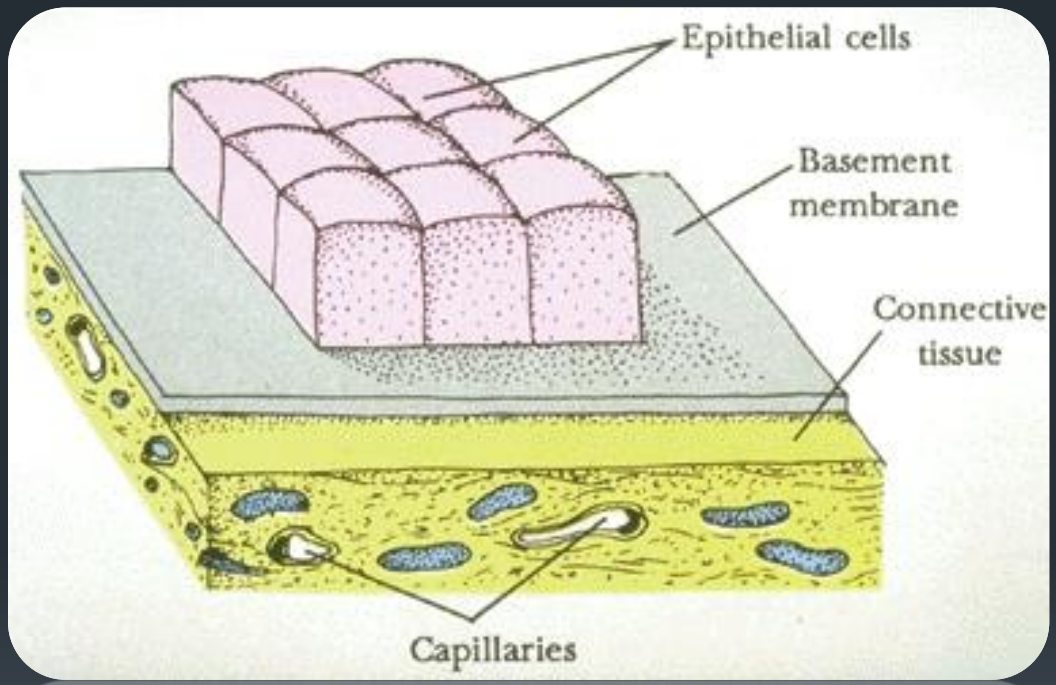
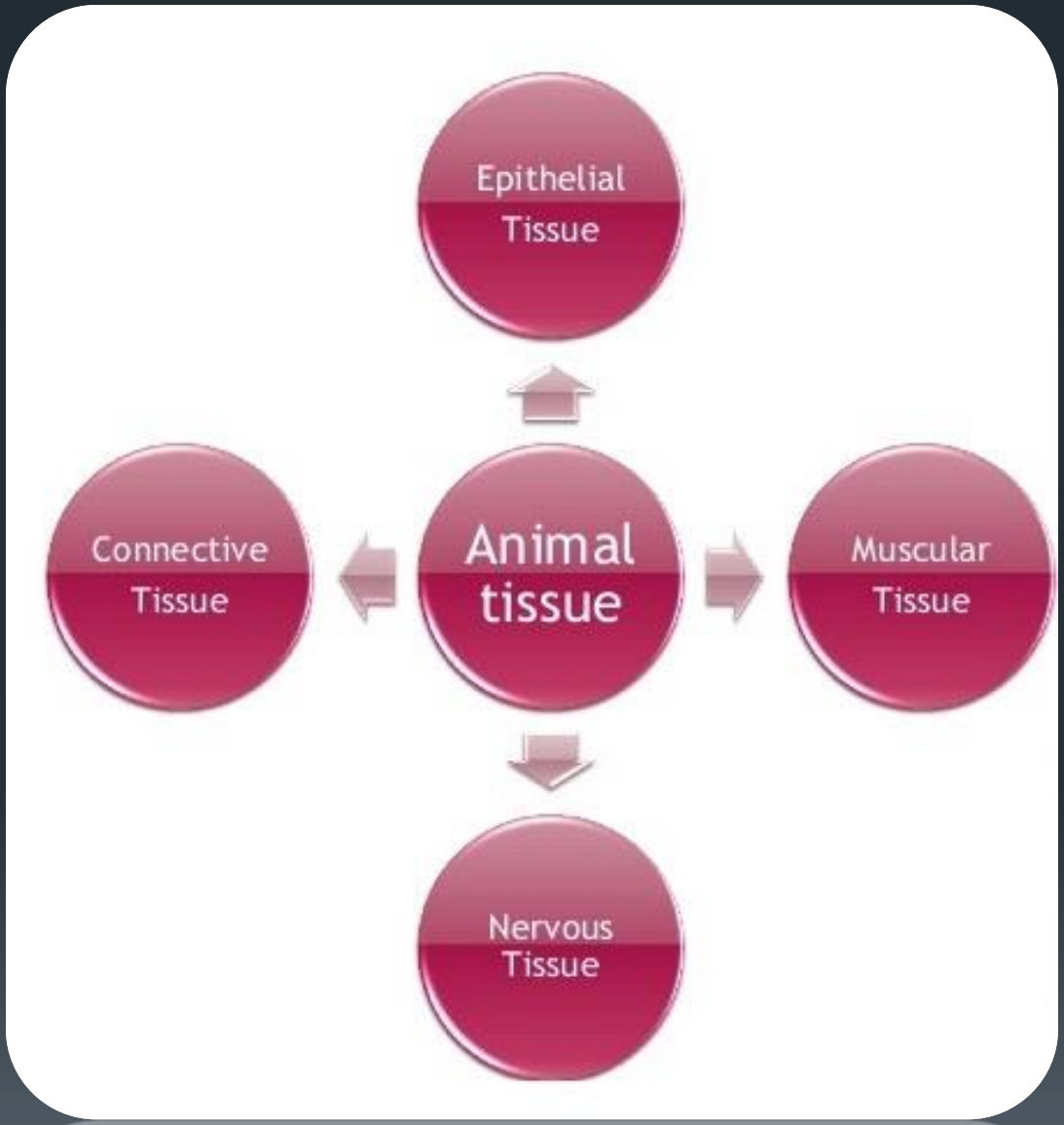
Epithelial tissue




Epithelial Tissue
Connective Tissue
Animal tissue
Muscular Tissue
Nervous Tissue

What are epithelia?

A. simple definition - "a layer of cells with a free surface"

B. better definition - single or multiple layers of cells characterized by,

1. a layer or layers composed of closely aggregated, polyhedral cells

2. one side of cell layer(s) has a free surface

3. little intercellular substance between cells

4. cells cohere (stick) strongly to each other

5. cells form a sheet that covers a surface

In embryonic terms we can say that epithelia are derived from all 3 major germ layers, i.e. ectoderm, mesoderm, endoderm.

Functions of Epithelia

A. Covering and lining surfaces (a barrier) and Protection

Examples:

a. skin

b. epithelial cells (endothelium) lining blood vessels,

c. mesothelium of peritoneal cavity (coelom)

Functions of epithelia

B. Regulation of materials and sensory information passing between, into, or out of organs/tissues

1. absorption (e.g. tall columnar epithelium of intestine)

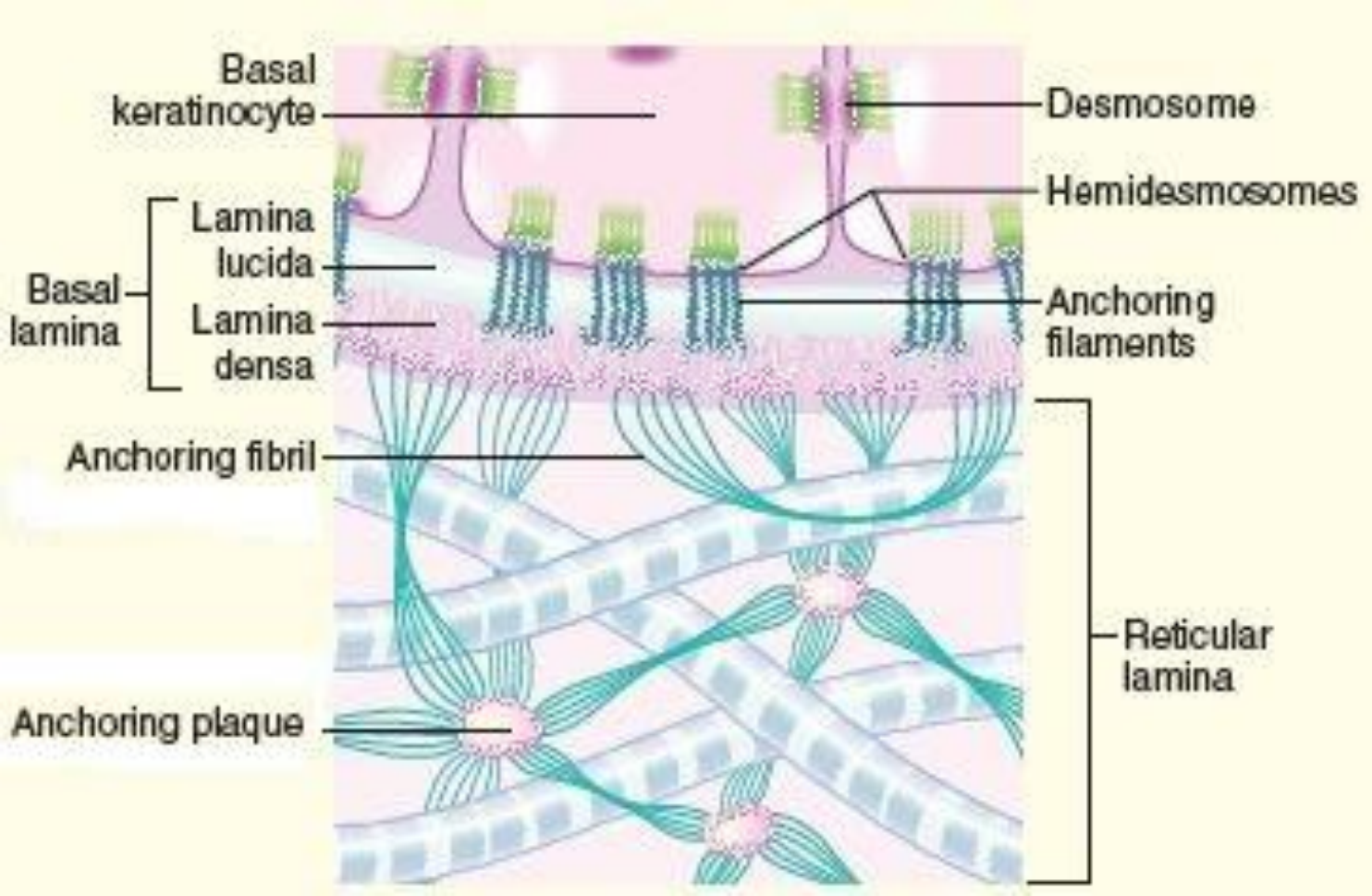
2. secretion (e.g. epithelial lining of glands)

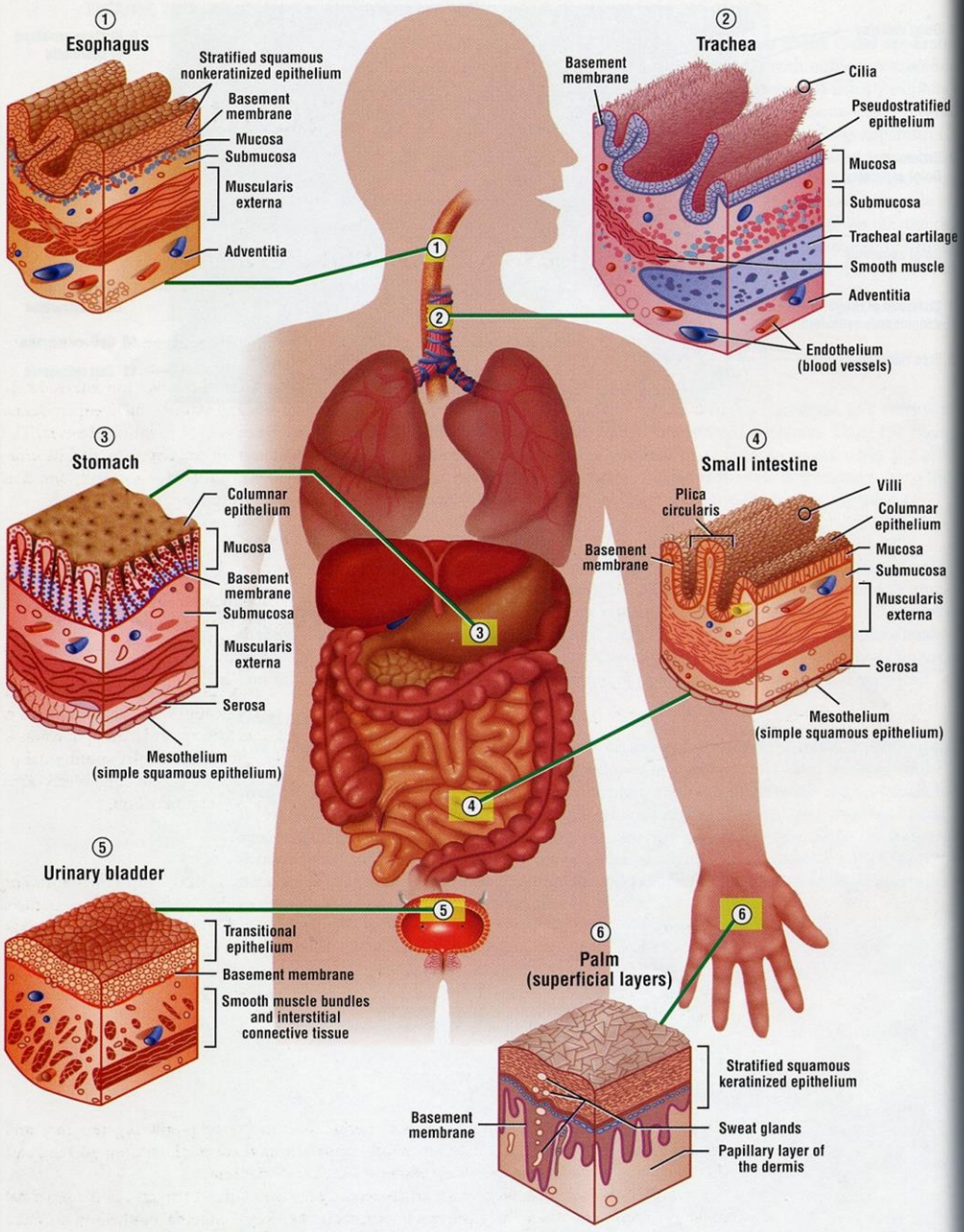
3. sensation (e.g. sensory cells, neuroepithelium - taste buds)

4. lubrication (e.g. mucus secreting epithelium of digestive tract)

C. In some cases contractility (e.g. myoepithelium - often associated with glands such as sweat and mammary glands)

Basement Membrane





OVERVIEW FIGURE ■ Different types of epithelia in selected organs.

Classification of Epithelia

Epithelia mainly classified into 2 sorts:

Covering epithelia : **Cells arranged like membrane**

Localization: covering the outer surface of the body and the inner surface of the cavities ,Sacs or ducts within the body.

Function: Protection.

Glandular epithelia : Function- Secretion

Covering epithelia

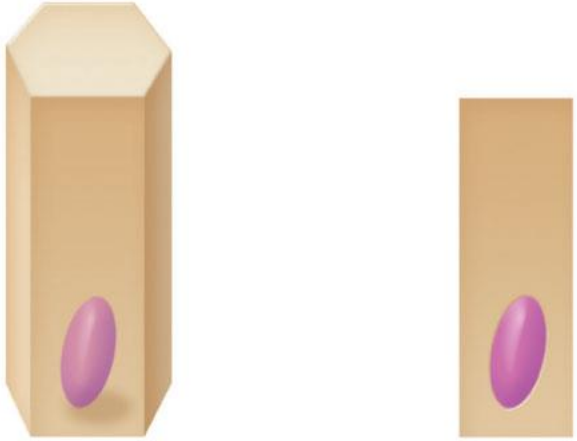
Principles of the classification:

Shape of the cells: Squamous epithelia
Cuboidal epithelia
Columnar epithelia

Layers of the cells: simple epithelia
stratified epithelia

Squamous

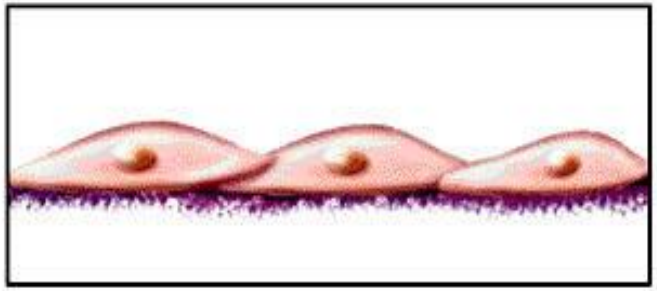
Cuboidal



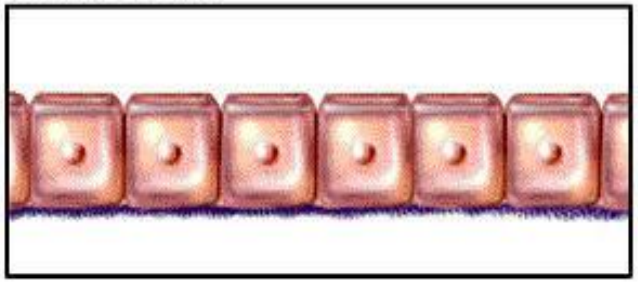
Columnar

Classification based on cell shape.

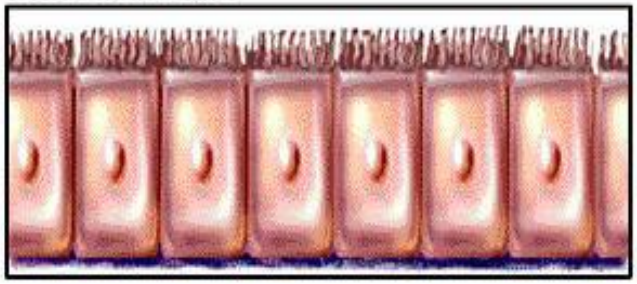
Squamous

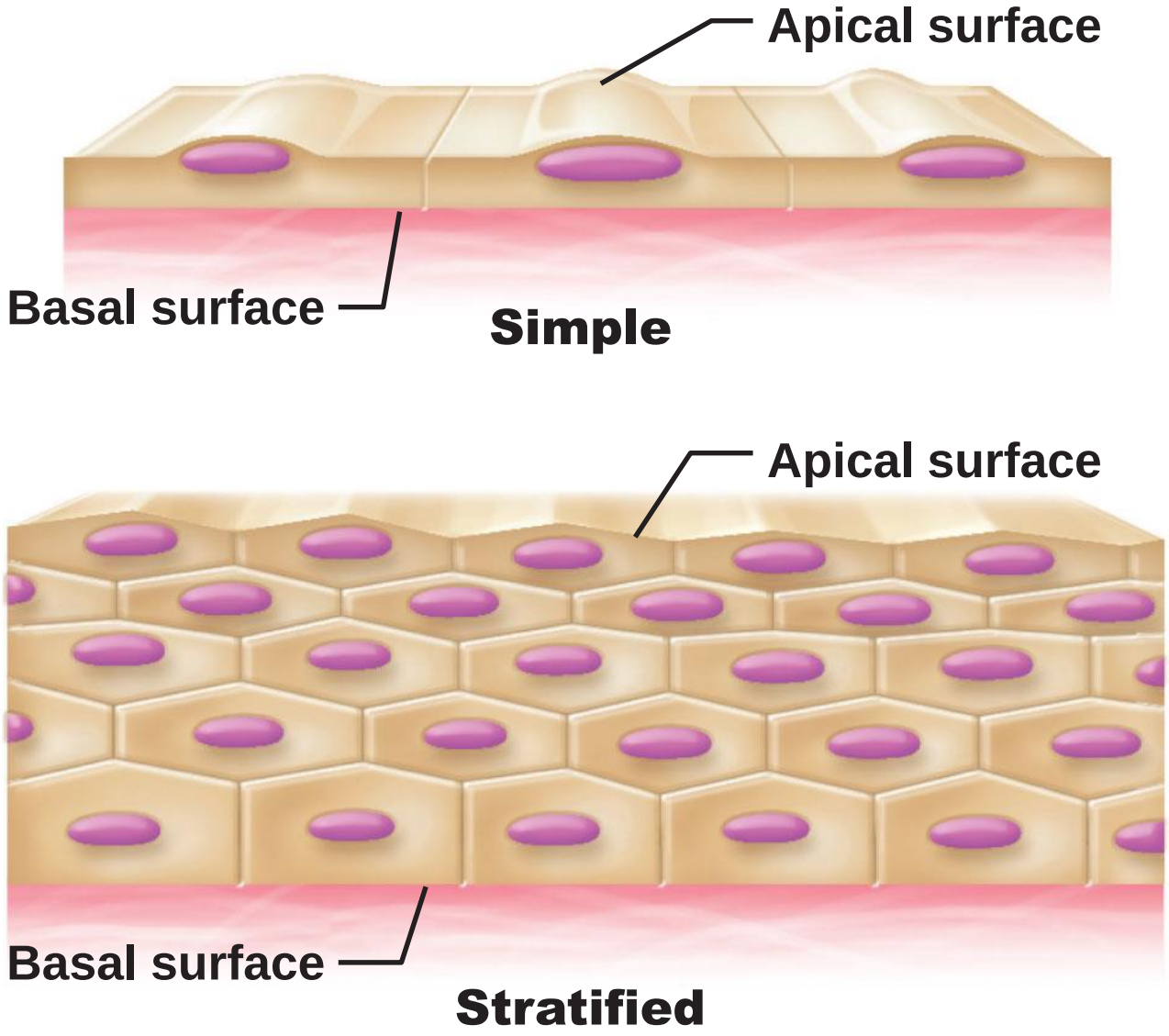


Cuboidal

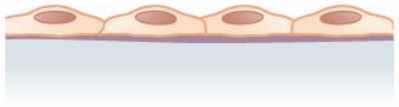
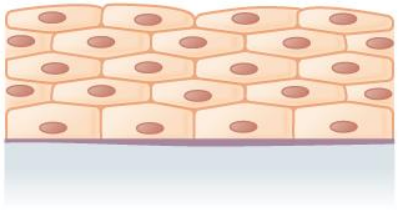
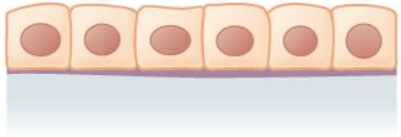
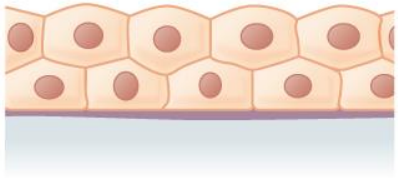
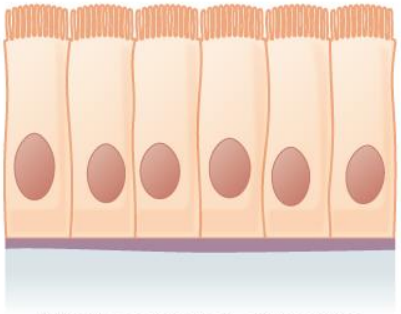
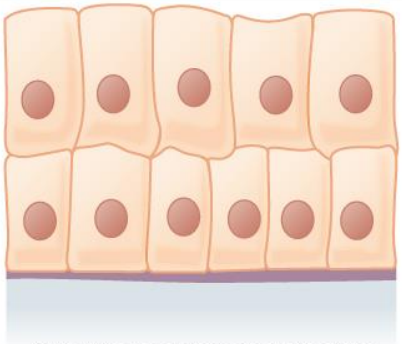
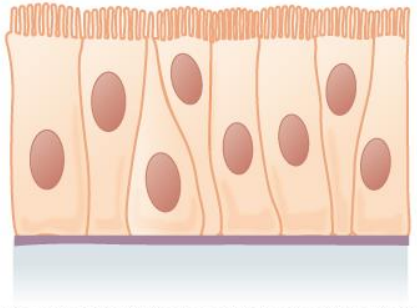


Columnar





Classification based on number of cell layers.

