Tissues

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Before we start the stain

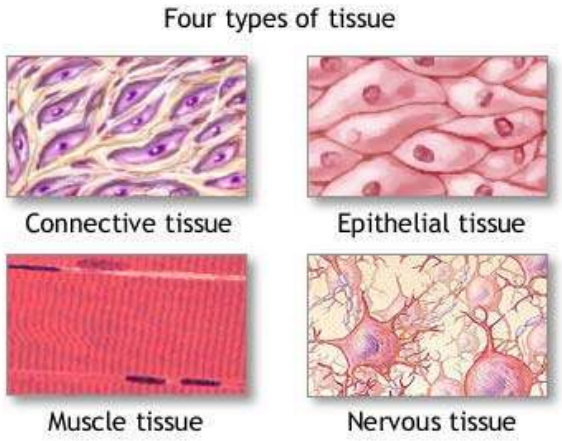
What is used for which color

- **Hematoxylin and Eosin (H&E)**: **This is the most commonly used stain in histology. Hematoxylin stains acidic structures such as nucleic acids (DNA, RNA) and basophilic structures (e.g., cell nuclei) blue-purple, while eosin stains basic structures such as cytoplasm and extracellular matrix pink-red. H&E staining provides excellent contrast and allows for the visualization of cellular morphology and tissue architecture.**

- **Periodic Acid-Schiff (PAS)**: PAS stain is used to detect polysaccharides, such as glycogen, mucopolysaccharides, and glycoproteins, in tissues. It stains these substances magenta, providing contrast against the background. PAS staining is commonly used to highlight structures like glycogen in liver cells and mucin in goblet cells of the gastrointestinal tract.
- **Masson's Trichrome**: Masson's trichrome stain is used to differentiate collagen (stains blue), muscle fibers (stains red), and cytoplasmic structures (stains pink). It is particularly useful for distinguishing between different types of connective tissues, such as collagen-rich fibrous tissue and smooth muscle.
- **Giemsa**: Giemsa stain is commonly used for staining blood smears to visualize blood cells and for detecting microorganisms, such as bacteria and parasites. It stains nuclei blue-purple and cytoplasm pink, allowing for the identification of different cell types and pathogens.
- **Wright-Giemsa**: Wright-Giemsa stain is similar to Giemsa stain but includes a mixture of dyes that provide better differentiation of blood cell types. It is commonly used for staining blood smears for the identification of white blood cells, red blood cells, and platelets.
- **Silver Stains**: Silver stains, such as the Gomori methenamine silver (GMS) stain and the Warthin-Starry stain, are used to visualize structures such as fungi, reticular fibers, and neurofibrils. These stains use silver ions to selectively bind to specific tissue components, resulting in black or dark brown staining.

Tissues

- Groups of cells similar in structure and function
- The four types of tissues
  - Epithelial
  - Connective
  - Muscle
  - Nerve



Epithelial Tissue

- Cellularity – composed almost entirely of cells
- Special contacts – form continuous sheets held together by tight junctions and desmosomes
- Polarity – apical and basal surfaces

Epithelial Tissue

- Supported by connective tissue – reticular and basal laminae
- Avascular but innervated – contains no blood vessels but supplied by nerve fibers
- Regenerative – rapidly replaces lost cells by cell division

