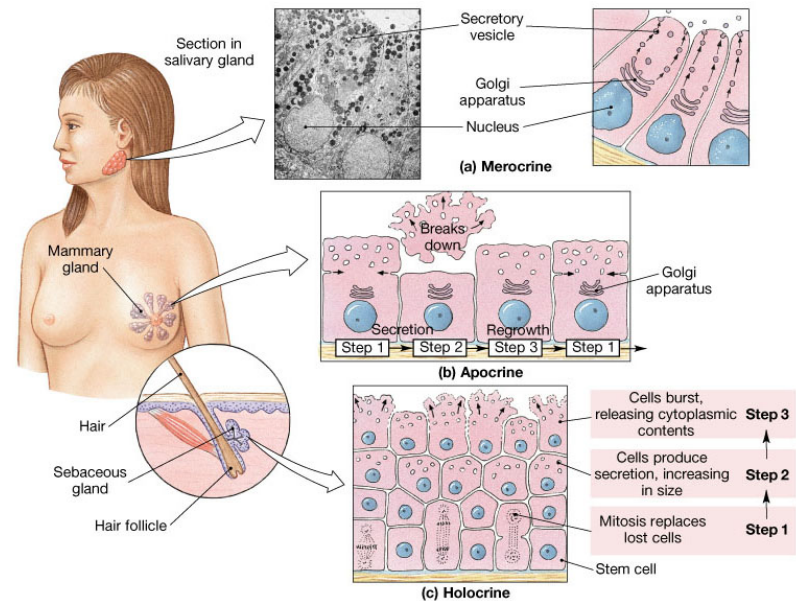
SIMPLE GLANDS				
				
<b>SIMPLE TUBULAR</b> <i>Examples:</i> Intestinal glands (crypts of Lieberkühn)	<b>SIMPLE COILED TUBULAR</b> <i>Examples:</i> Merocrine sweat glands	<b>SIMPLE BRANCHED TUBULAR</b> <i>Examples:</i> Gastric glands Mucous glands of esophagus, tongue, duodenum	<b>SIMPLE ALVEOLAR (ACINAR)</b> <i>Examples:</i> Not found in adult; a stage in development of simple branched glands	<b>SIMPLE BRANCHED ALVEOLAR</b> <i>Examples:</i> Sebaceous (oil) glands

COMPOUND GLANDS		
		
<b>COMPOUND TUBULAR</b> <i>Examples:</i> Mucous glands (in mouth) Bulbourethral glands (in male reproductive system) Testes (seminiferous tubules)	<b>COMPOUND ALVEOLAR (ACINAR)</b> <i>Examples:</i> Mammary glands	<b>COMPOUND TUBULOALVEOLAR</b> <i>Examples:</i> Salivary glands Glands of respiratory passages Pancreas

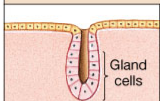
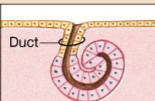
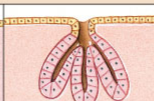
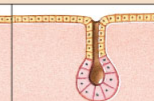
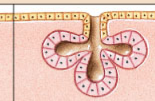
# Epithelium – Glandular cont.

- Structural classification of multicellular exocrine glands – 2<sup>nd</sup> criterion used – shape of secretory portion – tubular – tube like – or acinar – flask like

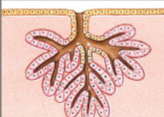
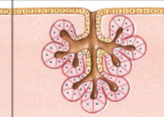
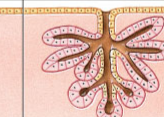


# Epithelium Glandular cont.

- Classification combines the 2 giving – simple tubular, simple branched tubular simple acinar, compound tubular or acinar and compound tubuloacinar

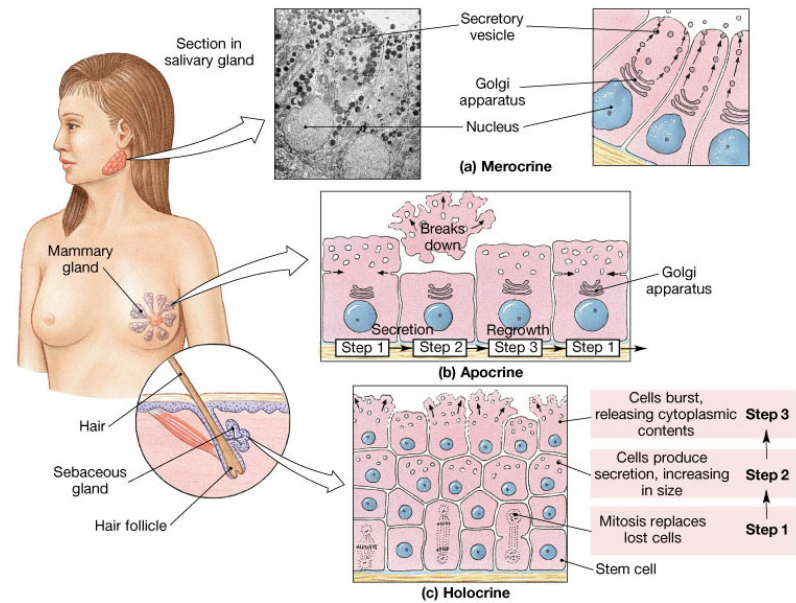
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# Epithelium – Glandular cont.

- Functional classification of multicellular exocrine glands – based on mode of secretion - merocrine – product released from secretory vesicles by exocytosis



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# Epithelium – Glandular cont.

- Merocrine is most common
- Apocrine – involves loss of cytoplasm and secretory product
- Holocrine – cell gets packed with secretory product and bursts killing the cell which is renewed by division of stem cells