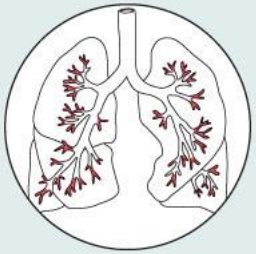
	Simple	Stratified	
Squamous	 Simple squamous epithelium	 Stratified squamous epithelium	
Cuboidal	 Simple cuboidal epithelium	 Stratified cuboidal epithelium	
Columnar	 Simple columnar epithelium	 Stratified columnar epithelium	**Pseudostratified**  Pseudostratified columnar epithelium

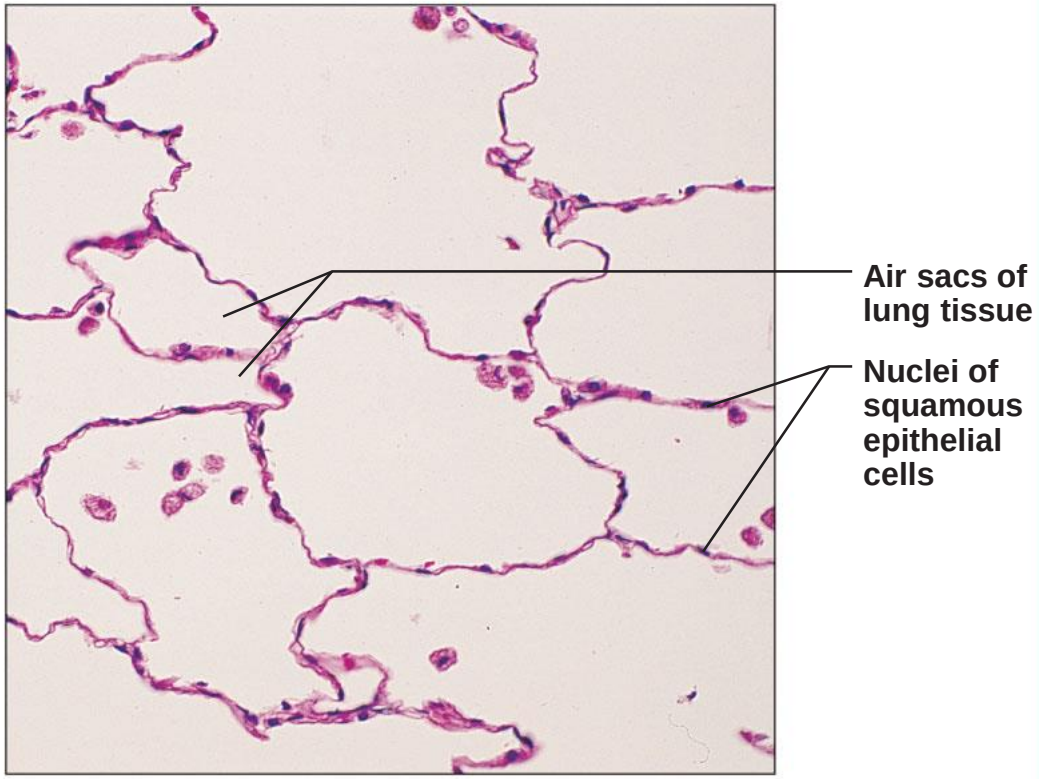
Simple squamous epithelium

Description: Single layer of flattened cells with disc-shaped central nuclei and sparse cytoplasm; the simplest of the epithelia.

Function: Allows passage of materials by diffusion and filtration in sites where protection is not important; secretes lubricating substances in serosae.

Location: Kidney glomeruli; air sacs of lungs; lining of heart, blood vessels, and lymphatic vessels; lining of ventral body cavity (serosae).





Photomicrograph: Simple squamous epithelium forming part of the alveolar (air sac) walls (125x).

Localization

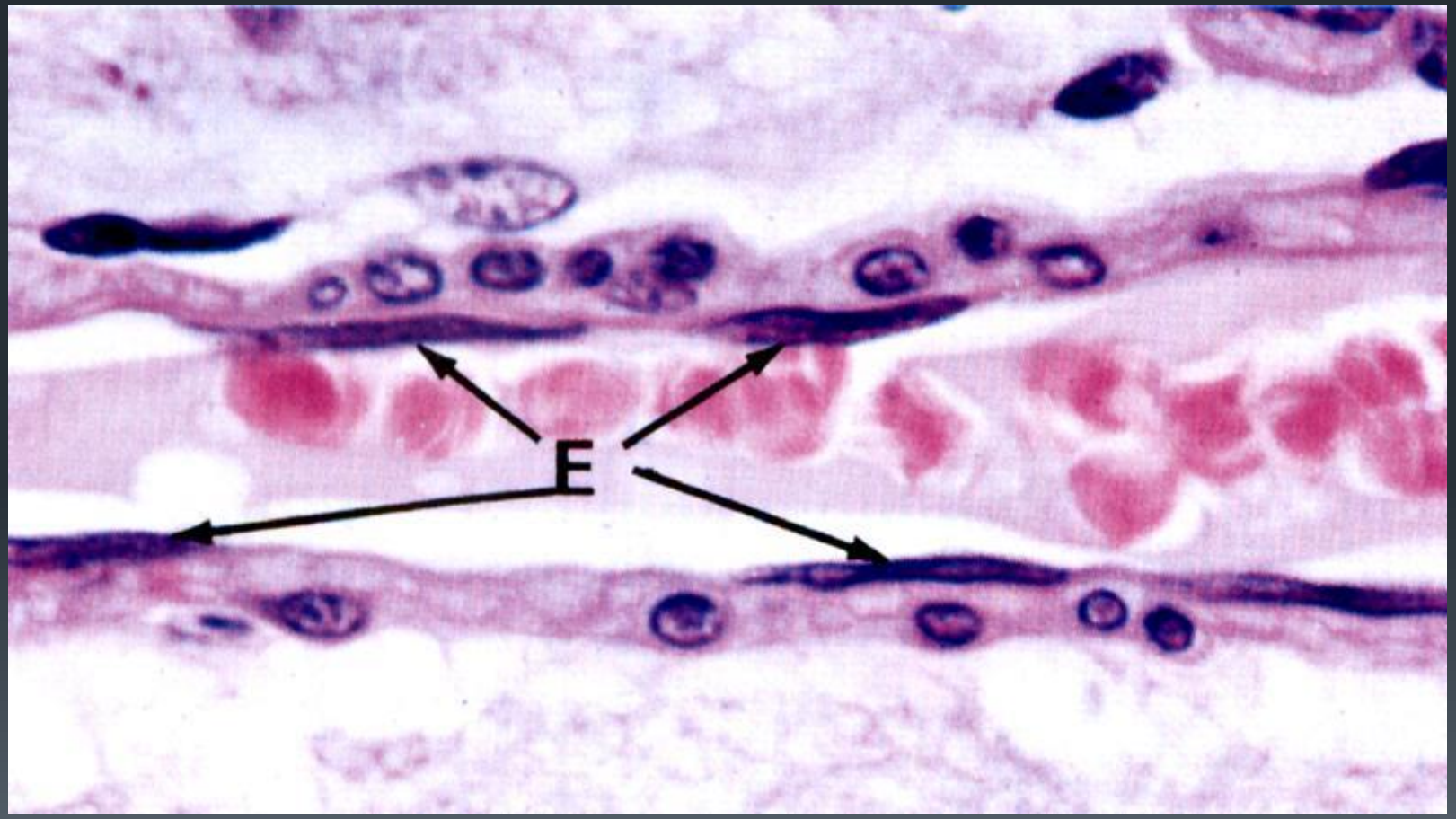
Simple squamous epithelia

endothelium : heart, blood vessles lymphatics

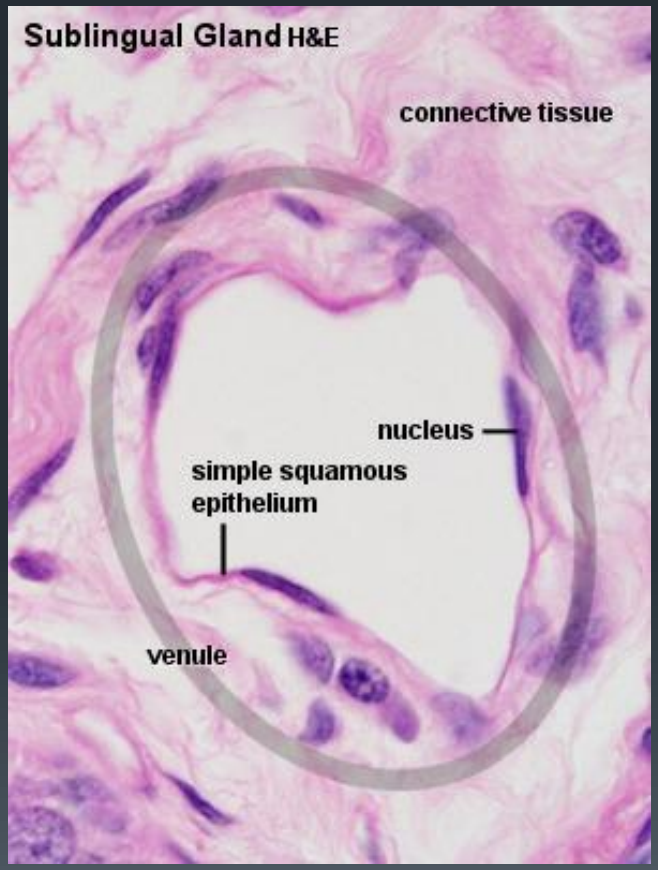
mesothelium : Pericardium, pleura peritoneum

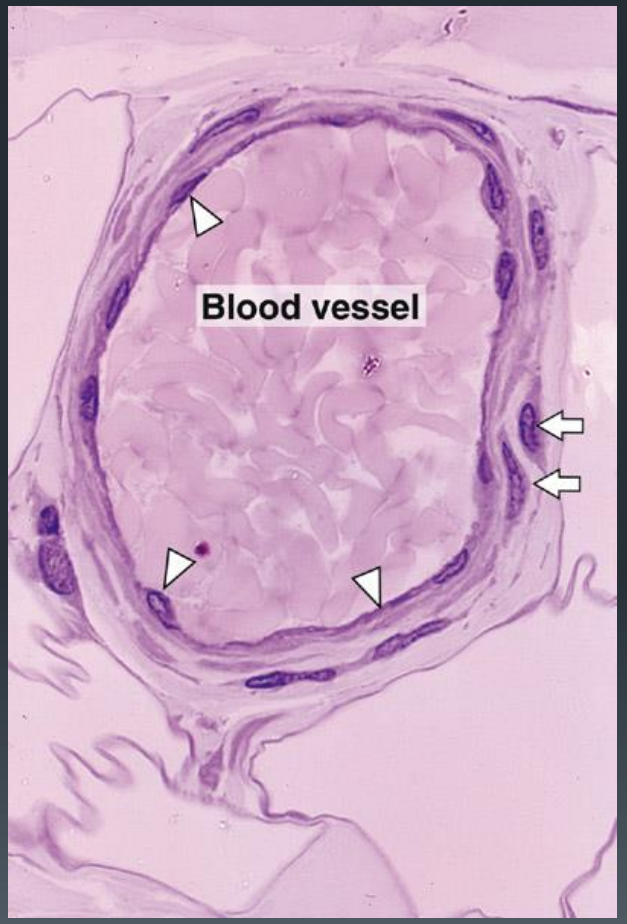
others : alveoli of the lungs, glomeruli in the kidney, etc

Endothelium



Endothelium

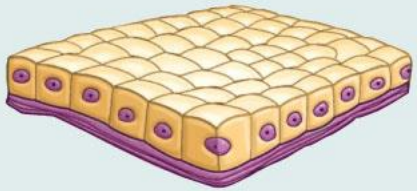




Mesothelium

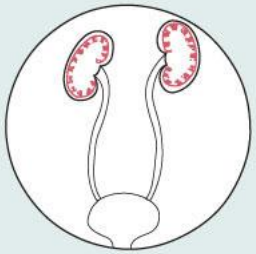
Simple cuboidal epithelium

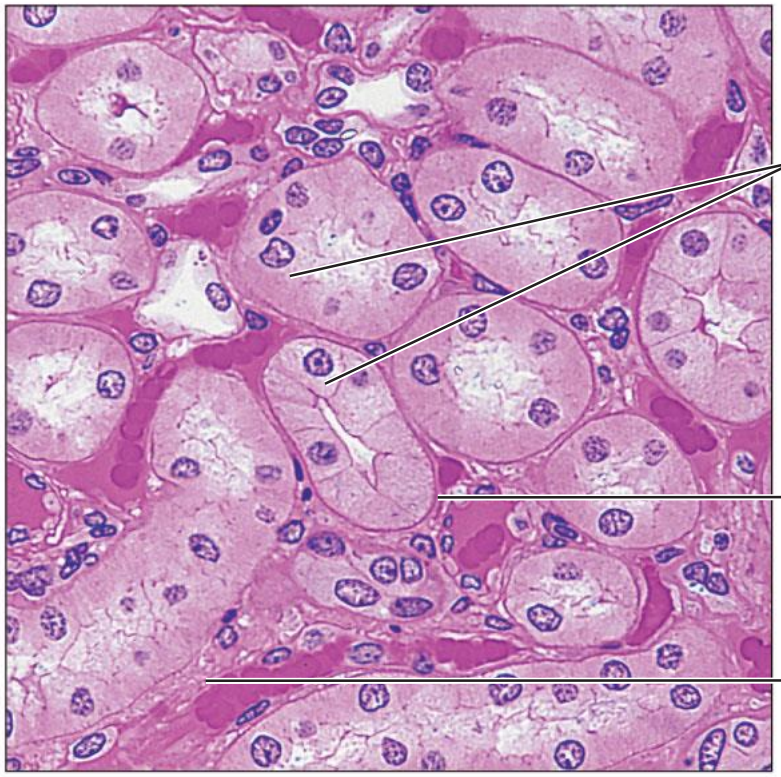
Description: Single layer of cubelike cells with large, spherical central nuclei.



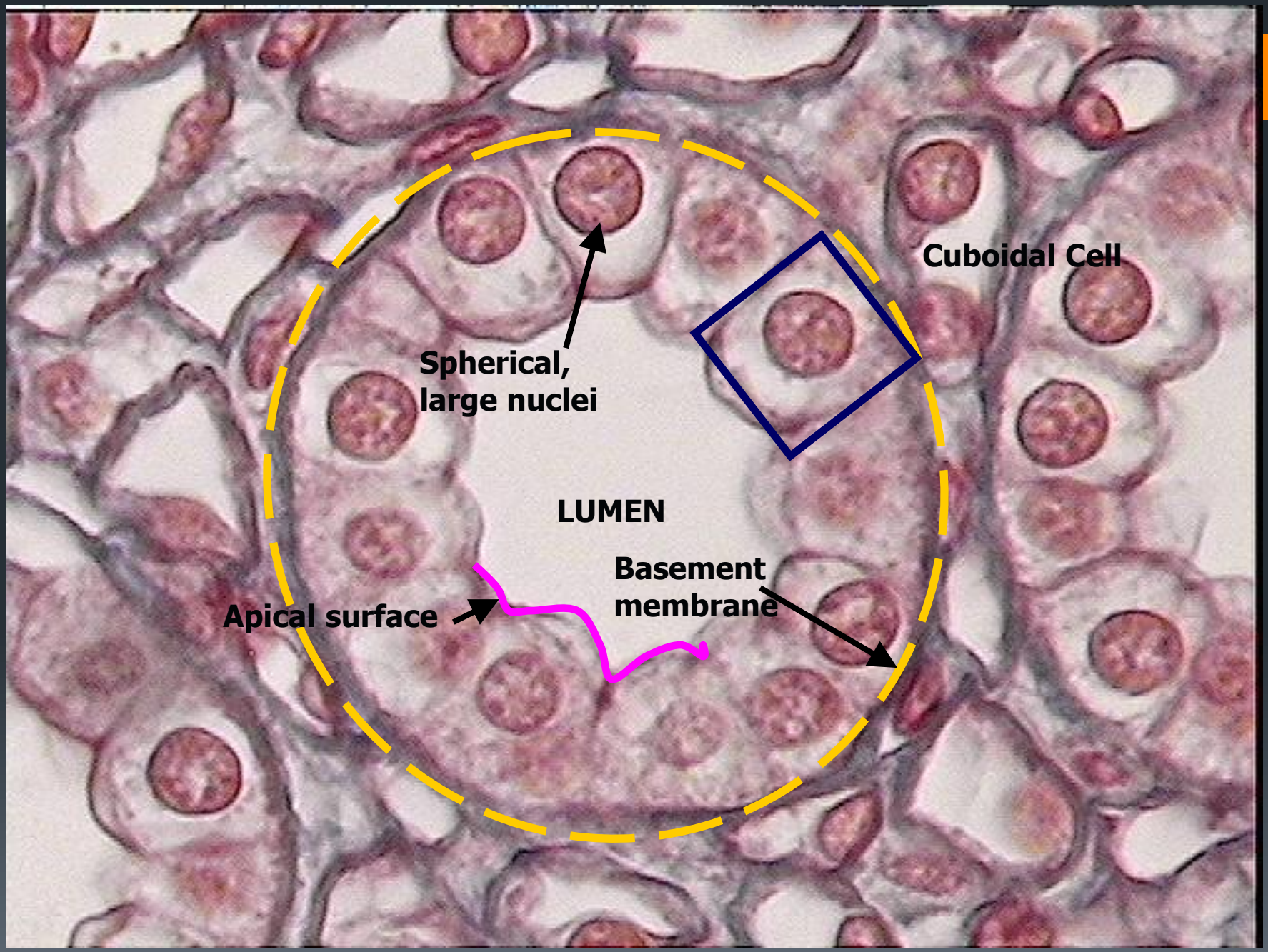
Function: Secretion and absorption.

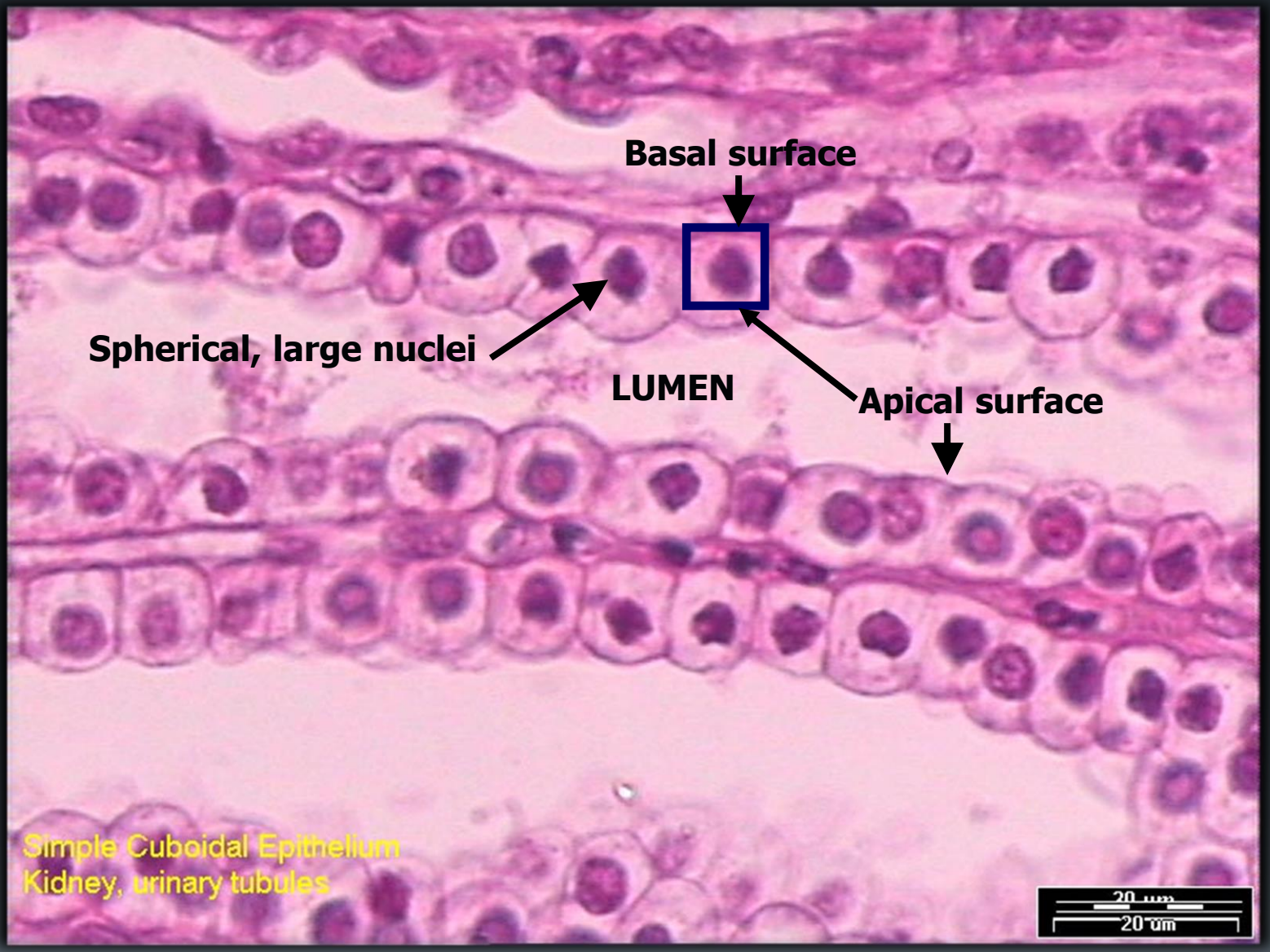
Location: Kidney tubules; ducts and secretory portions of small glands; ovary surface.