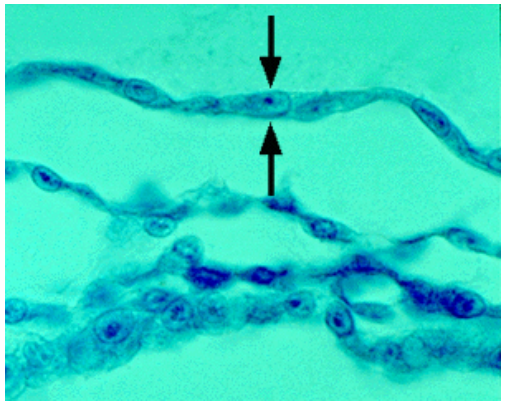
Function of the epithelial tissue

- **Protection** Epithelial cells from the skin *protect underlying tissue from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water*.
- **Sensation** Sensory stimuli *penetrate specialized epithelial cells*. Specialized epithelial tissue containing sensory nerve endings is found in the skin, eyes, ears, nose and on the tongue.
- **Secretion** In glands, epithelial tissue is specialized to *secrete specific chemical substances* such as enzymes, hormones and lubricating fluids.
- **Absorption** Certain epithelial cells lining the small intestine *absorb nutrients from the digestion of food*.
- **Excretion** Epithelial tissues in the kidney *excrete waste products from the body and reabsorb needed materials from the urine*. *Sweat* is also excreted from the body by epithelial cells in the sweat glands.

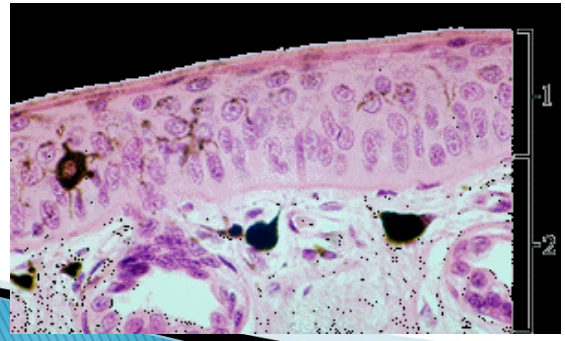
Function

- **Diffusion** Simple epithelium *promotes the diffusion of gases, liquids and nutrients*.
  - Because they form such a thin lining, they are ideal for the diffusion of gases (eg. walls of capillaries and lungs).
- **Cleaning** Ciliated epithelium assists in *removing dust particles and foreign bodies* which have entered the air passages.
- **Reduces Friction** The smooth, tightly-interlocking, epithelial cells that line the entire circulatory system *reduce friction between the blood and the walls of the blood vessels*.

Classification of Epithelia



- Simple
  or
  stratified



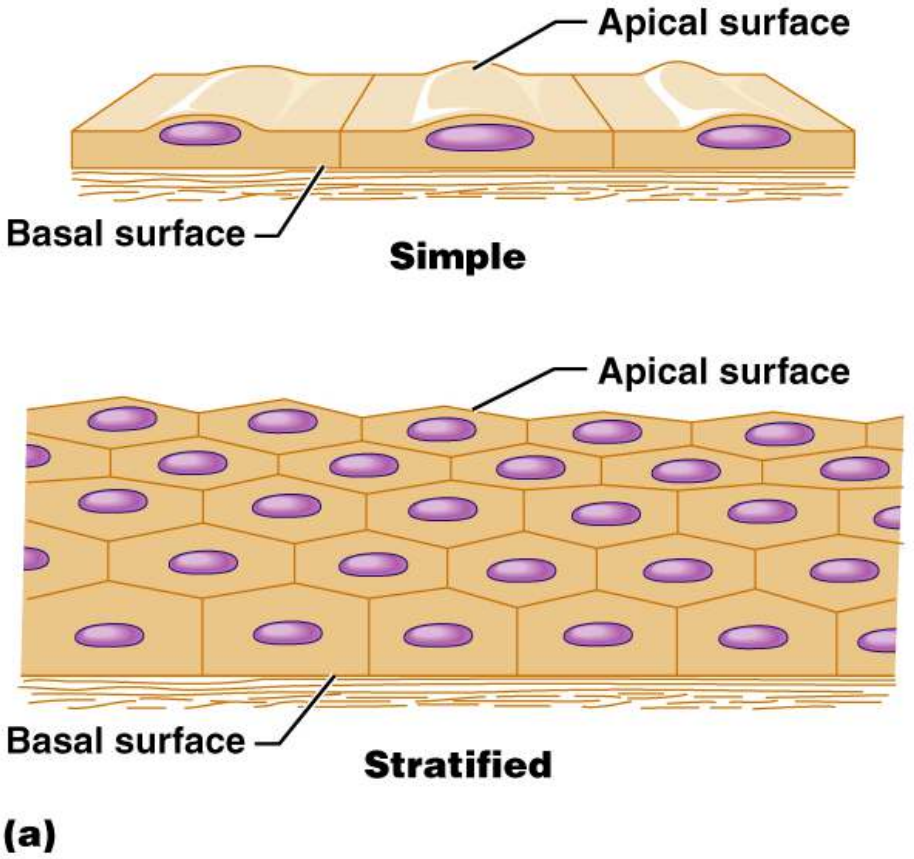
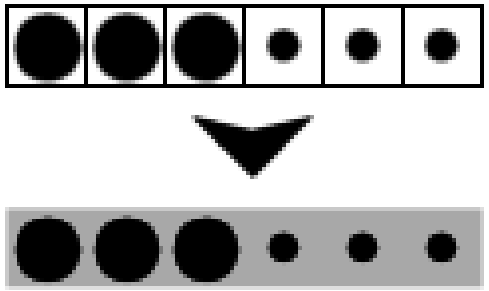


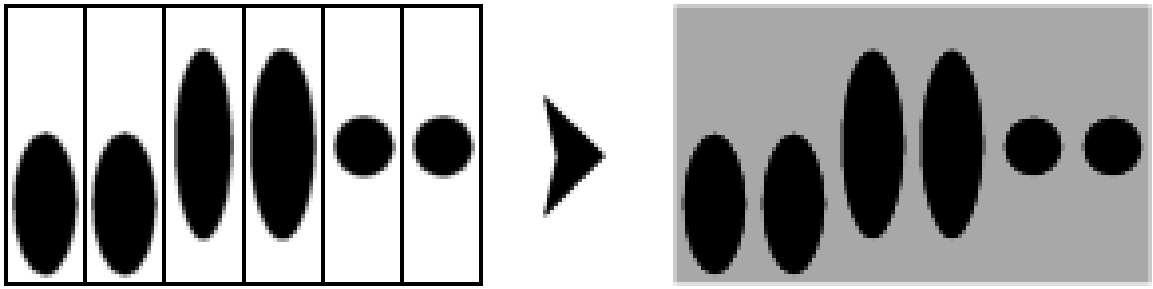
Figure 4.1a

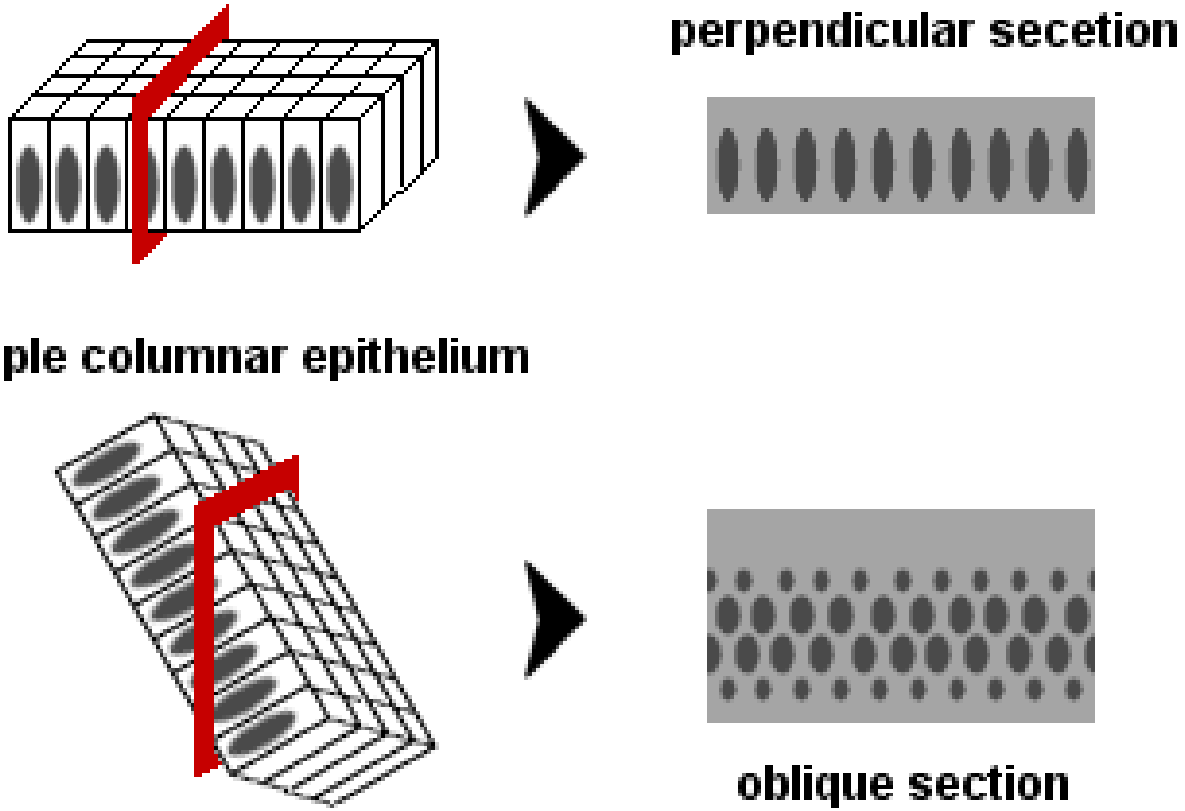
squamous cells

cuboidal cells



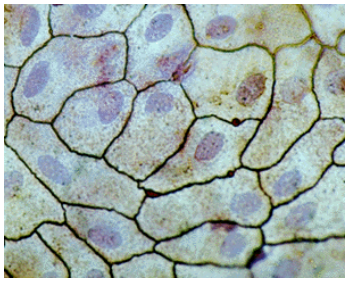
columnar cells

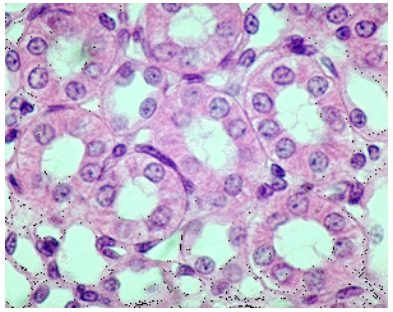