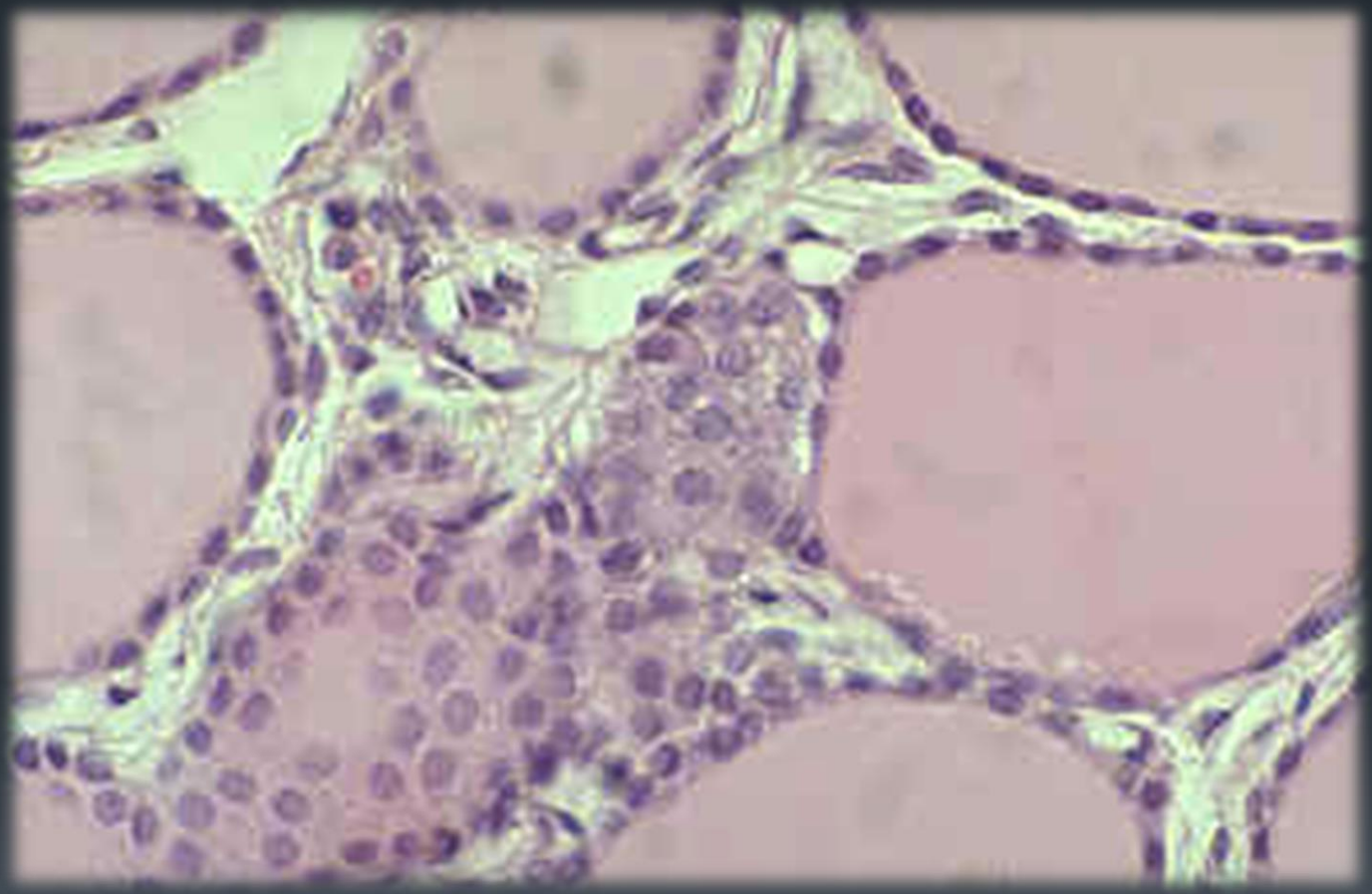




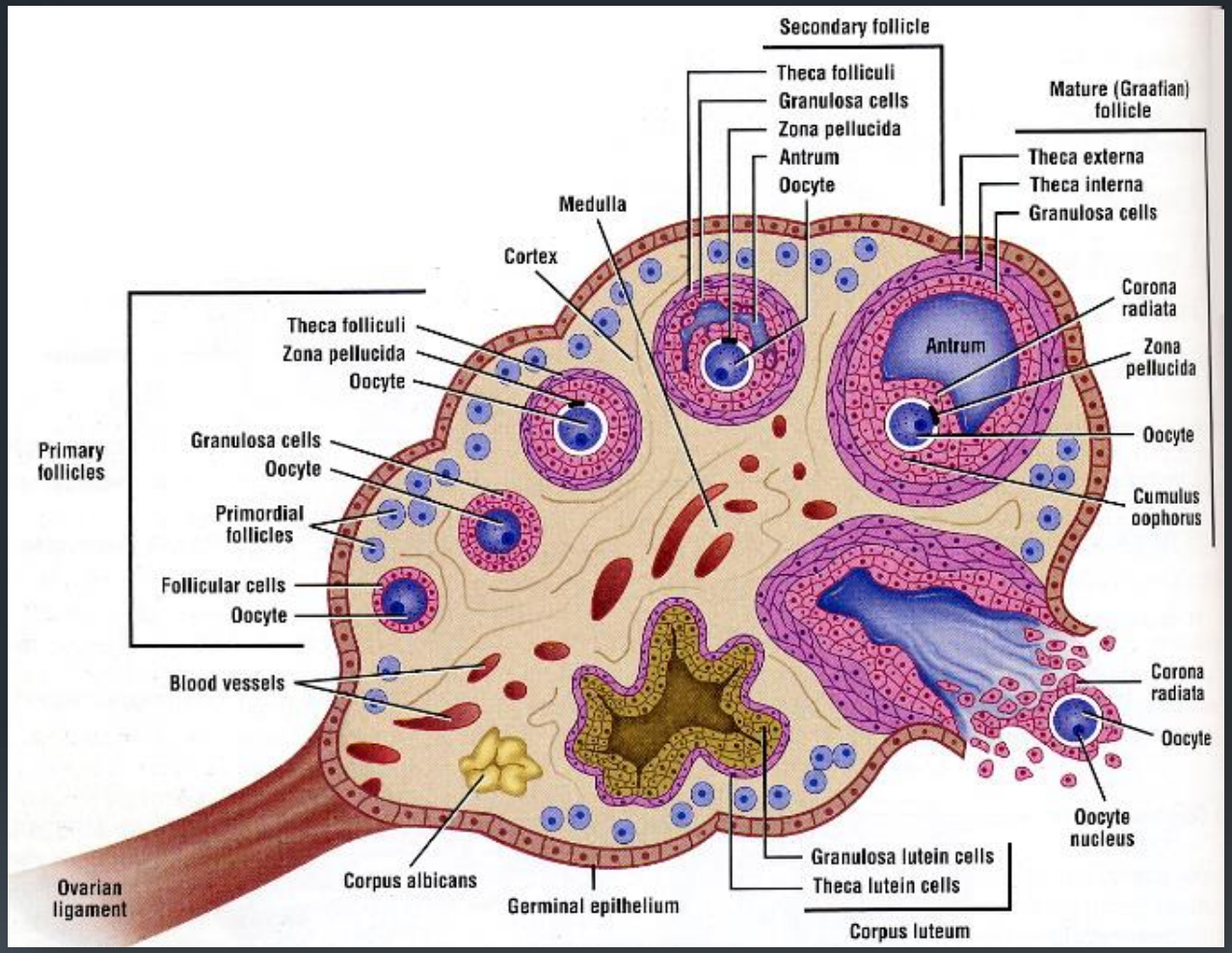
Photomicrograph: Simple cuboidal epithelium in kidney tubules (430x).


Cuboidal Cell
Spherical,
large nuclei
LUMEN
Basement
membrane
Apical surface


Basal surface
Spherical, large nuclei
LUMEN
Apical surface
Simple Cuboidal Epithelium
Kidney, urinary tubules
20 um
20 um



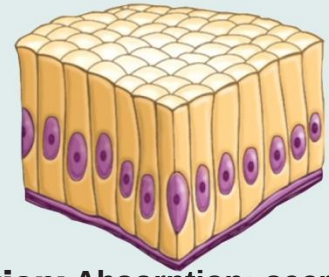
Thyroid gland


Secondary follicle
Theca folliculi
Granulosa cells
Zona pellucida
Antrum
Oocyte
Mature (Graafian) follicle
Theca externa
Theca interna
Granulosa cells
Medulla
Cortex
Corona radiata
Antrum
Zona pellucida
Theca folliculi
Zona pellucida
Oocyte
Oocyte
Primary follicles
Granulosa cells
Oocyte
Cumulus oophorus
Primordial follicles
Follicular cells
Oocyte
Blood vessels
Corona radiata
Oocyte
Oocyte nucleus
Granulosa lutein cells
Theca lutein cells
Corpus luteum
Ovarian ligament
Corpus albicans
Germinal epithelium

Ovary

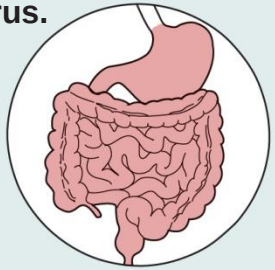
Simple columnar epithelium

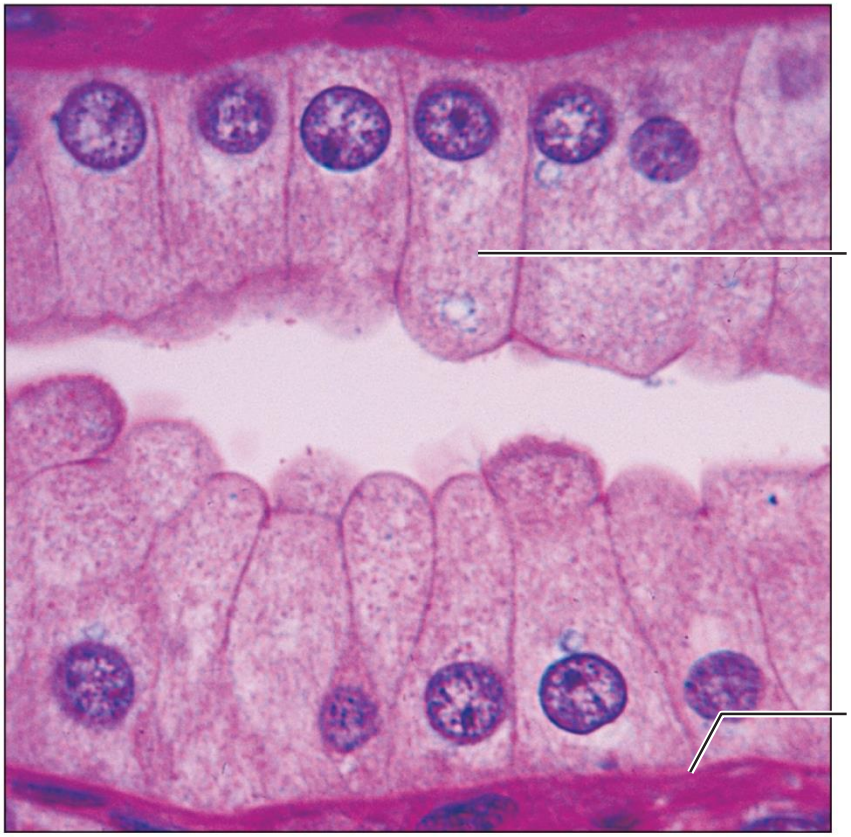
Description: Single layer of tall cells with *round* to *oval* nuclei; some cells bear cilia; layer may contain mucus-secreting unicellular glands (goblet cells).



Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliary action.

Location: Nonciliated type lines most of the digestive tract (stomach to anal canal), gallbladder, and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.





Photomicrograph: Simple columnar epithelium of the stomach mucosa (860X).

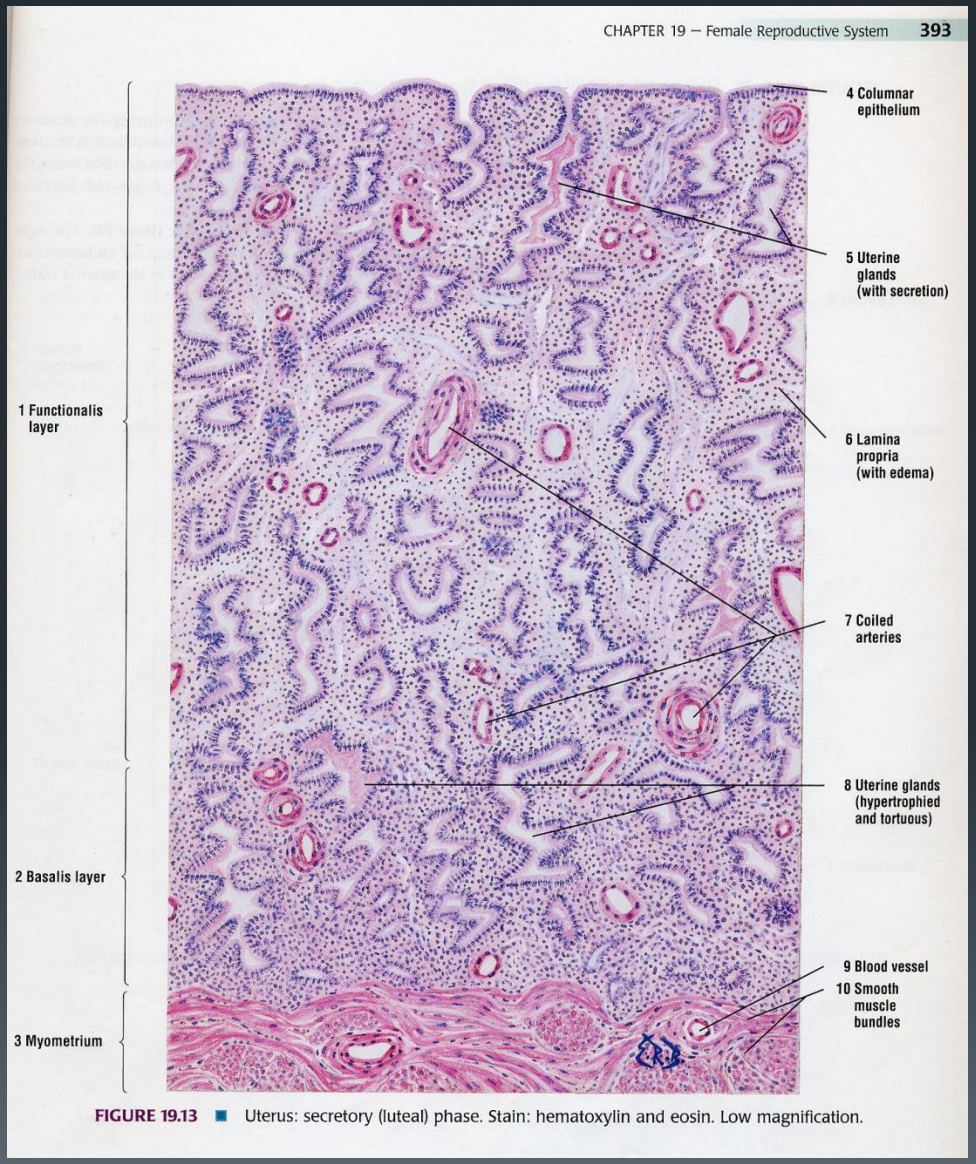
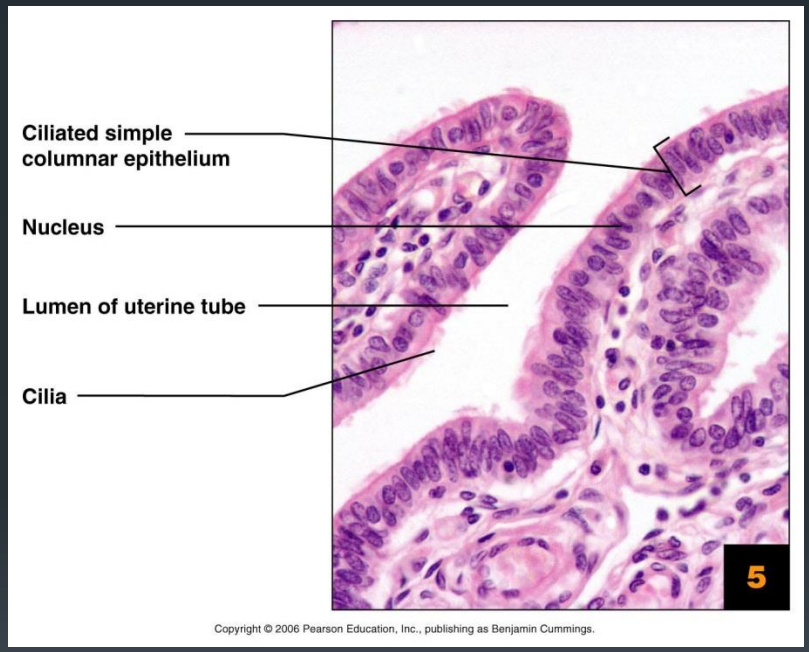


FIGURE 19.13 ■ Uterus: secretory (luteal) phase. Stain: hematoxylin and eosin. Low magnification.



Uterus

FIGURE 19.8 ■ Uterine tube: ampulla (panoramic view, transverse section). Stain: hematoxylin and eosin. Low magnification.

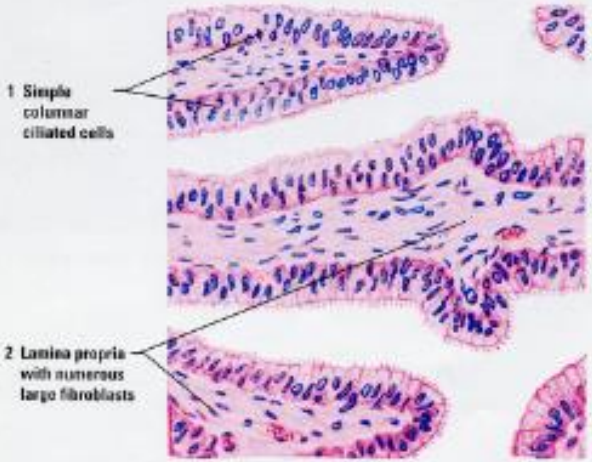
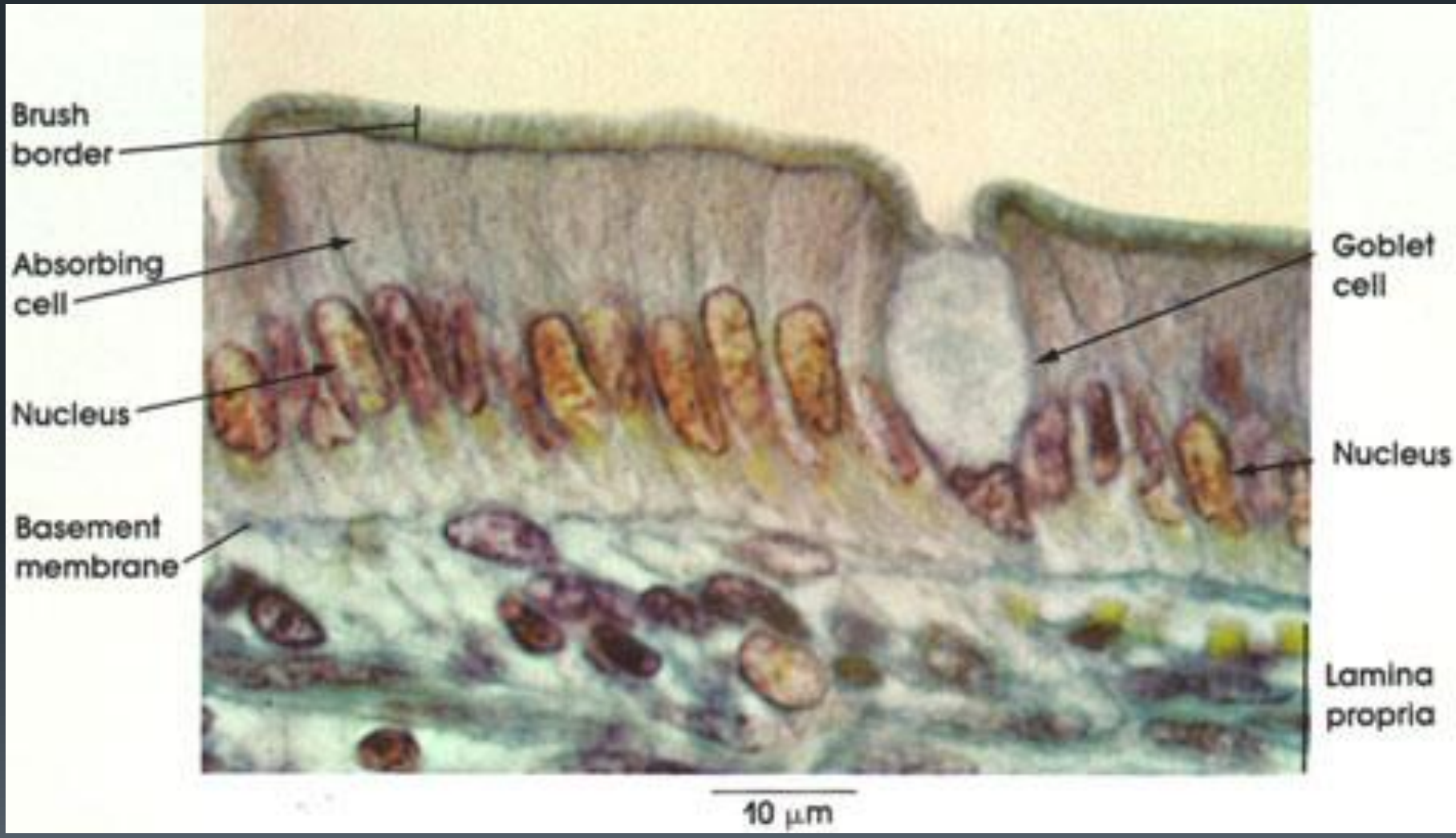


FIGURE 19.9 ■ Uterine tube: mucosal folds (early proliferative phase). Stain: hematoxylin and eosin. High magnification.


Brush border
Absorbing cell
Nucleus
Basement membrane
Goblet cell
Nucleus
Lamina propria
10 μm

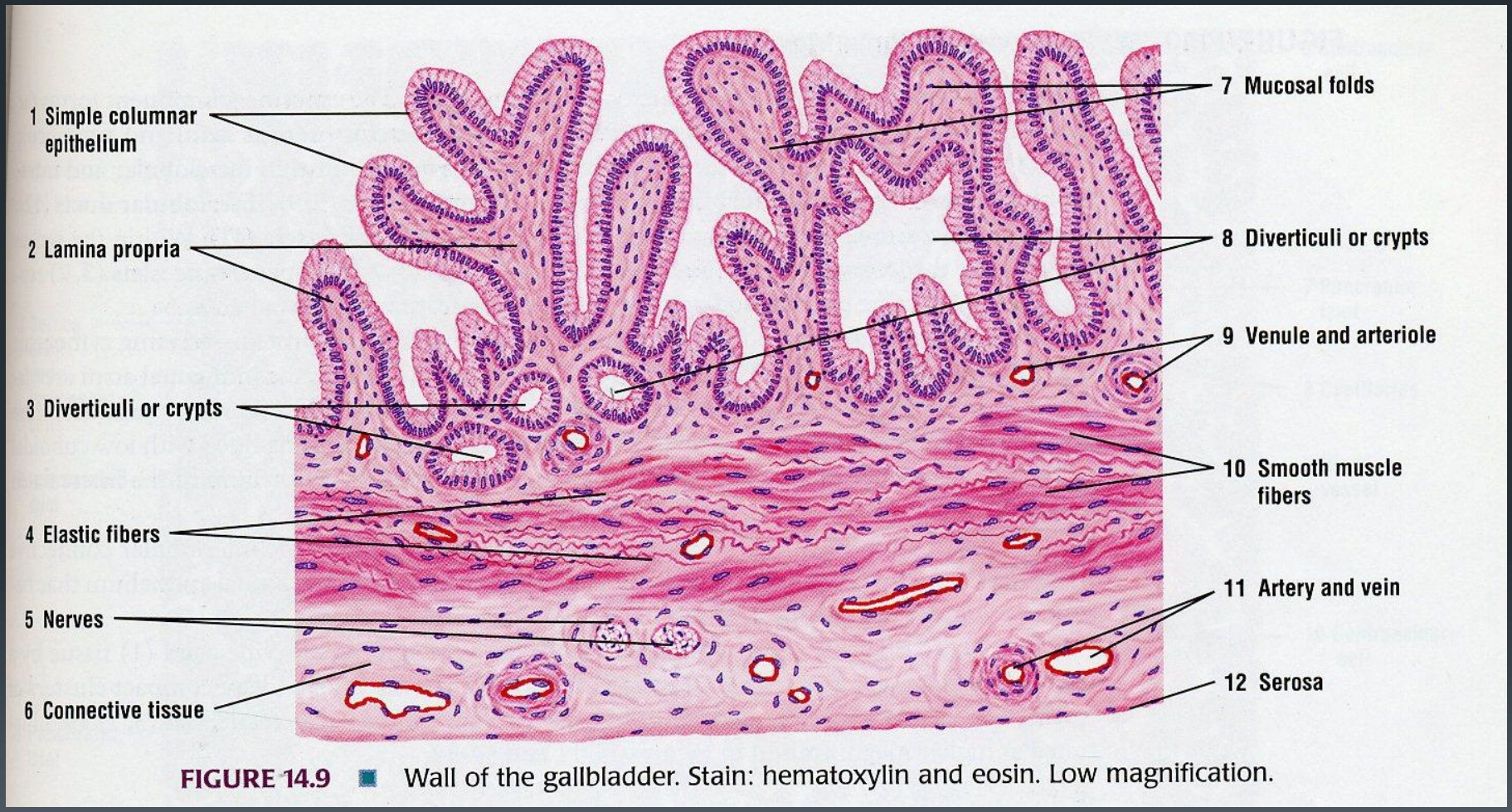
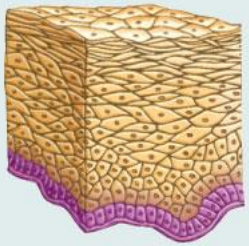


FIGURE 14.9 ■ Wall of the gallbladder. Stain: hematoxylin and eosin. Low magnification.

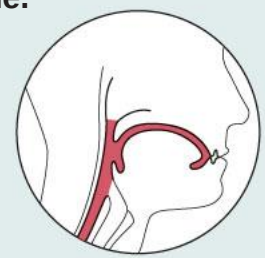
Stratified squamous epithelium

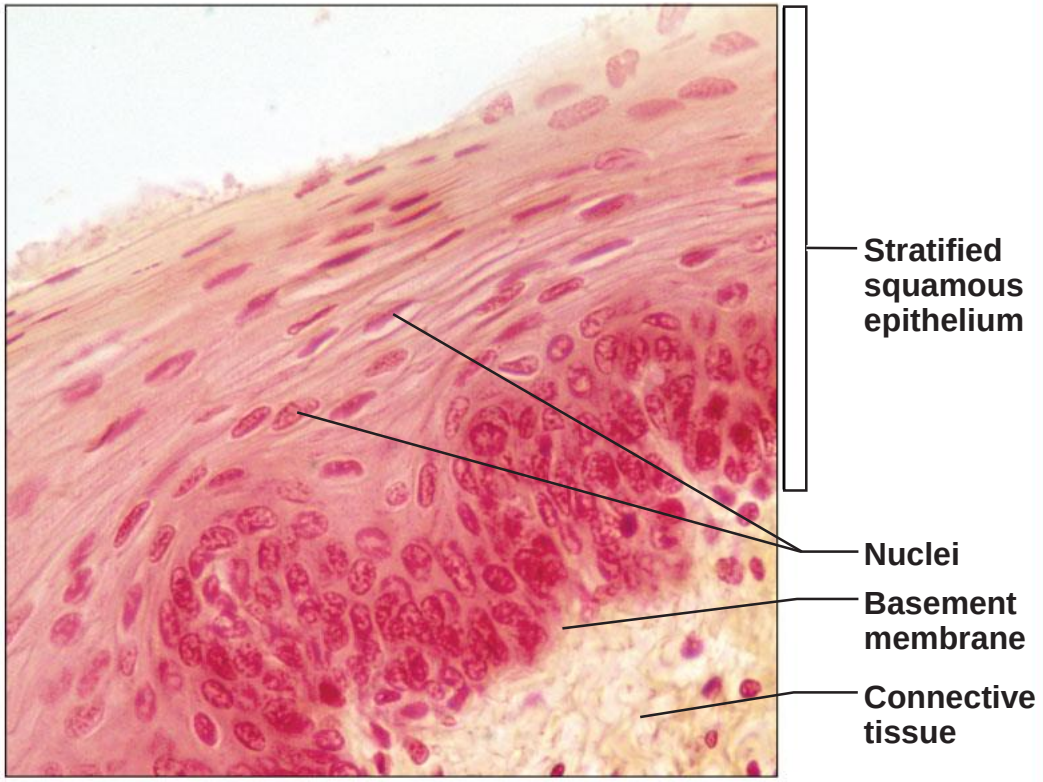
Description: Thick membrane composed of several cell layers; basal cells are cuboidal or columnar and metabolically active; surface cells are flattened (squamous); in the keratinized type, the surface cells are full of keratin and dead; basal cells are active in mitosis and produce the cells of the more superficial layers.



Function: Protects underlying tissues in areas subjected to abrasion.

Location: Nonkeratinized type forms the moist linings of the esophagus, mouth, and vagina; keratinized variety forms the epidermis of the skin, a dry membrane.





Photomicrograph: Stratified squamous epithelium lining the esophagus (285x).

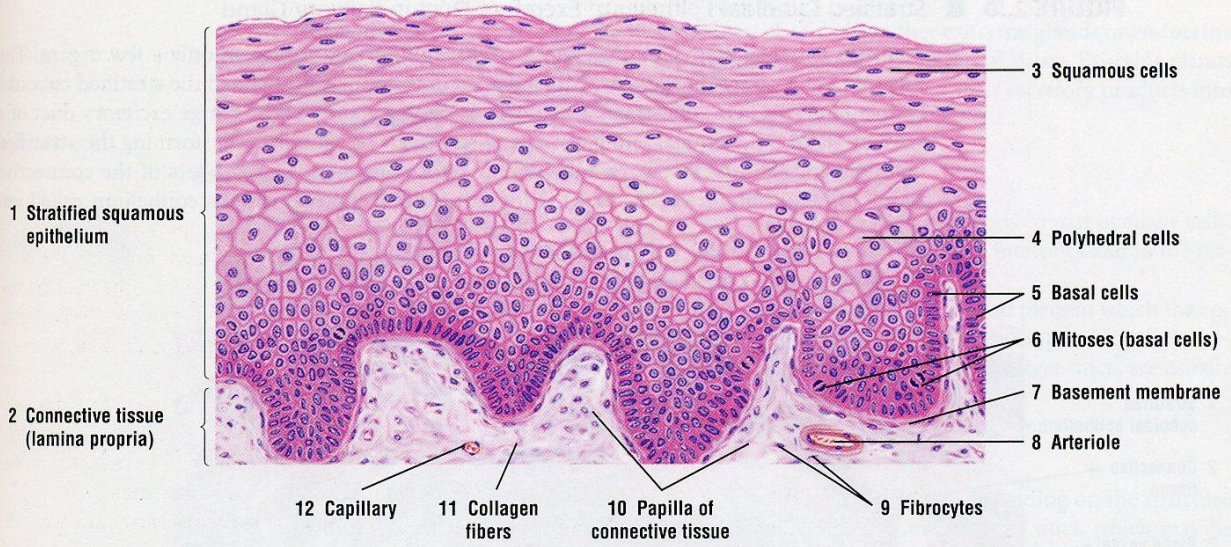
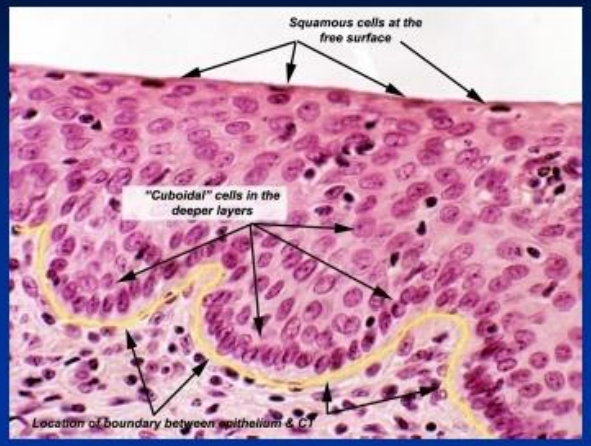
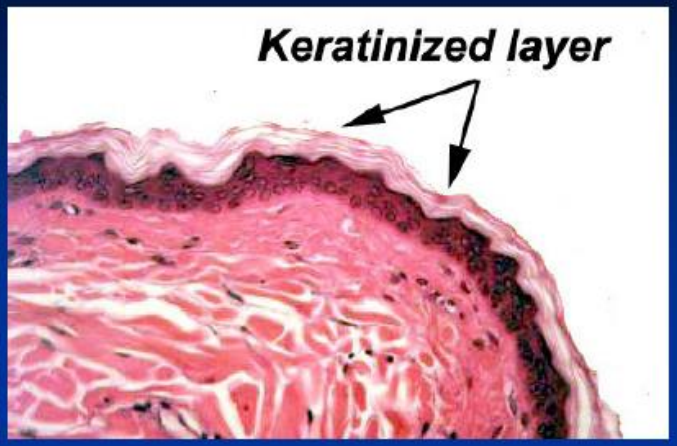


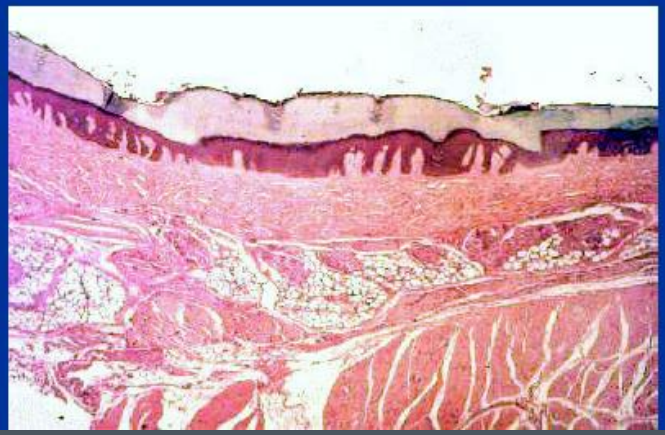
FIGURE 2.8 ■ Stratified squamous nonkeratinized epithelium: esophagus. Stain: hematoxylin and eosin. Medium magnification.

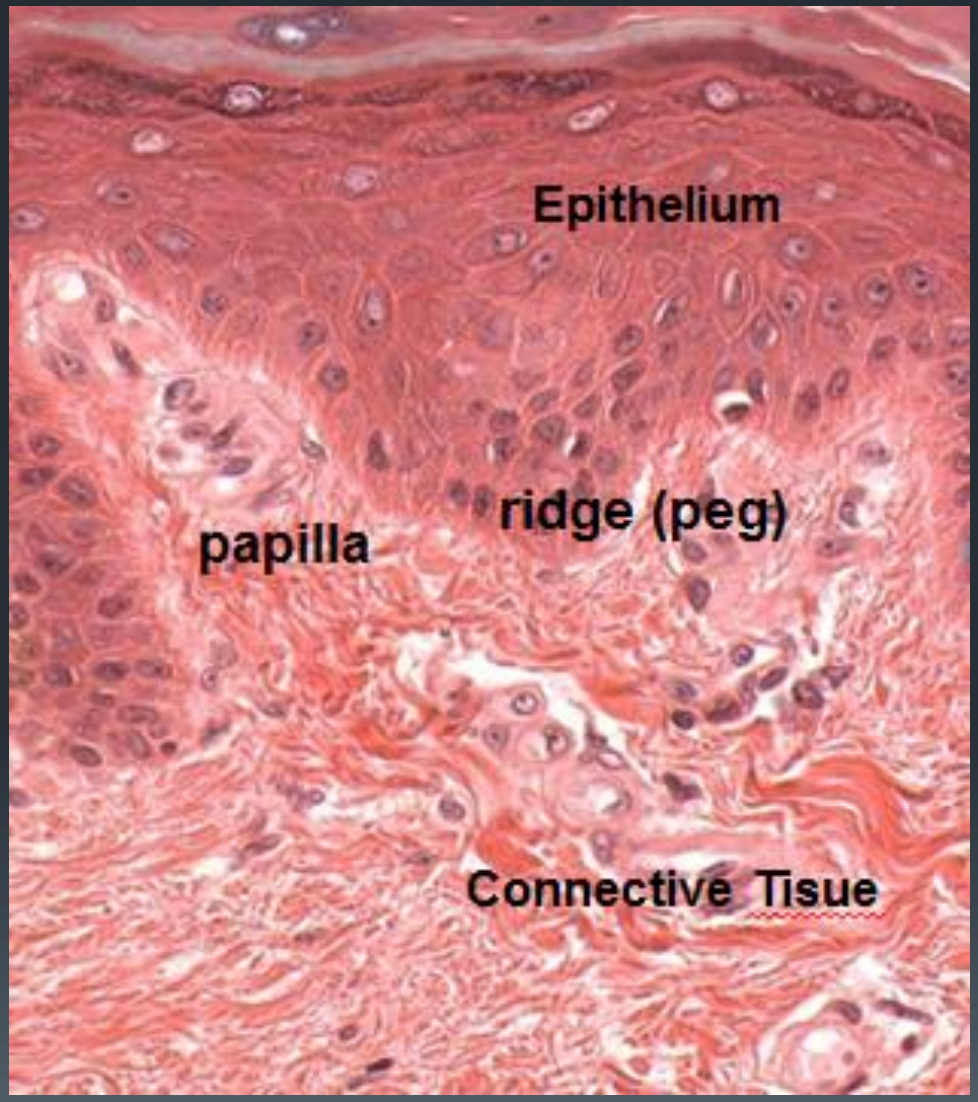
FIGURE 2.9 ■ Stratified squamous keratinized epithelium: palm of the hand. Stain: hematoxylin and eosin. 40×

Str squamous (1-Non Ker: vagina, 2- Ker: thin & thick skin)








Epithelium
ridge (peg)
papilla
Connective Tisue

Stratified cuboidal epithelium

FIGURE 2.10 ■ Stratified Cuboidal Epithelium: Excretory Duct in Salivary Gland

Stratified cuboidal epithelium has a limited distribution and is seen in only a few organs. The larger excretory ducts in the salivary glands and in the pancreas are lined the stratified cuboidal epithelium. This figure illustrates a high-power photomicrograph of a large excretory duct of a salivary gland. The luminal lining consists of two layers of cuboidal cells, forming the **stratified cuboidal epithelium (1).** Surrounding the excretory duct are collagen fibers of the **connective tissue (2,7)** and **blood vessels (3, 5)** that are lined by simple squamous epithelium called **endothelium (4,6).**

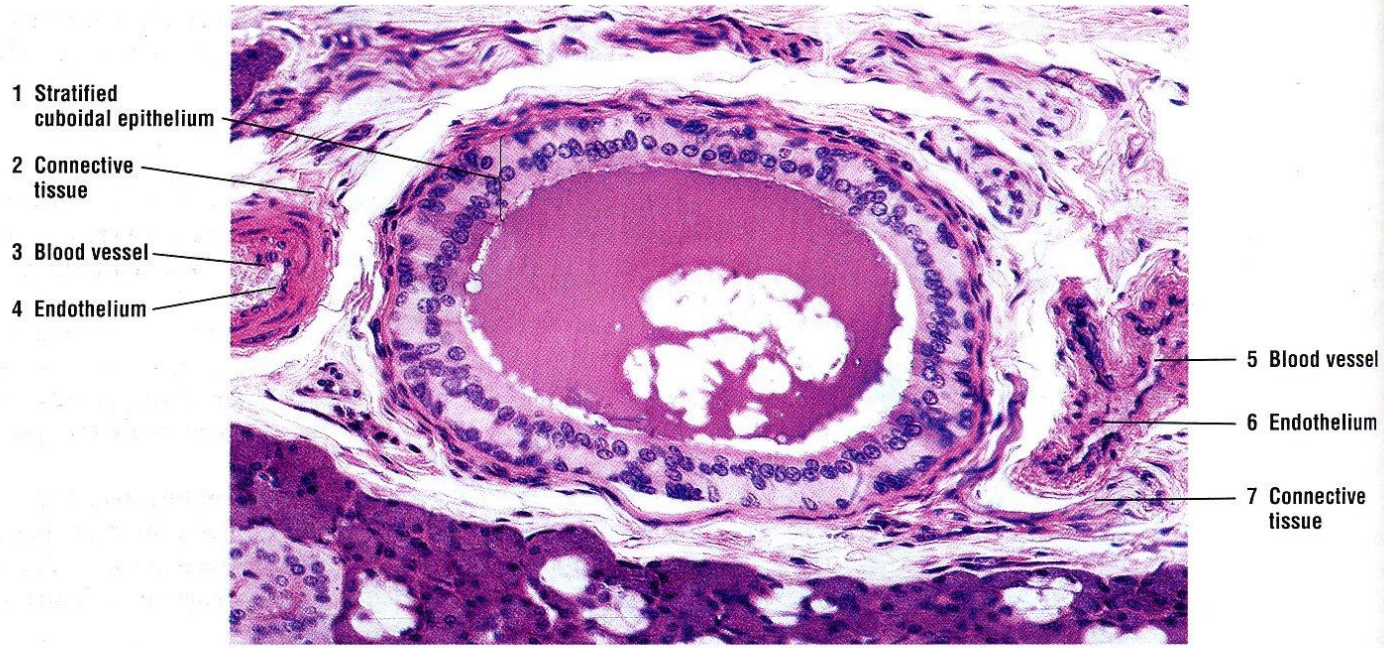
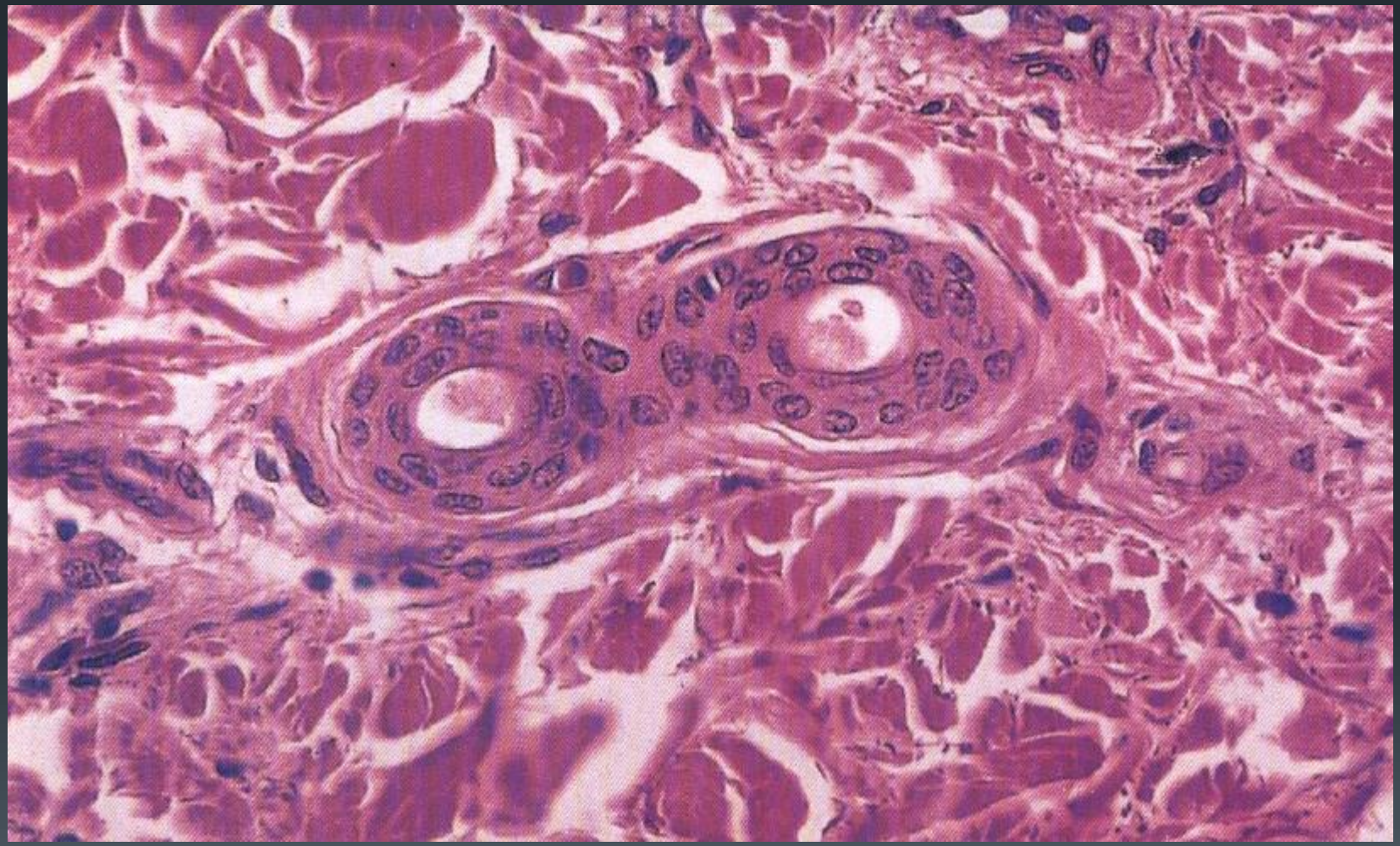
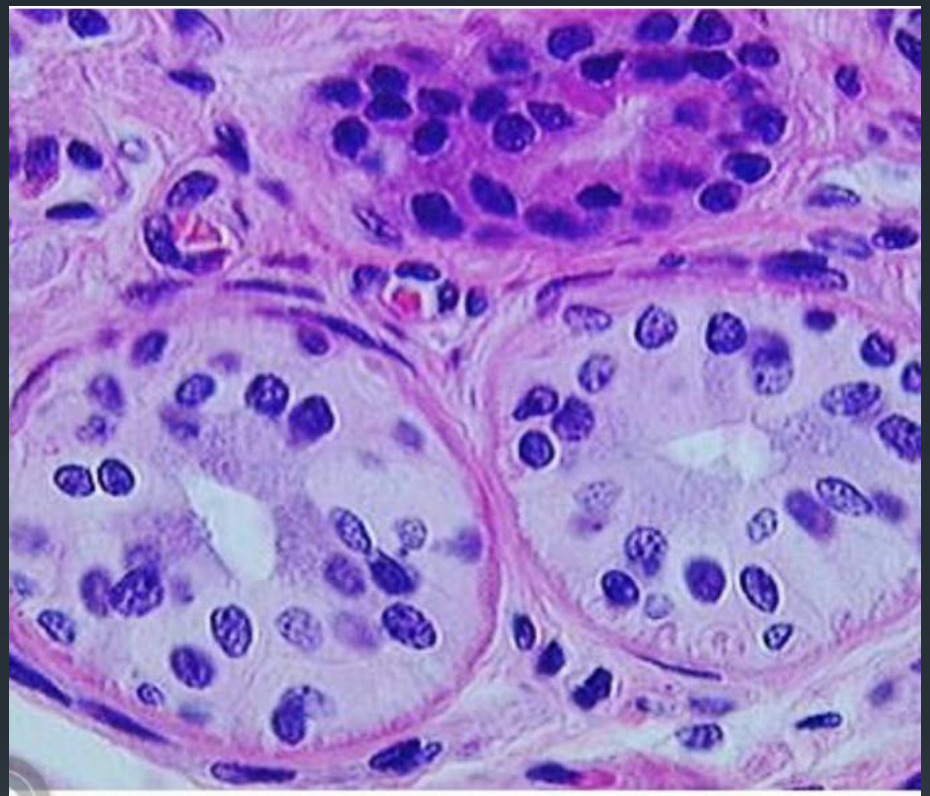


FIGURE 2.10 ■ Stratified cuboidal epithelium: excretory duct in salivary gland. Stain: hematoxylin and eosin. 100×



Sweat gland duct



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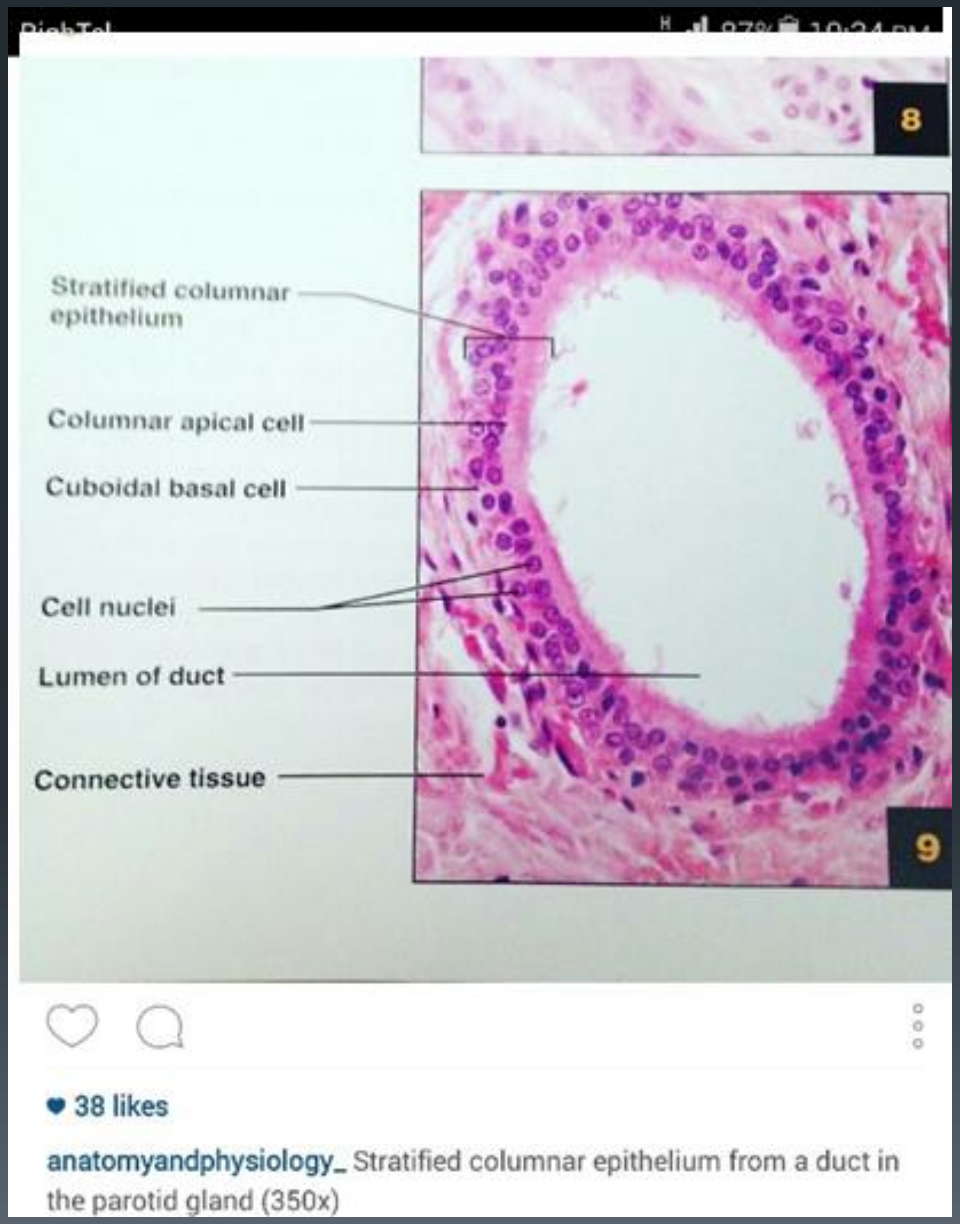
anatomyandphysiology_ Stratified cuboidal epithelium:

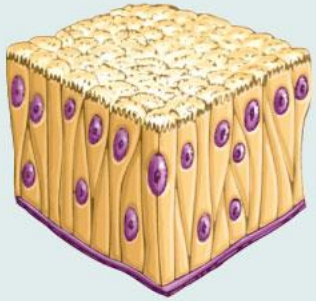
Stratified cuboidal epithelium has a limited distribution in the body, largely seen in larger size exocrine gland ducts. This example above is the duct of a sweat gland (blue dotted line). Notice that the secretory

Stratified columnar epithelium



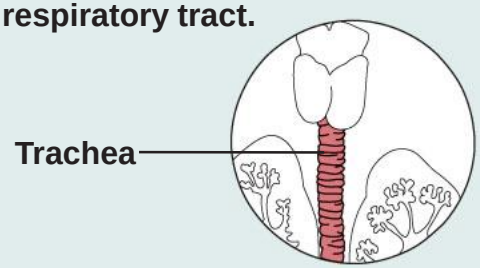
Pseudo-stratified columnar epithelium

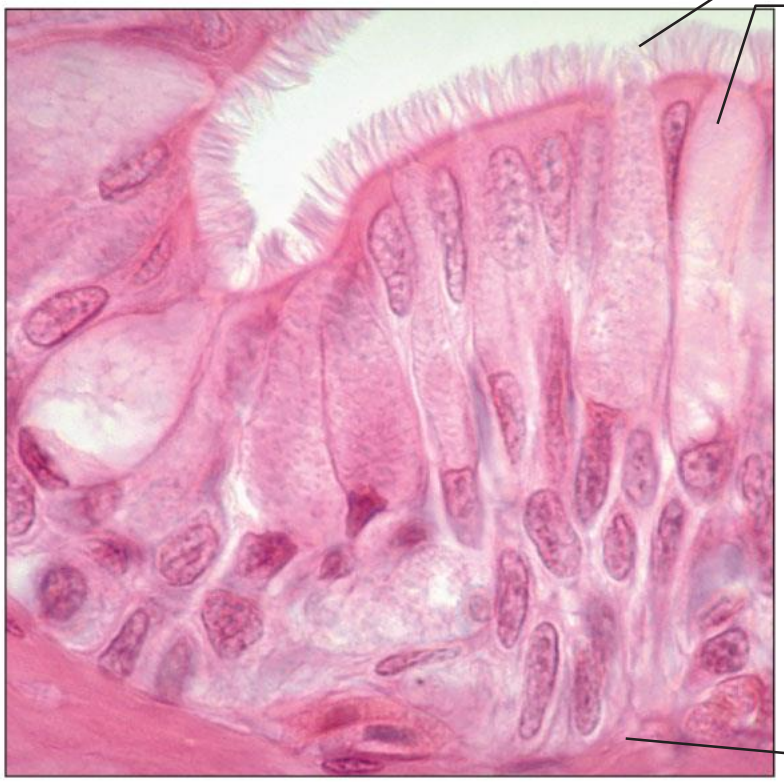
Description: Single layer of cells of differing heights, some not reaching the free surface; nuclei seen at different levels; may contain mucus-secreting cells and bear cilia.



Function: Secretion, particularly of mucus; propulsion of mucus by ciliary action.

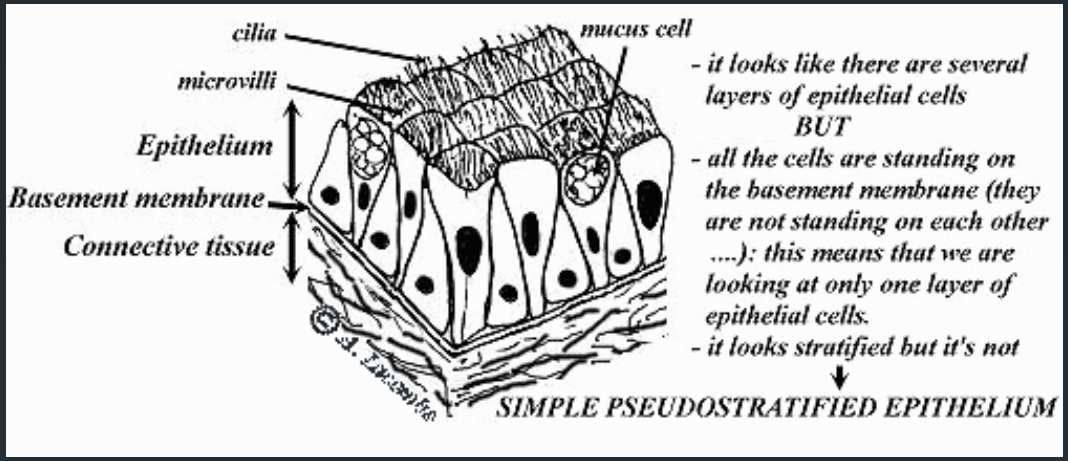
Location: Nonciliated type in male's sperm-carrying ducts and ducts of large glands; ciliated variety lines the trachea, most of the upper respiratory tract.





Photomicrograph: Pseudostratified ciliated columnar epithelium lining the human trachea (570x).

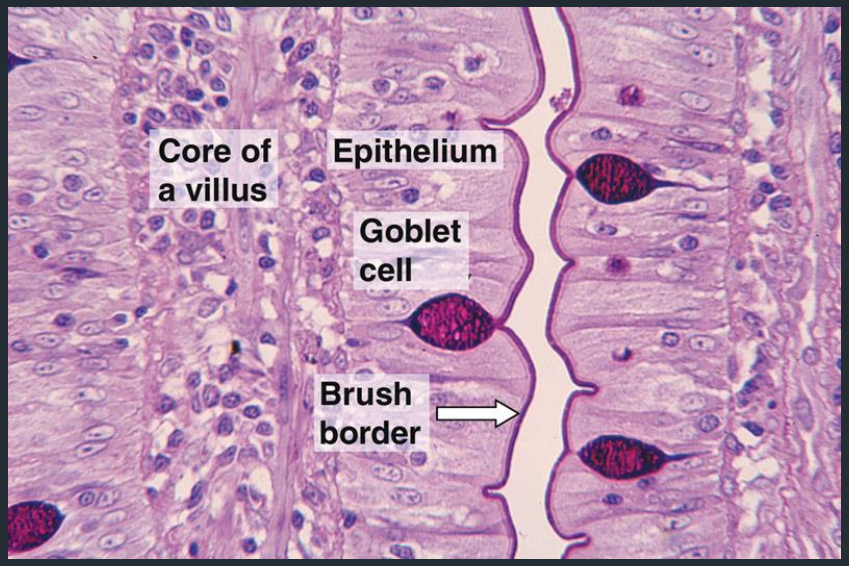
Pseudo-stratified ciliated columnar epithelium



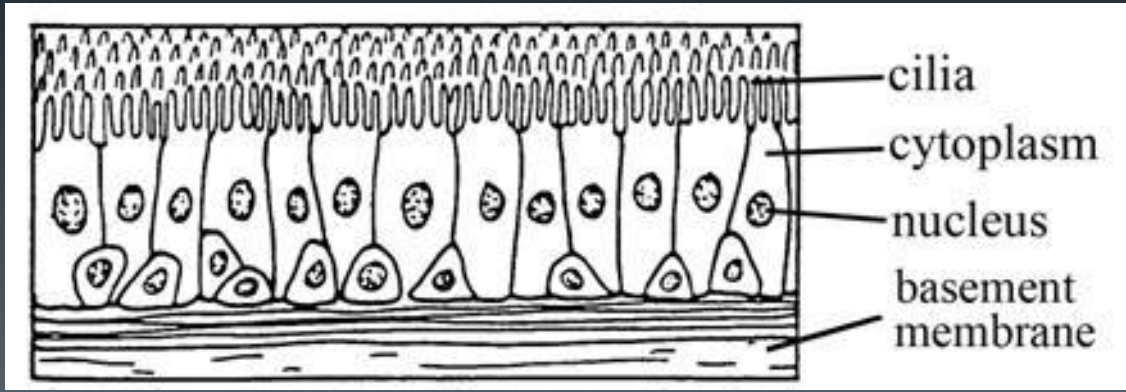
Description: **single layer of cells of differing heights**, but some don't reach the free surface. Nuclei are seen at many different levels. They contain goblet cells and cilia.

Function: secretion & propulsion of mucus

Locations: I the trachea & most of the upper respiratory trac



- Shapes vary in height
- Nuclei at different levels – appear stratified, but aren't.
- All cells reach basement membrane; only a few reach the surface



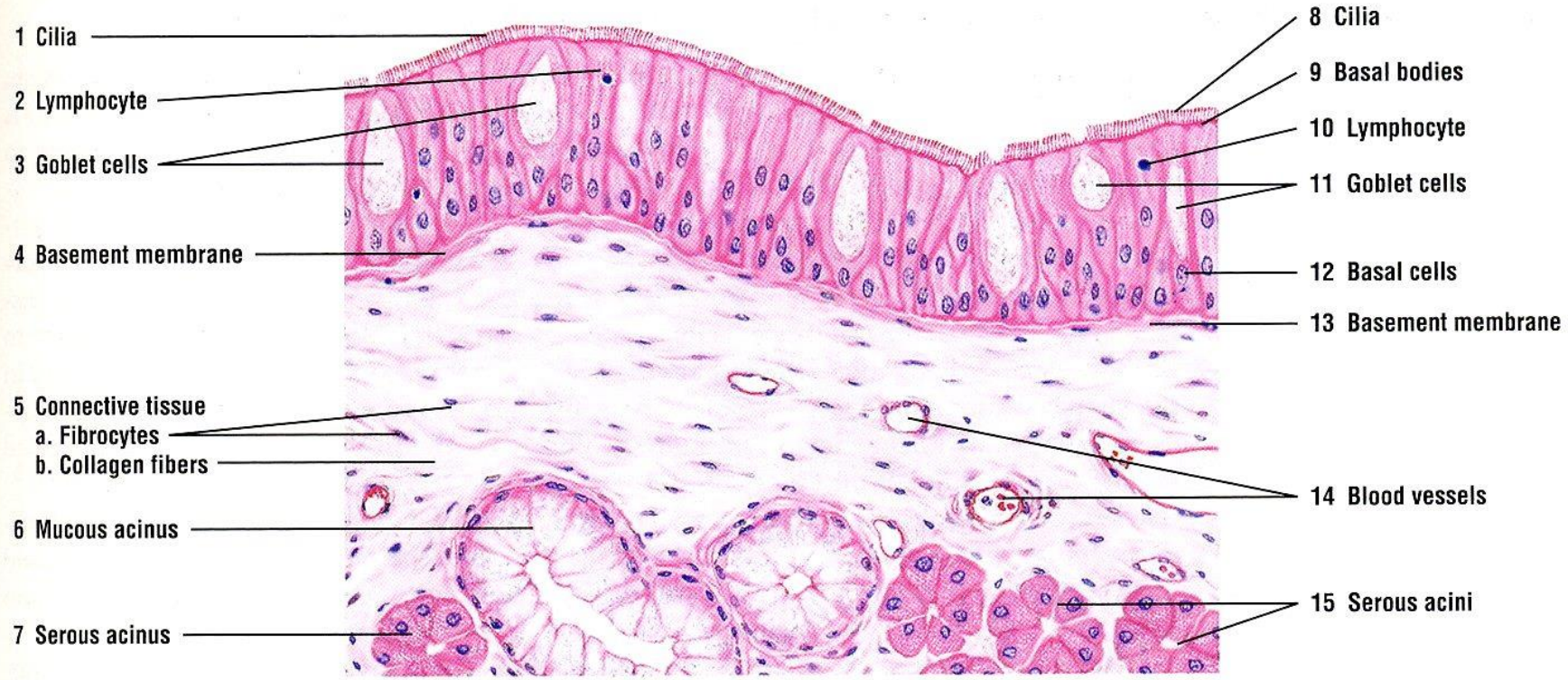
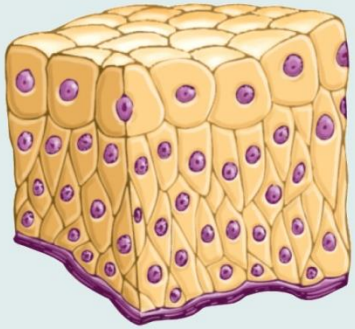


FIGURE 2.6 ■ Pseudostratified columnar ciliated epithelium: respiratory passages (trachea). Stain: hematoxylin and eosin. High magnification.


S

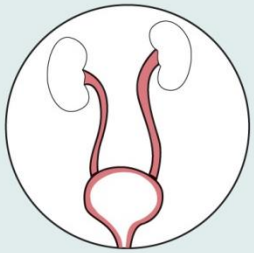
Transitional epithelium

Description: Resembles both stratified squamous and stratified cuboidal; basal cells cuboidal or columnar; surface cells dome shaped or squamouslike, depending on degree of organ stretch.



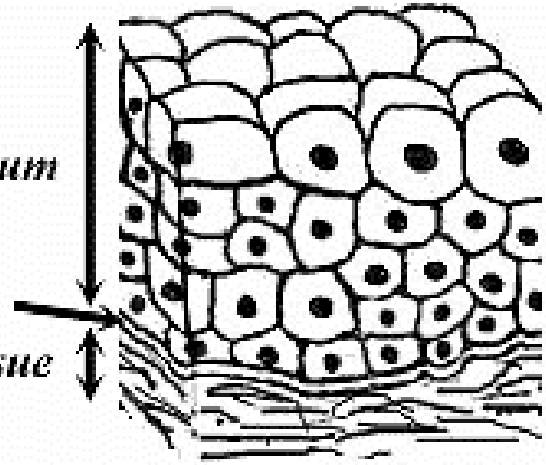
Function: Stretches readily and permits distension of urinary organ by contained urine.

Location: Lines the ureters, urinary bladder, and part of the urethra.



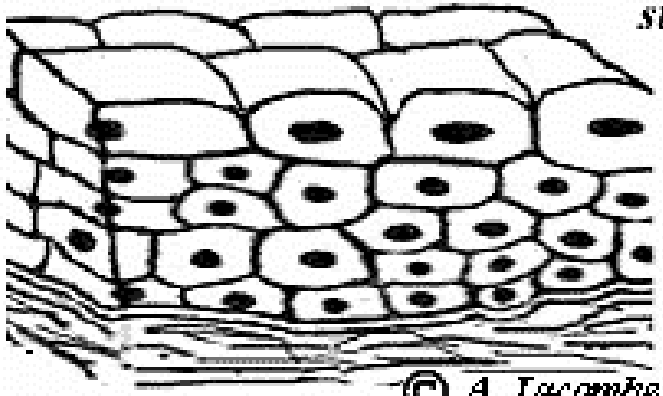
Photomicrograph: Transitional epithelium lining the urinary bladder, relaxed state (360X); note the bulbous, or rounded, appearance of the cells at the surface; these cells flatten and become elongated when the bladder is filled with urine.

RELAXED ORGAN:



- *several layers of epithelial cells*
- *the shape of the cells of the top layer changes from dome-shaped to squamous-like depending of the degree of organ stretch*

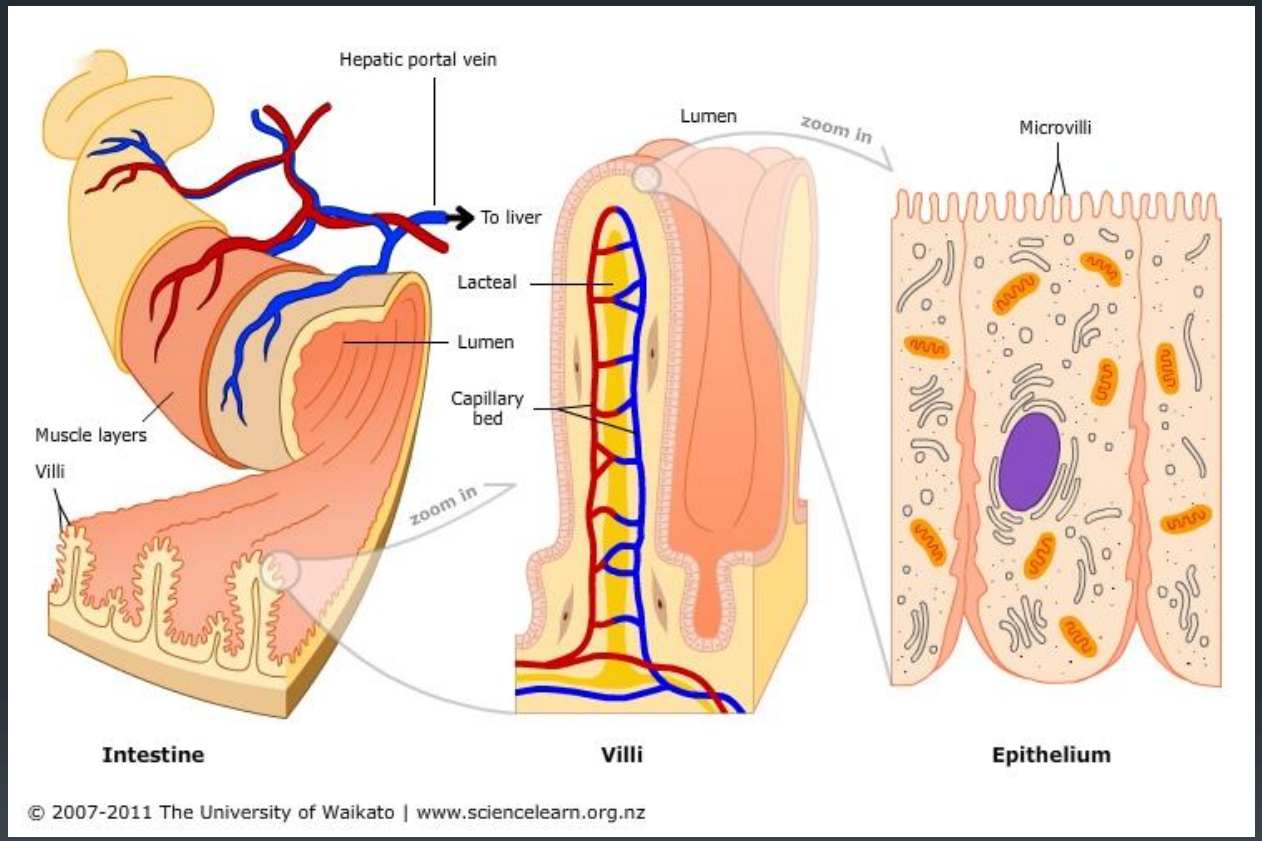
STRETCHED ORGAN:

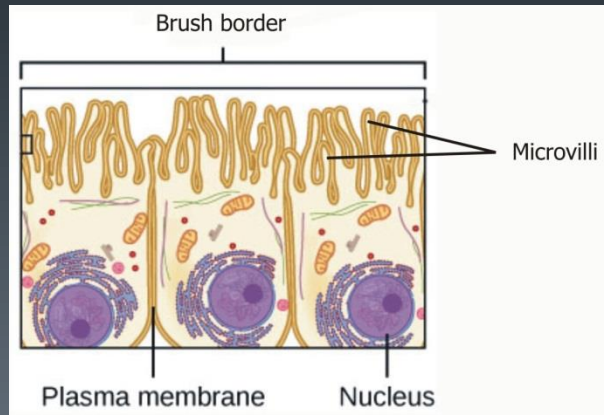


↓

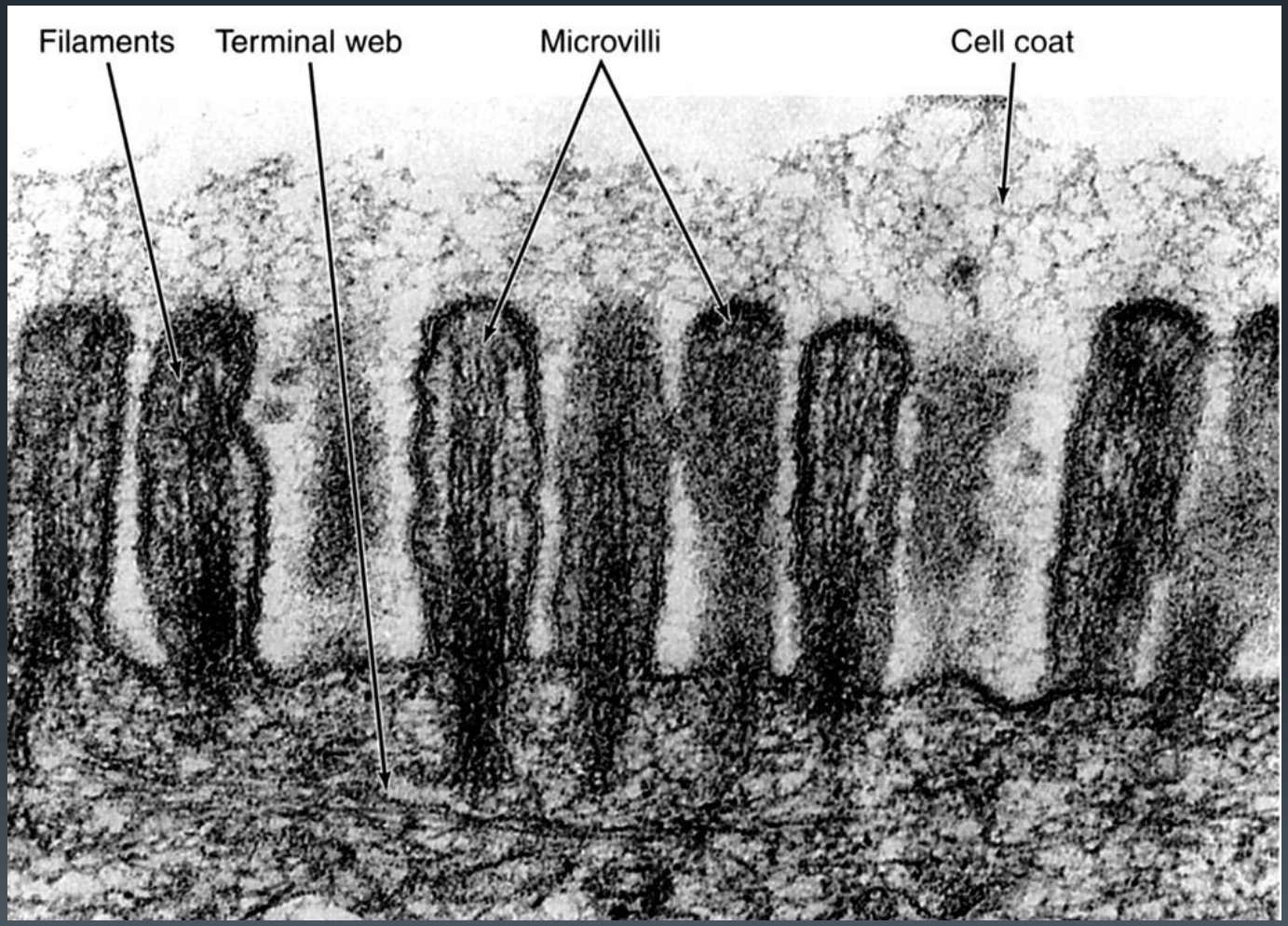
STRATIFIED TRANSITIONAL EPITHELIUM

Special structure of apical surface





1. microvilli(Brush border)


Filaments
Terminal web
Microvilli
Cell coat

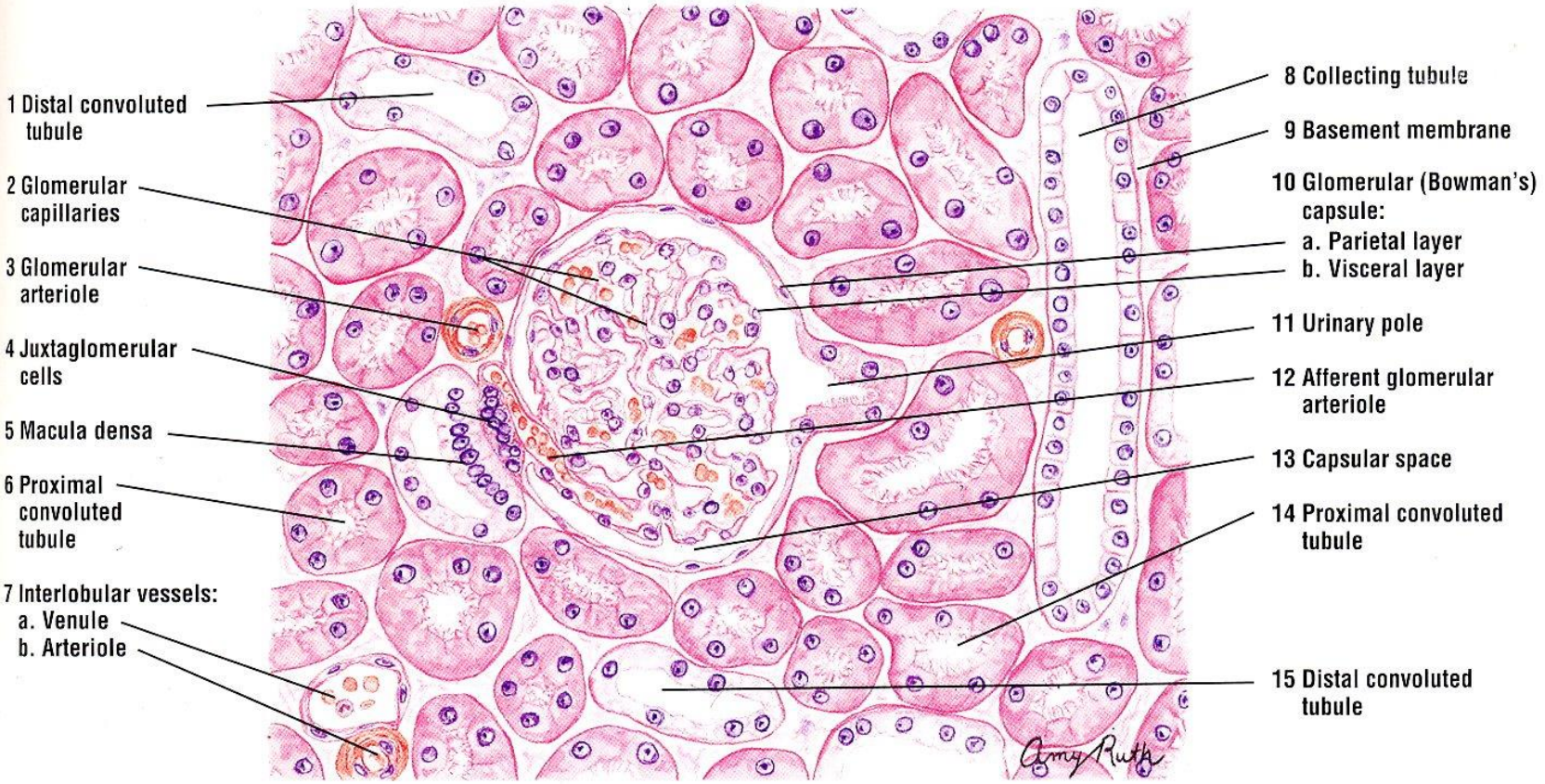
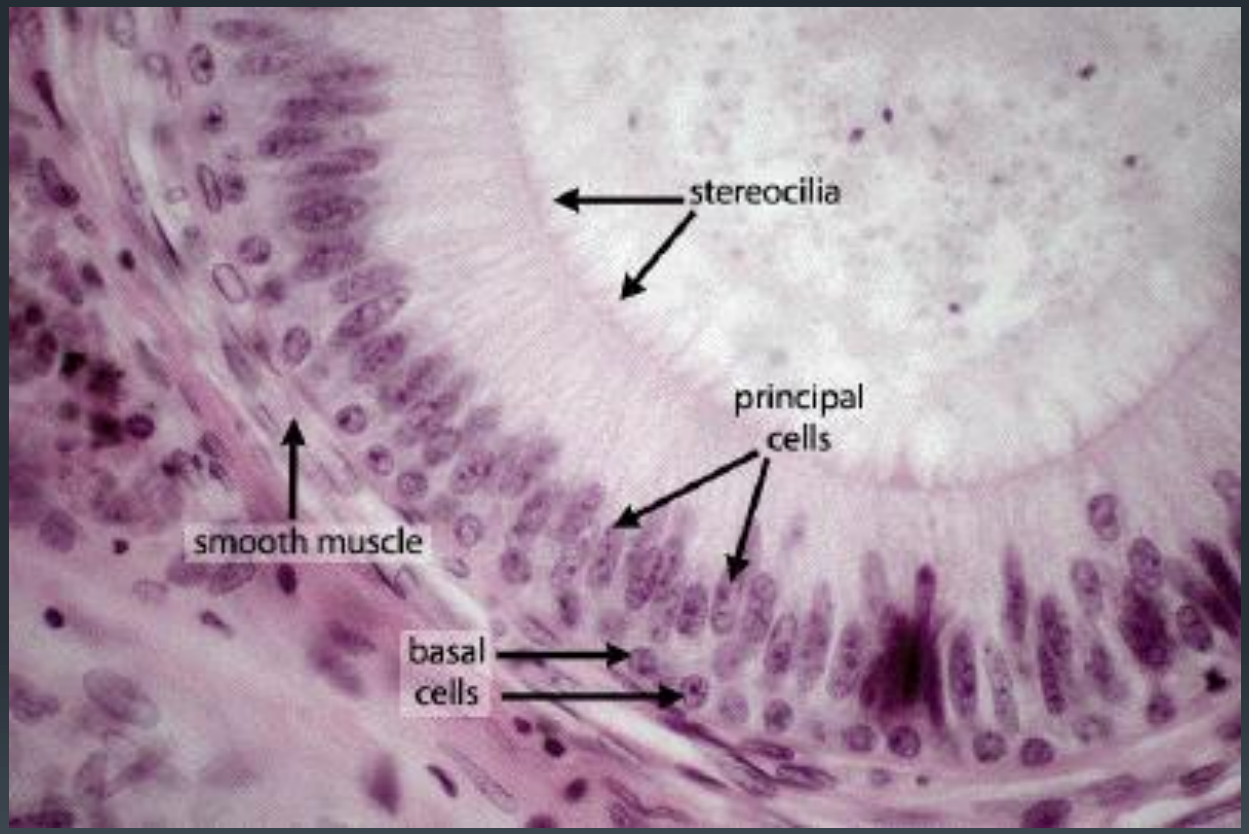
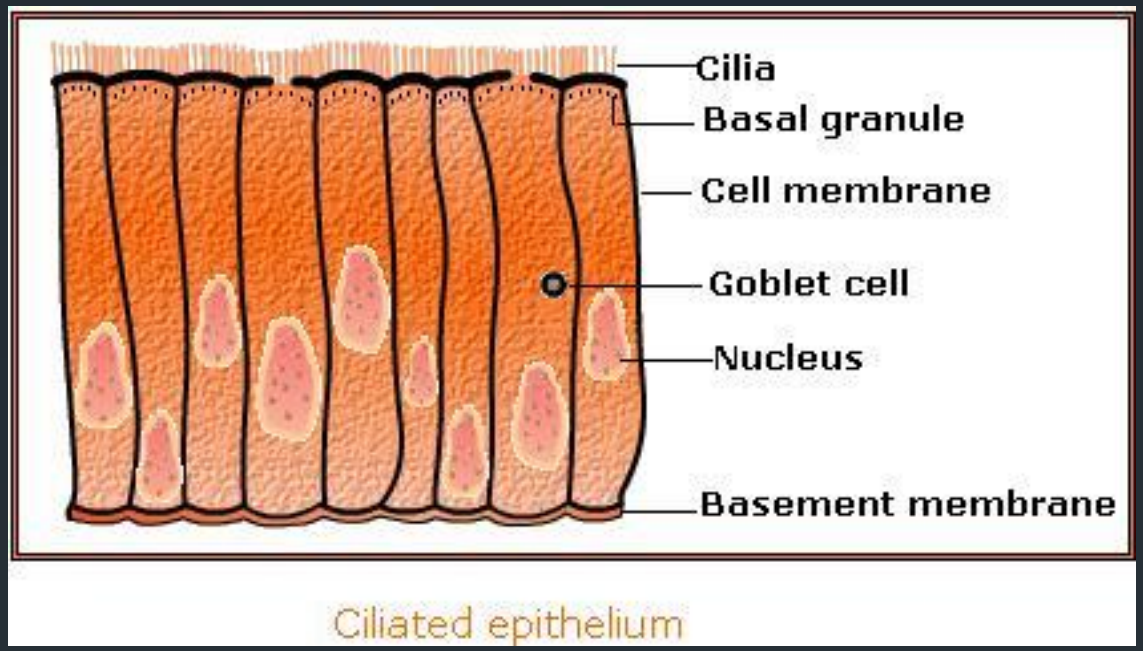


FIGURE 16.3 ■ Kidney cortex: juxtaglomerular apparatus. Stain: periodic acid-Schiff and hematoxylin. Medium magnification.

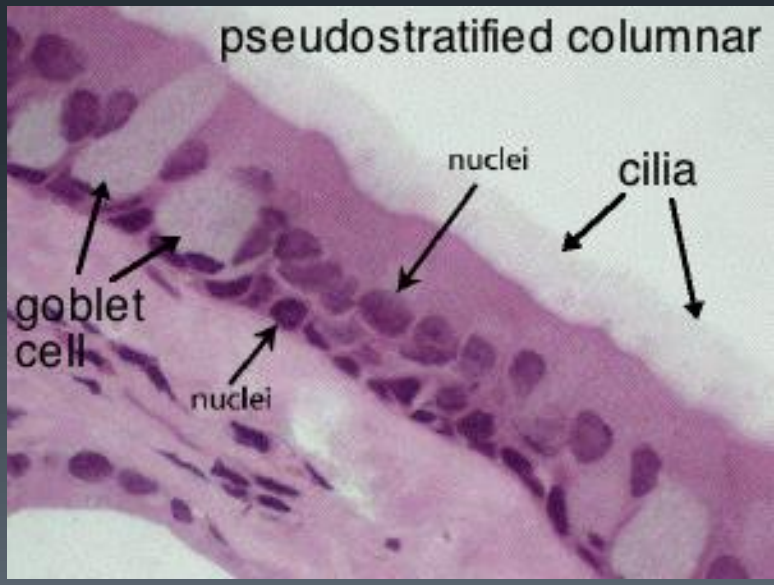


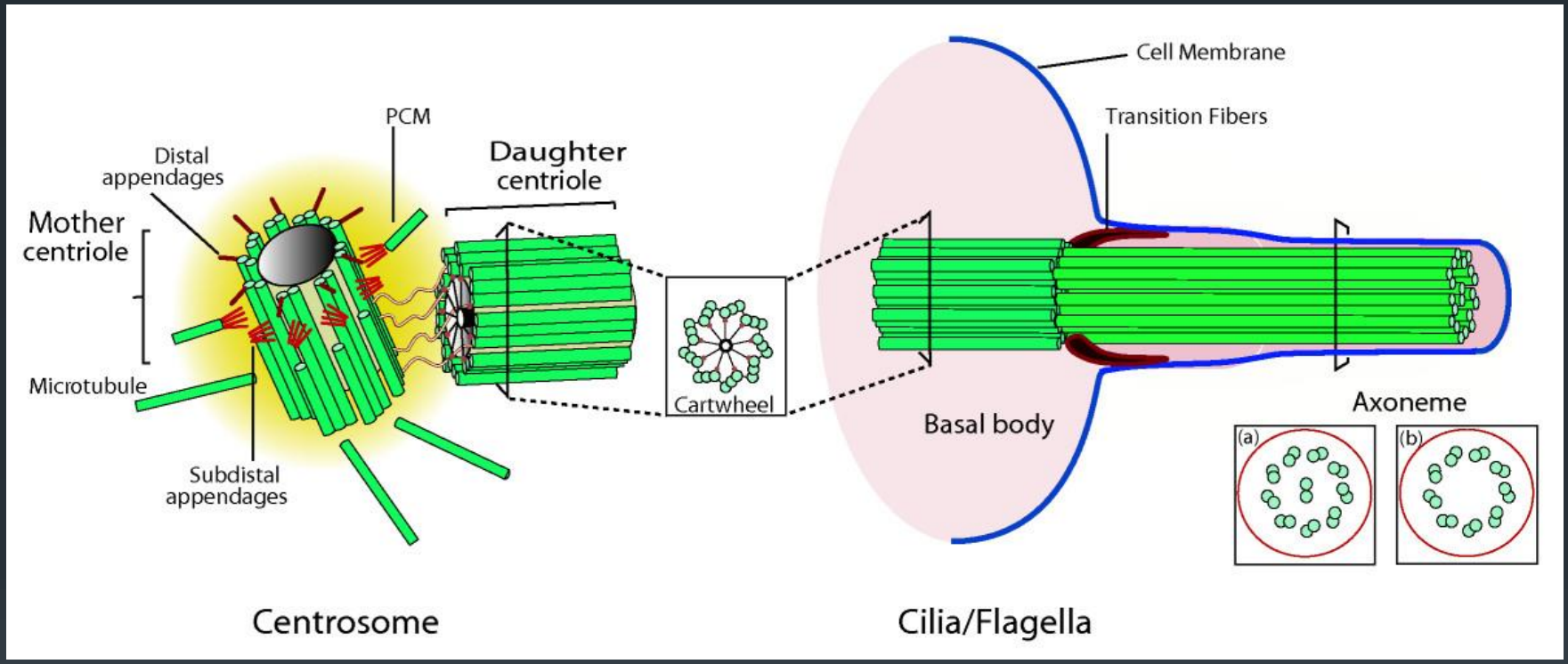
2.stericilia



Ciliated epithelium

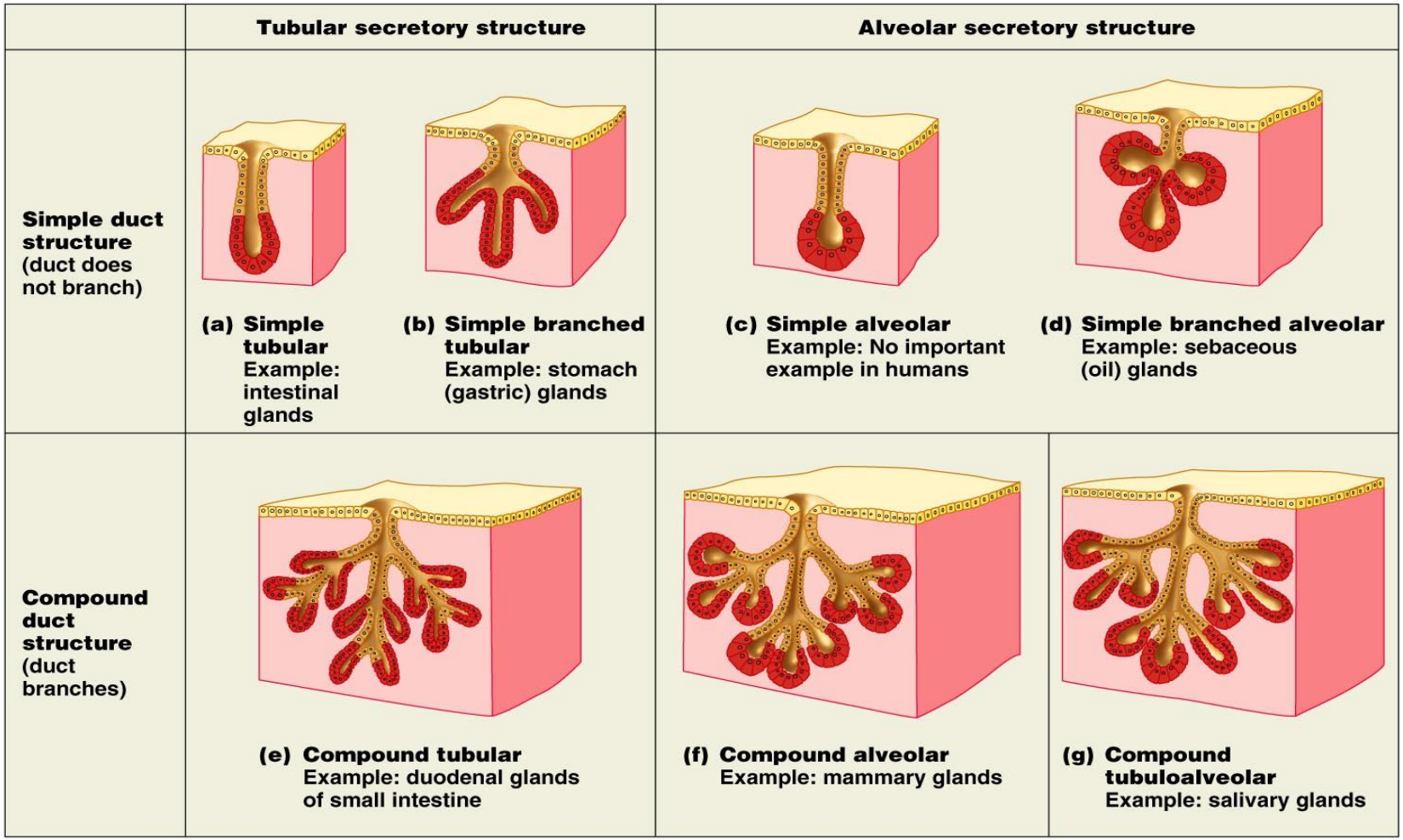
3. cilium




Cell Membrane
Transition Fibers
PCM
Distal appendages
Daughter centriole
Mother centriole
Microtubule
Cartwheel
Basal body
Axoneme
(a)
(b)
Subdistal appendages
Centrosome
Cilia/Flagella

Basal body

Glandular epithelium



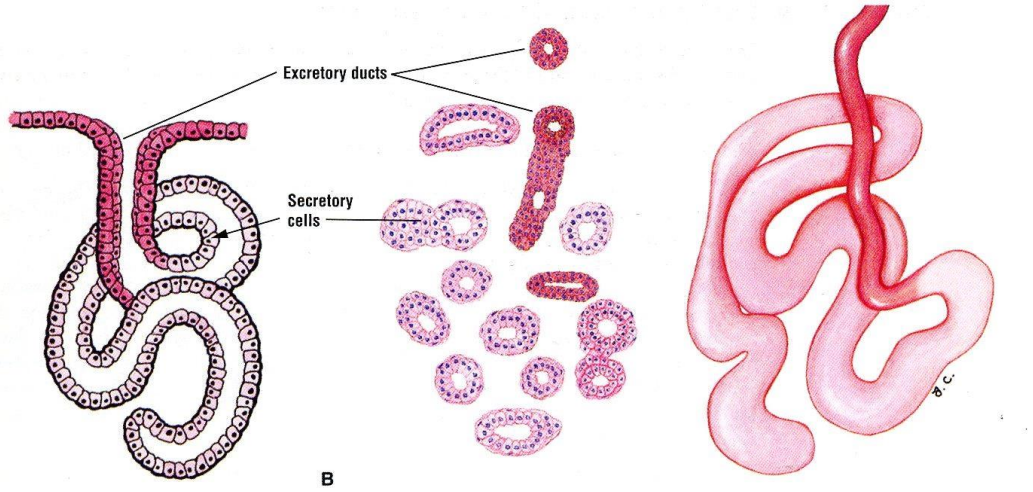


FIGURE 2.13 ■ Coiled tubular exocrine glands: sweat glands. **(A)** Diagram of gland. **(B)** Cross section. Stain: hematoxylin and eosin. Medium magnification.

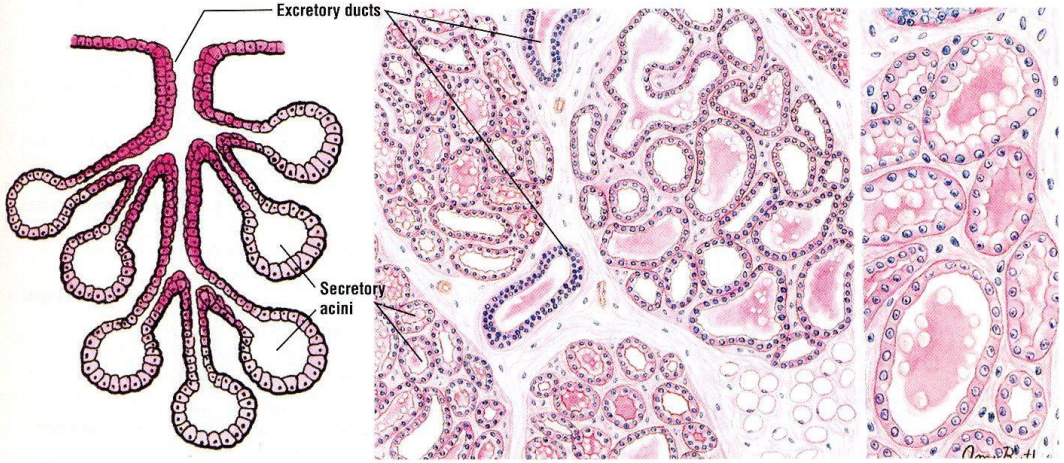
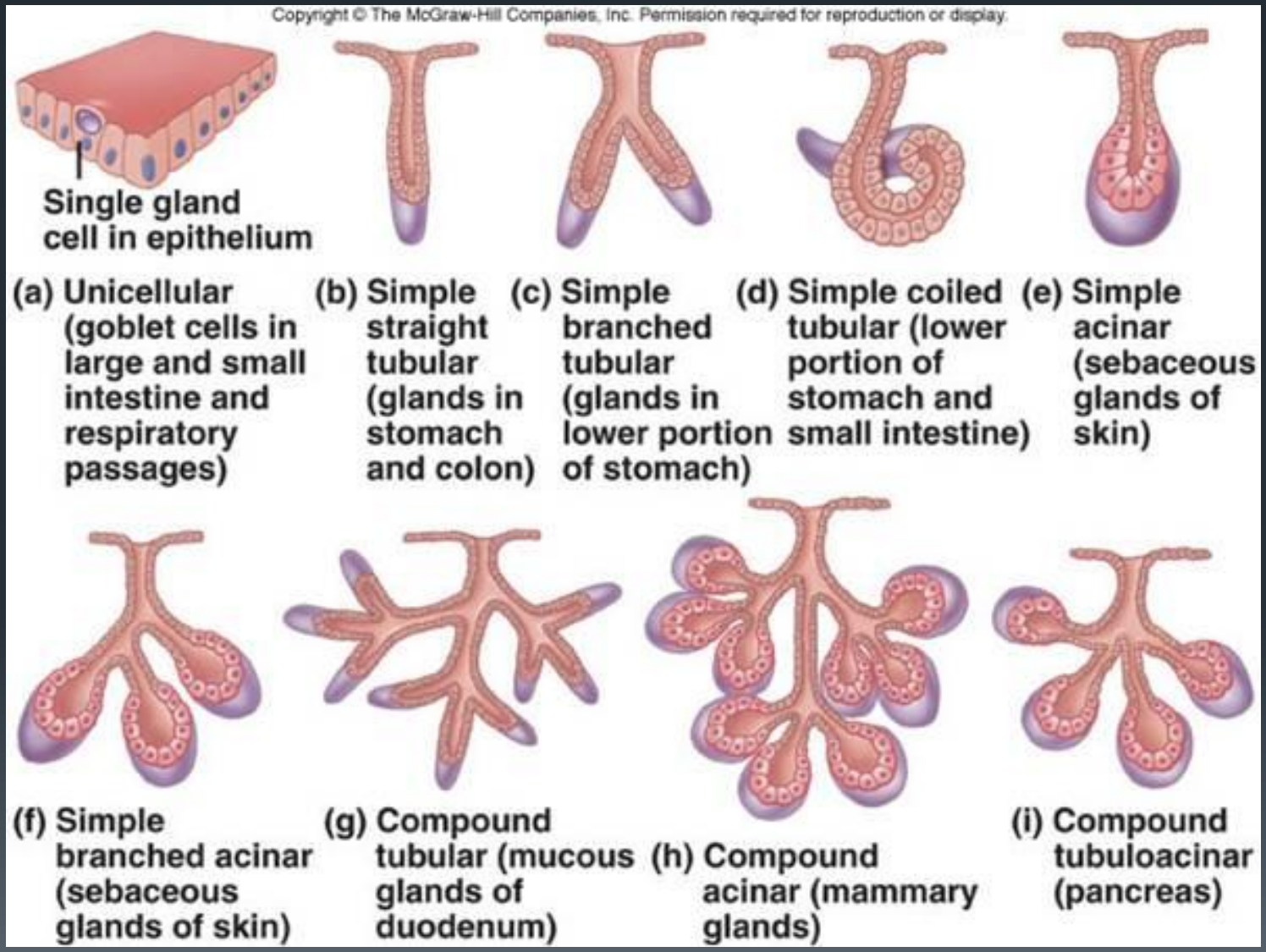
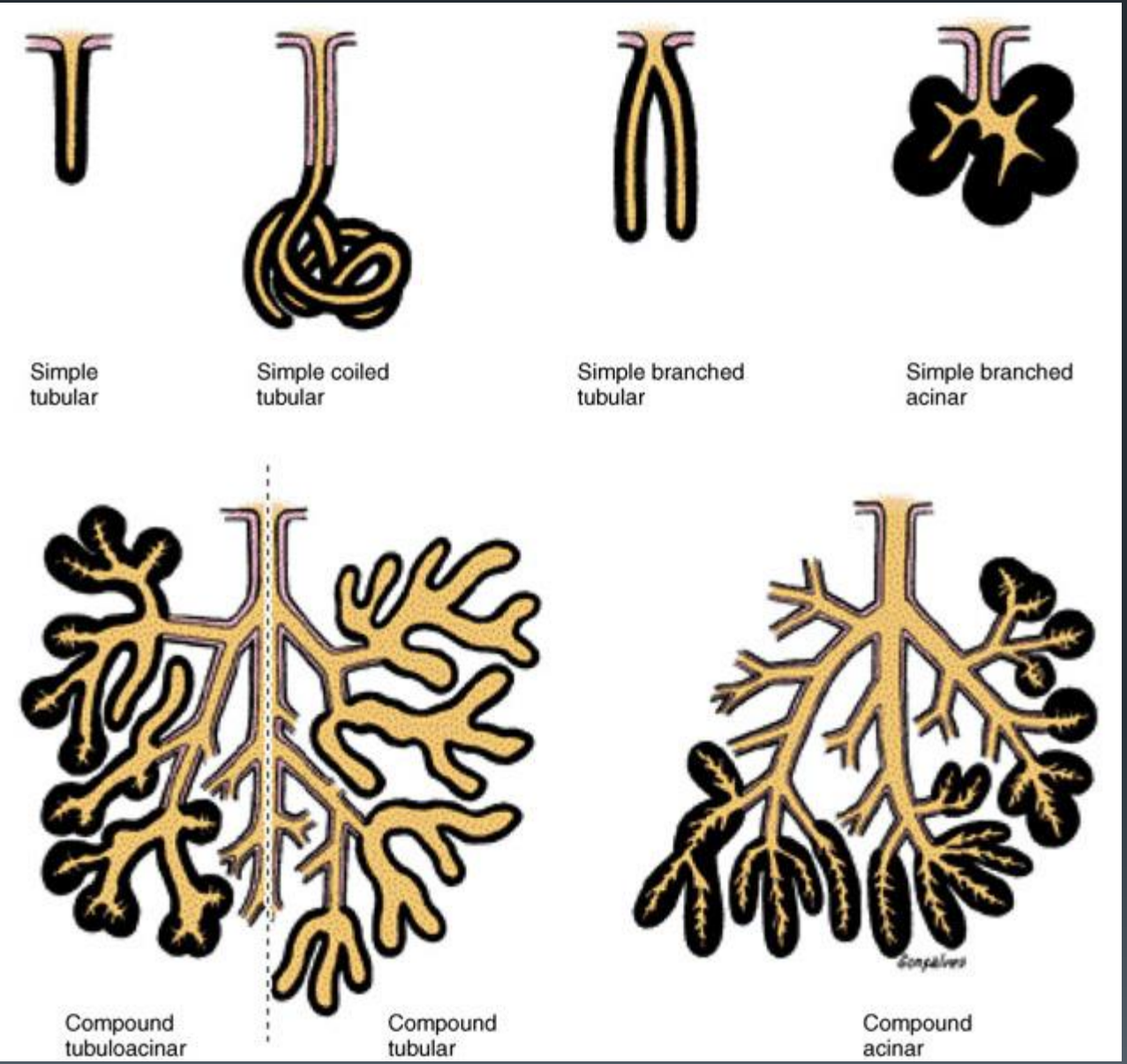
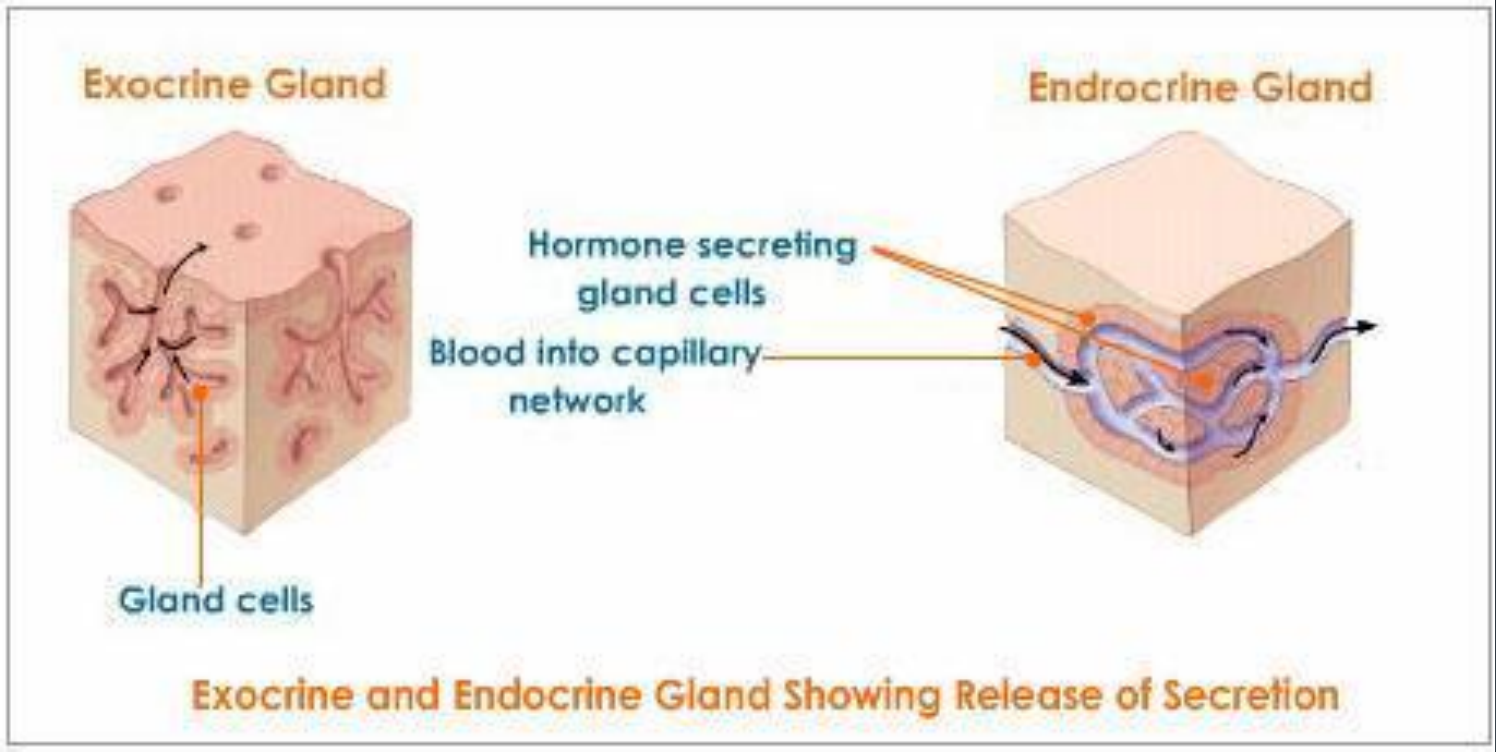


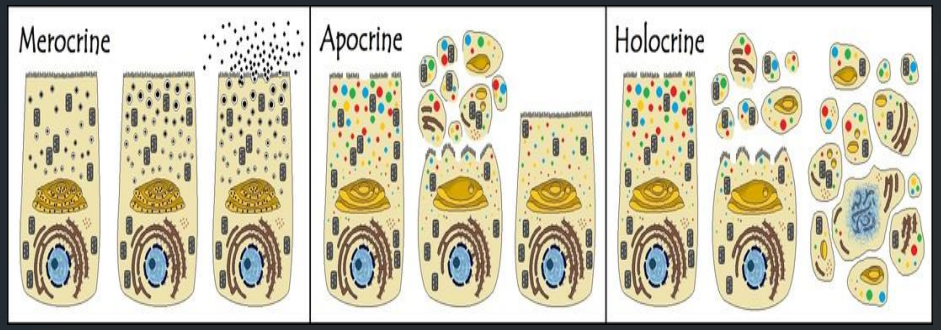
FIGURE 2.14 ■ Compound acinar exocrine gland: mammary gland. **(A)** Diagram of gland. **(B)** During lactation. Stain: hematoxylin and eosin. (A) Low magnification. (B) Medium magnification.

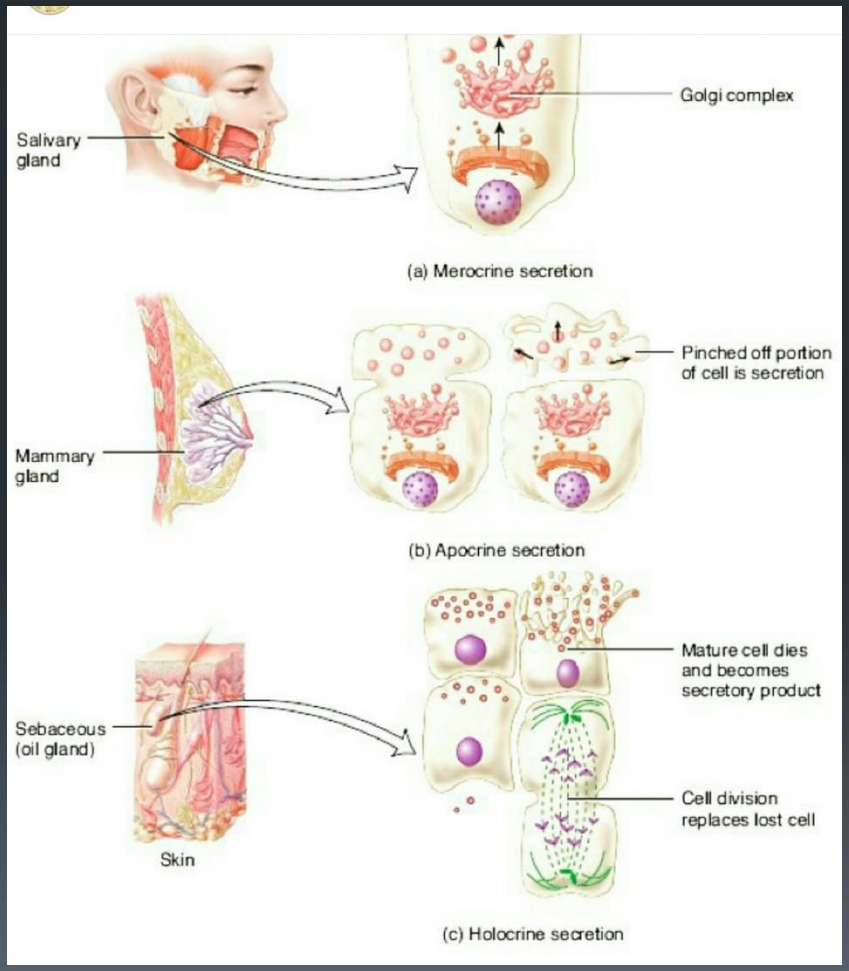



Simple tubular
Simple coiled tubular
Simple branched tubular
Simple branched acinar
Compound tubuloacinar
Compound tubular
Compound acinar

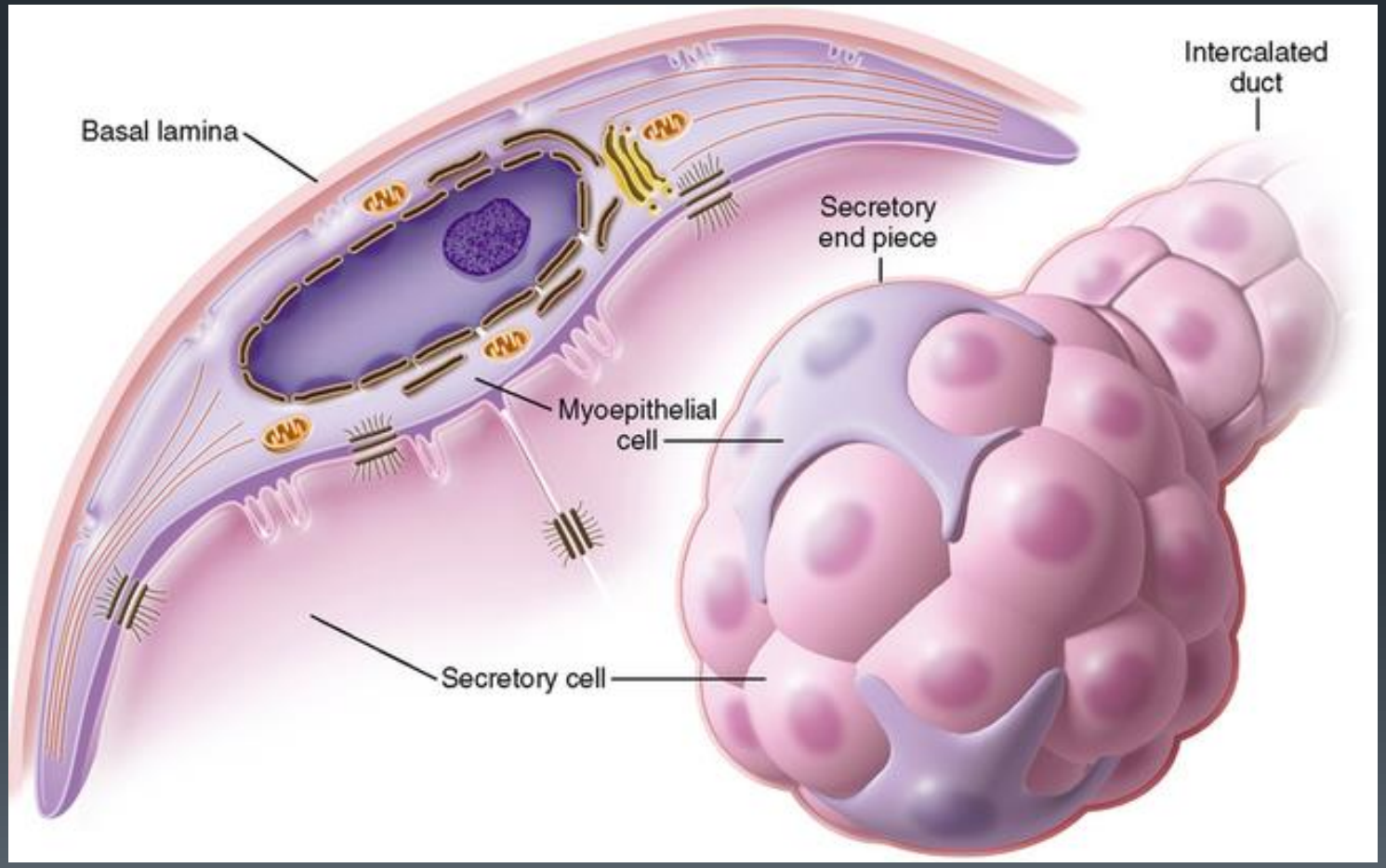


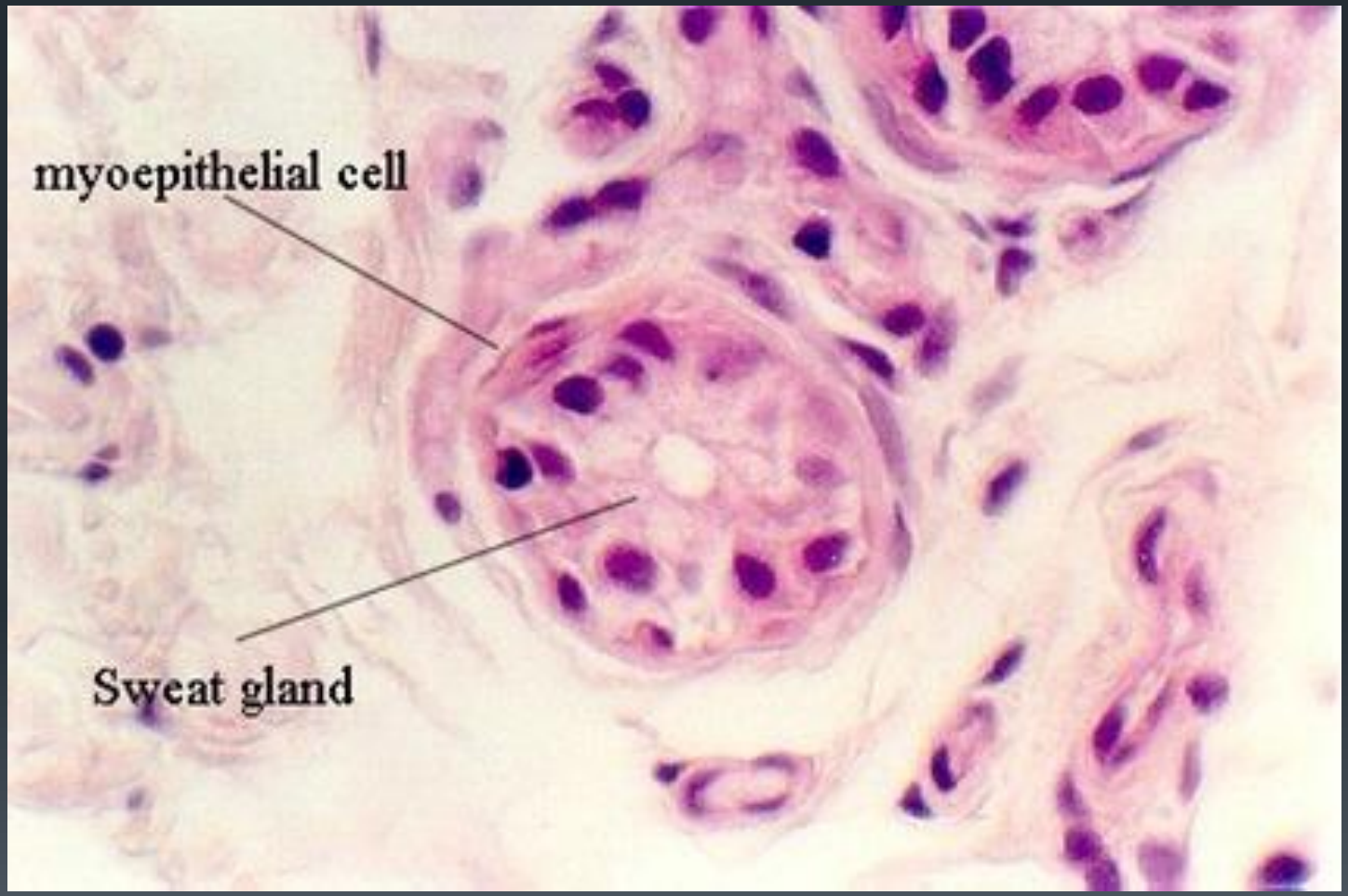
Exocrine and Endocrine Gland Showing Release of Secretion


Merocrine
Apocrine
Holocrine


Salivary gland
Golgi complex
(a) Merocrine secretion
Mammary gland
Pinched off portion of cell is secretion
(b) Apocrine secretion
Sebaceous (oil gland)
Skin
Mature cell dies and becomes secretory product
Cell division replaces lost cell
(c) Holocrine secretion

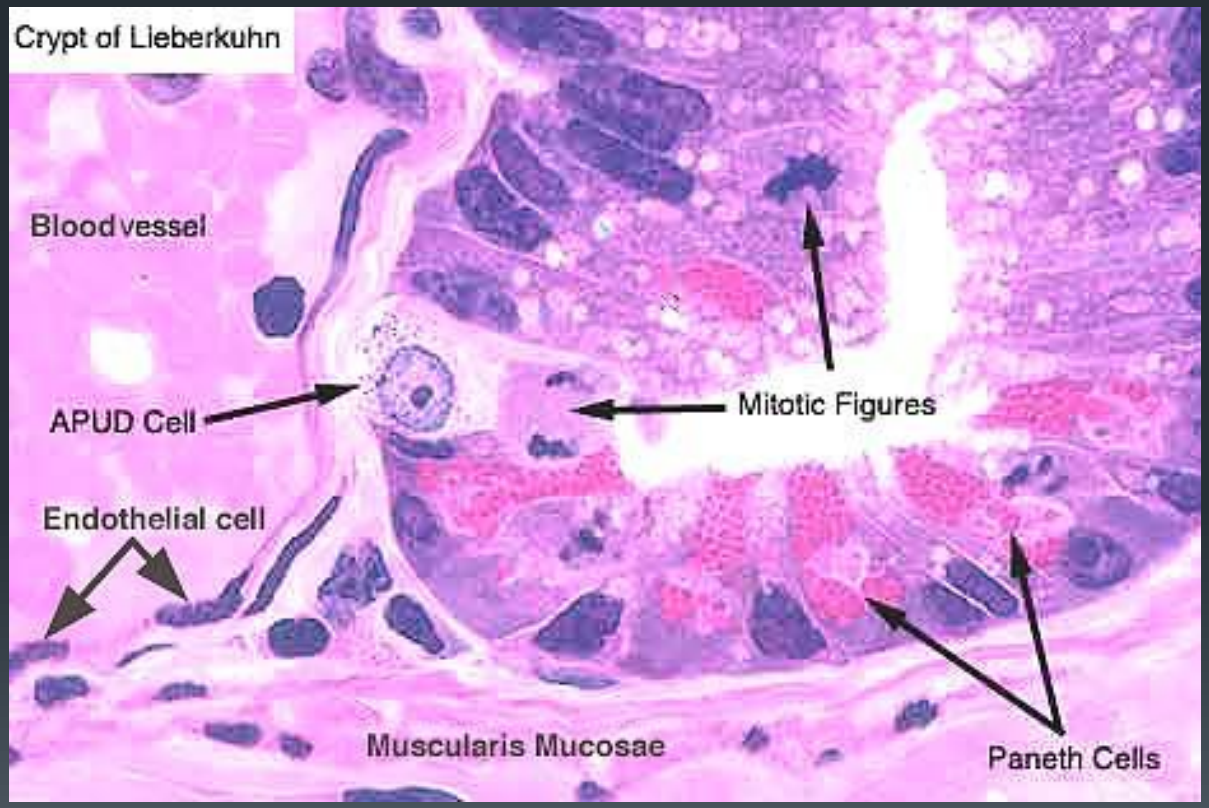
Myo-epithelial cells




myoepithelial cell
Sweat gland

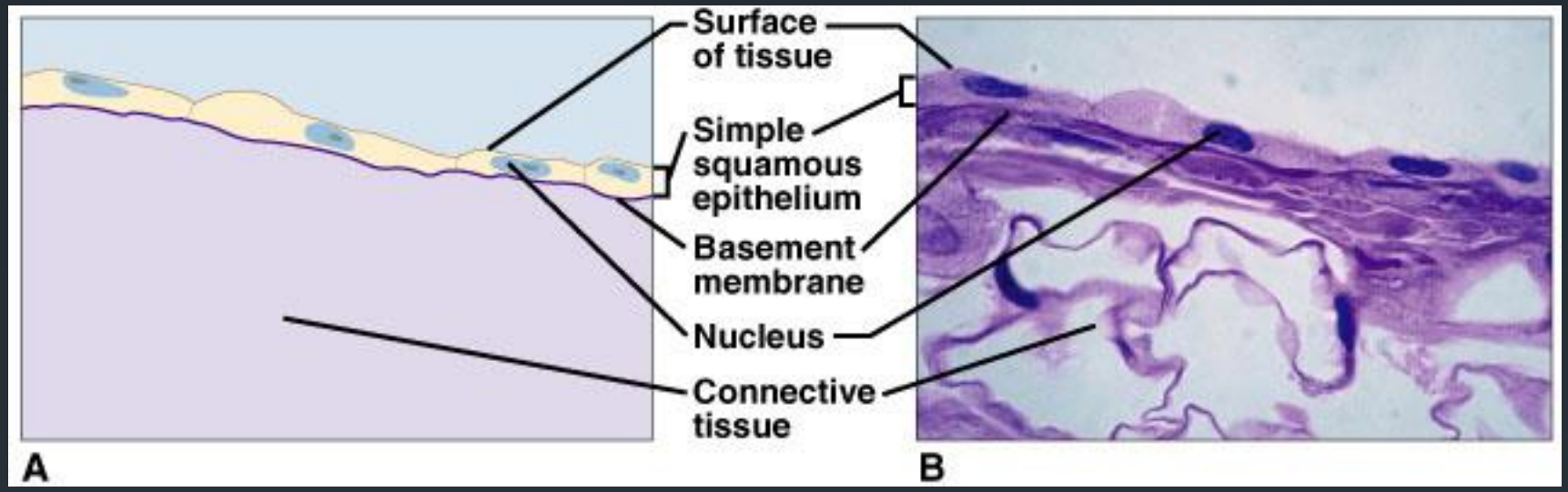
APUD cells

(*amine precursor uptake and decarboxylation*)



What kind of tissue does this represent?

Simple squamous epithelial tissue

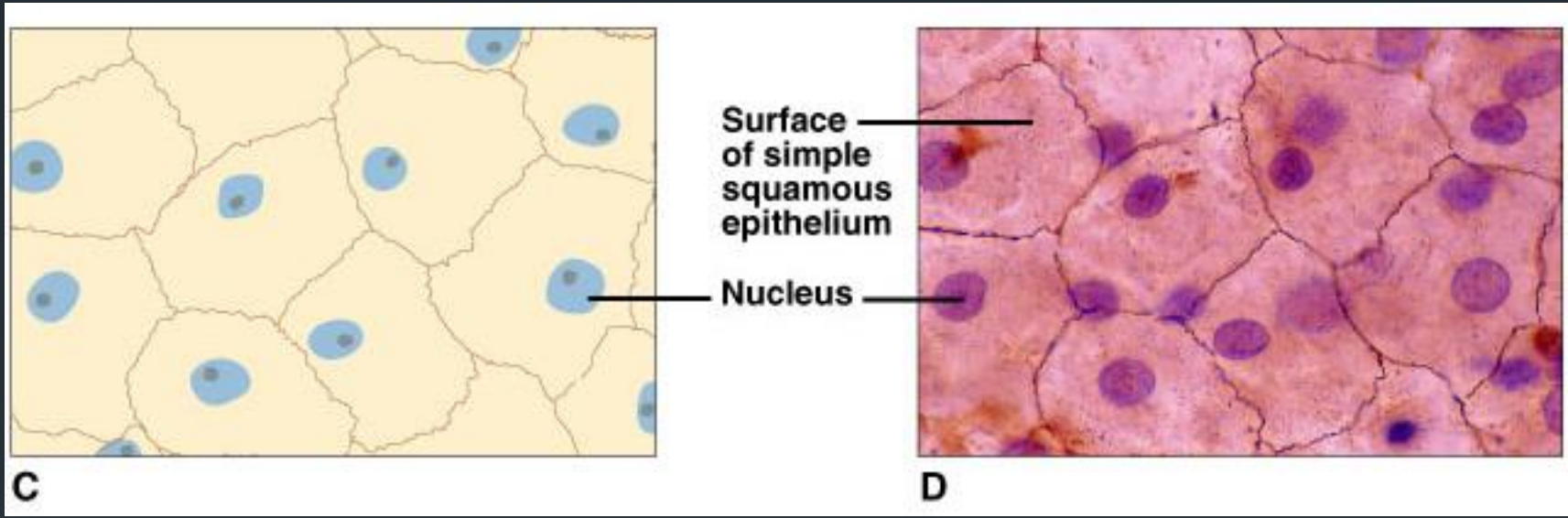


Where in the body would you find this tissue?

lungs

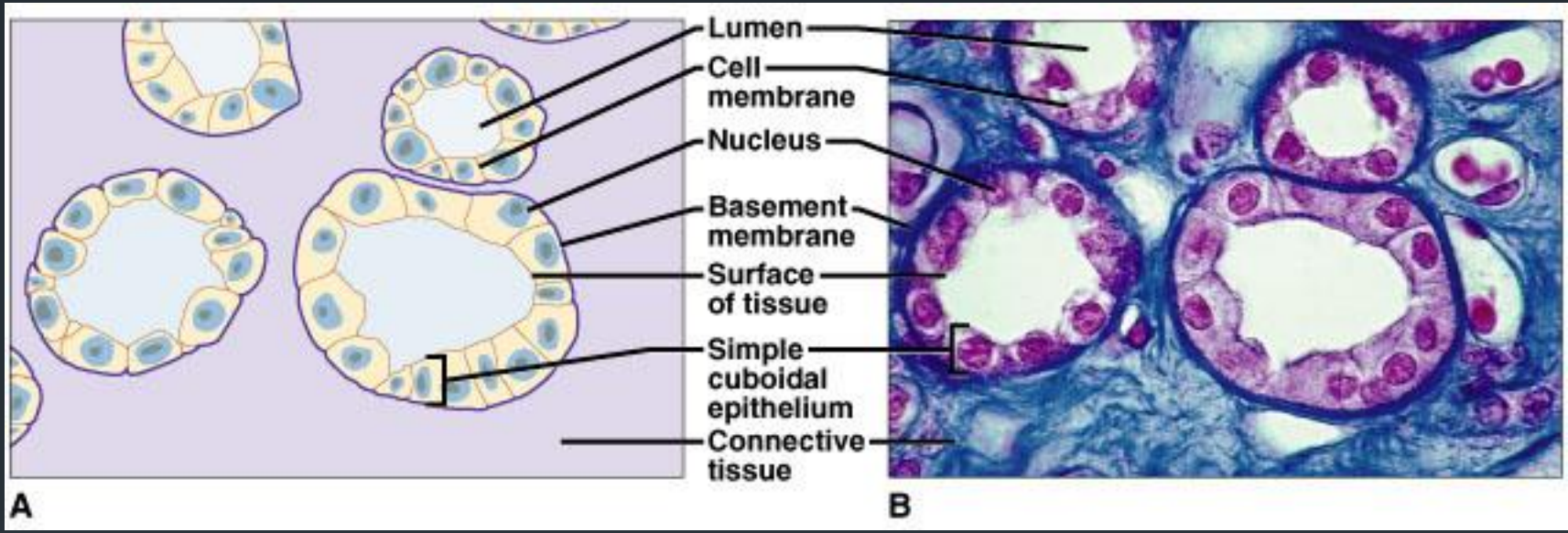
What kind of tissue does this represent?

Simple squamous epithelial tissue (superior view)



What kind of tissue does this represent?

Simple cuboidal epithelial tissue



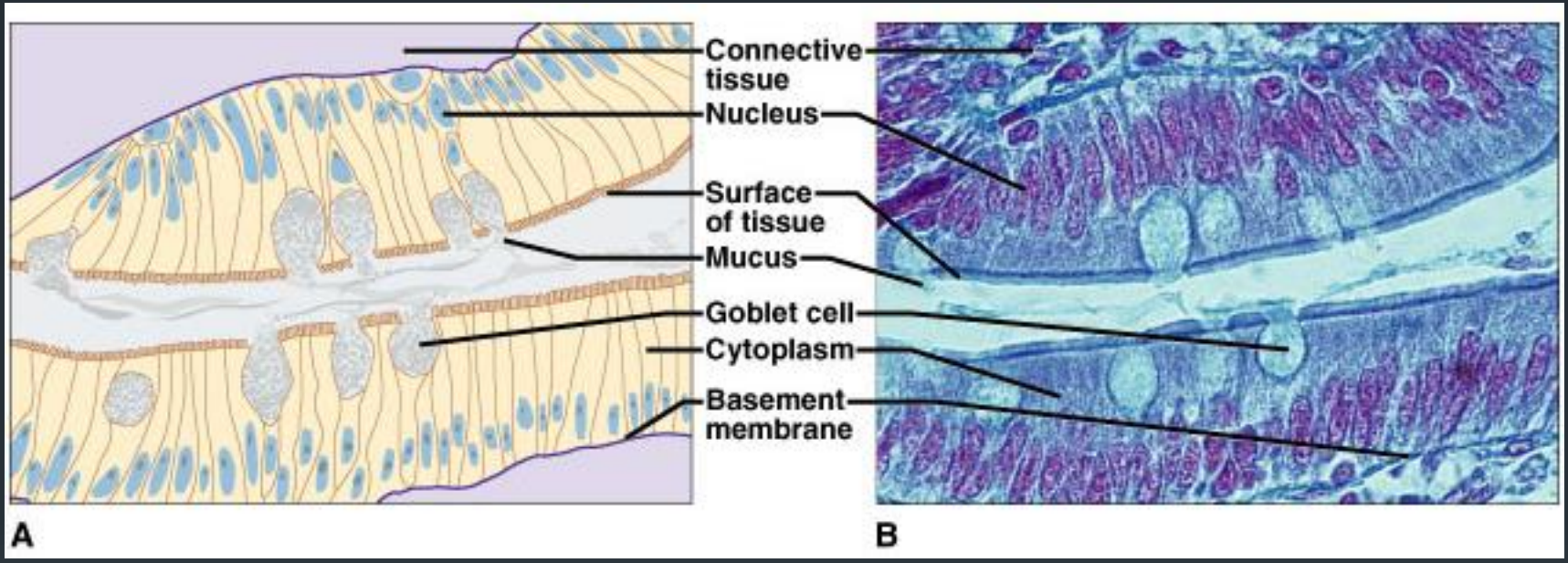
Where in the body would you find this tissue?

Kidneys (tubules)

The lining of the kidney glomerulus (sing.)/glomeruli (pl.) is simple squamous epithelial tissue

What kind of tissue does this represent?

Simple columnar epithelial tissue



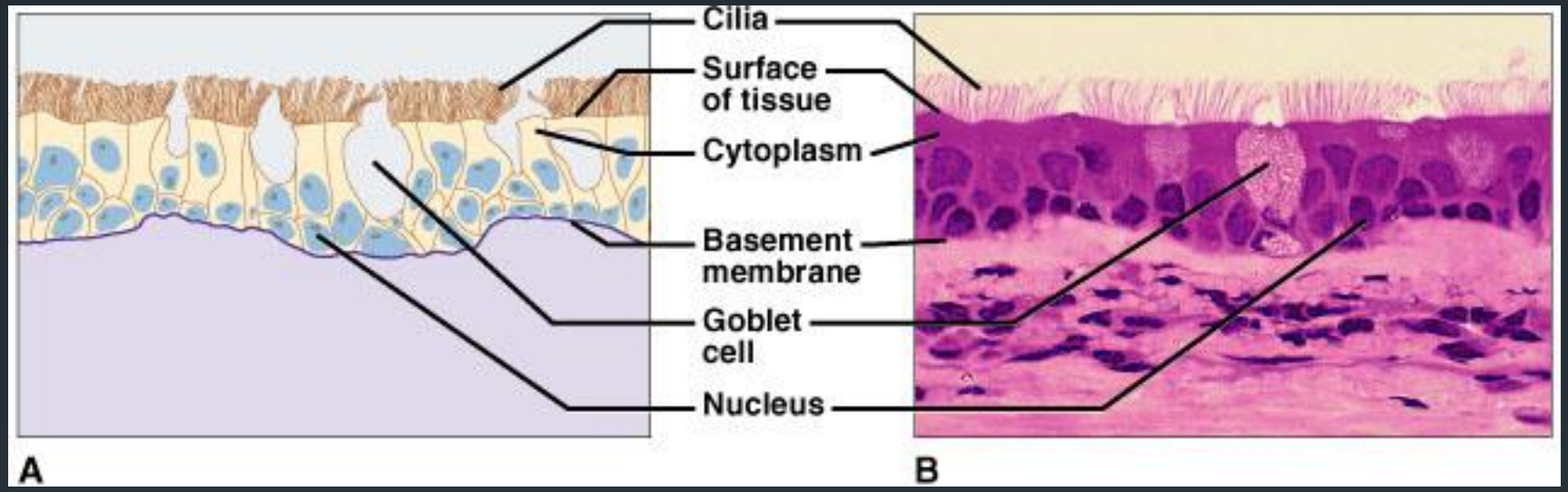
Where in the body would you find this tissue?

small intestine

What kind of tissue does this represent?

Pseudostratified (ciliated) columnar epithelial tissue

"false layered"; it looks like more than one layer, but it is not

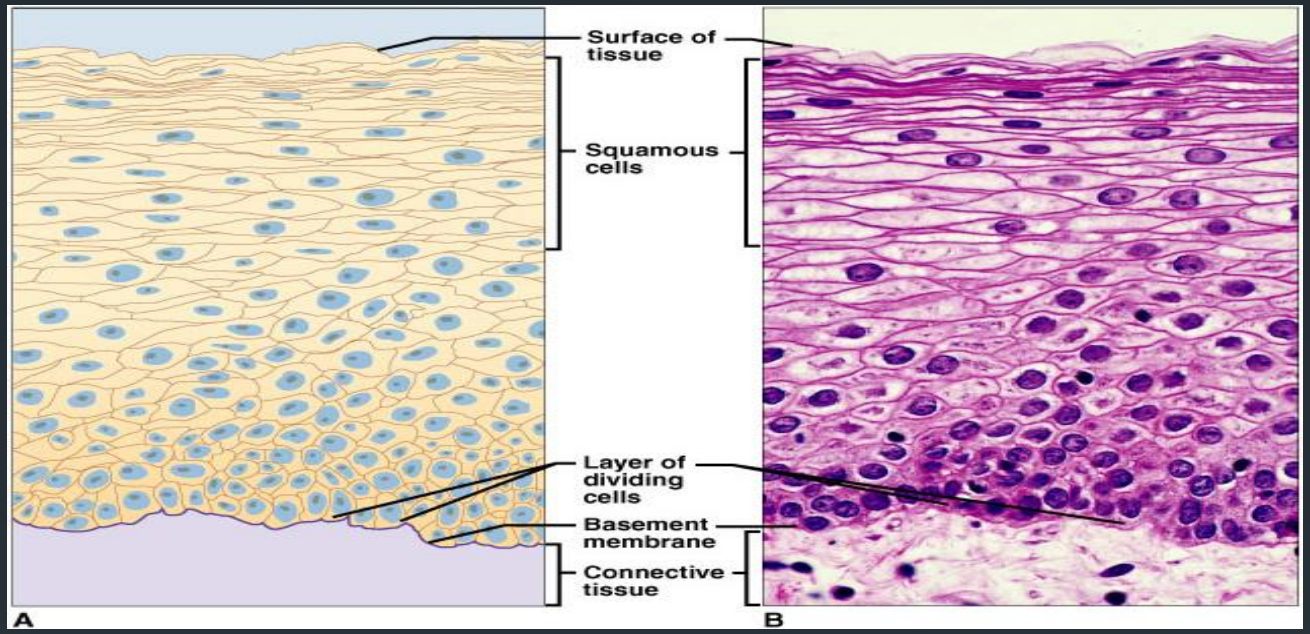


Where in the body would you find this tissue?

trachea lining

What kind of tissue does this represent?

Stratified squamous epithelial tissue

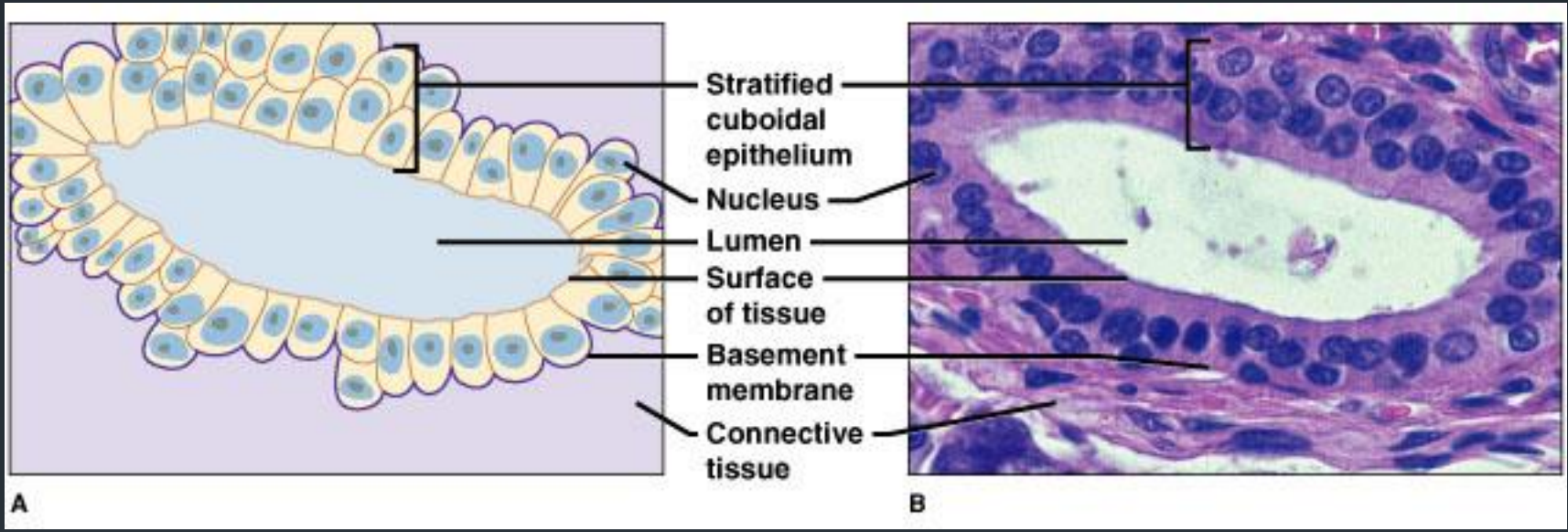


Where in the body would you find this tissue?

mouth lining

What kind of tissue does this represent?

Stratified cuboidal epithelial tissue

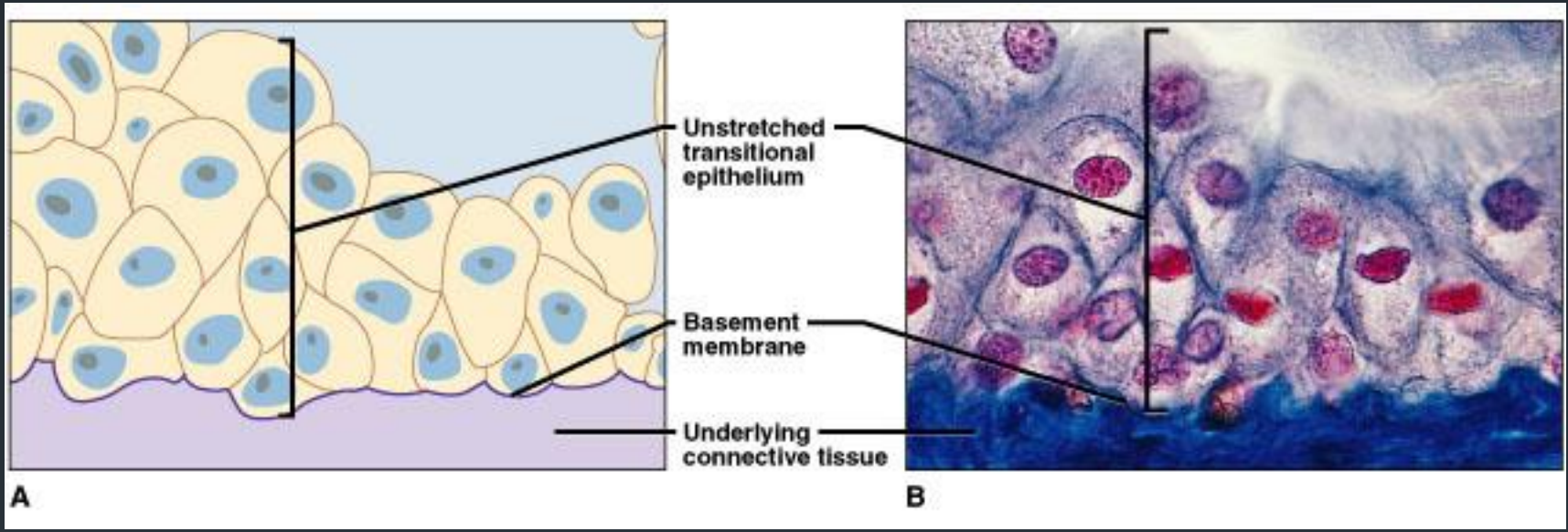


Where in the body would you find this tissue?

salivary glands, sweat glands

What kind of tissue does this represent?

Transitional epithelial tissue

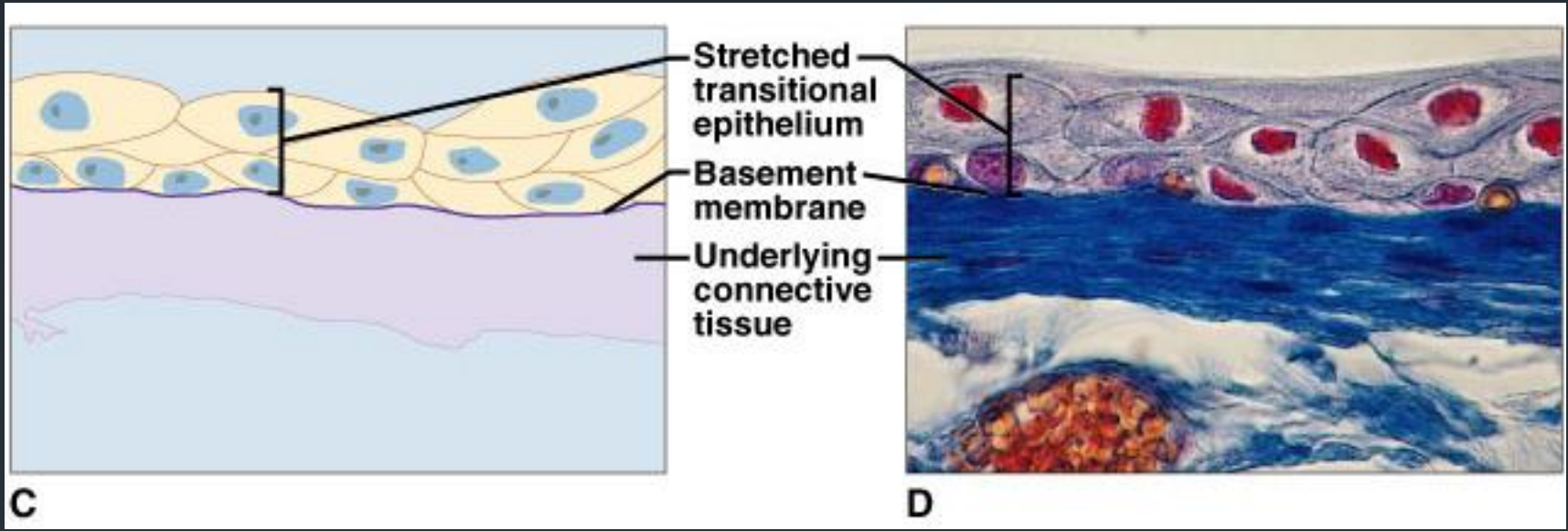


Where in the body would you find this tissue?

<u>empty</u> bladder

What kind of tissue does this represent?

Transitional epithelial tissue



Where in the body would you find this tissue?

distended (full) bladder


22