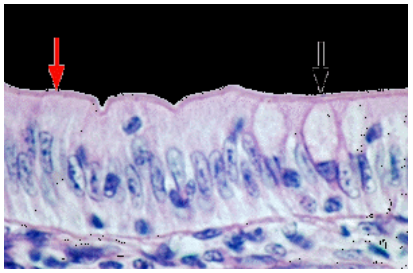

perpendicular secetion
simple columnar epithelium
oblique section

Classification of Epithelia

- Squamous, cuboidal, or columnar







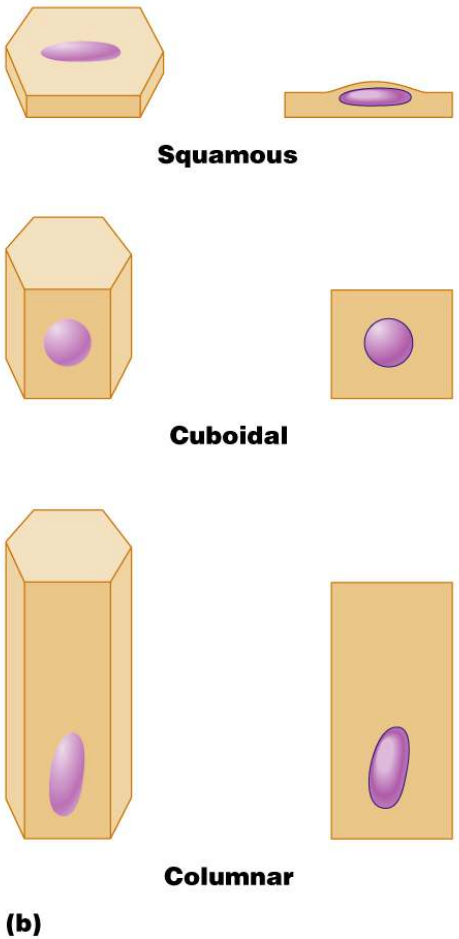


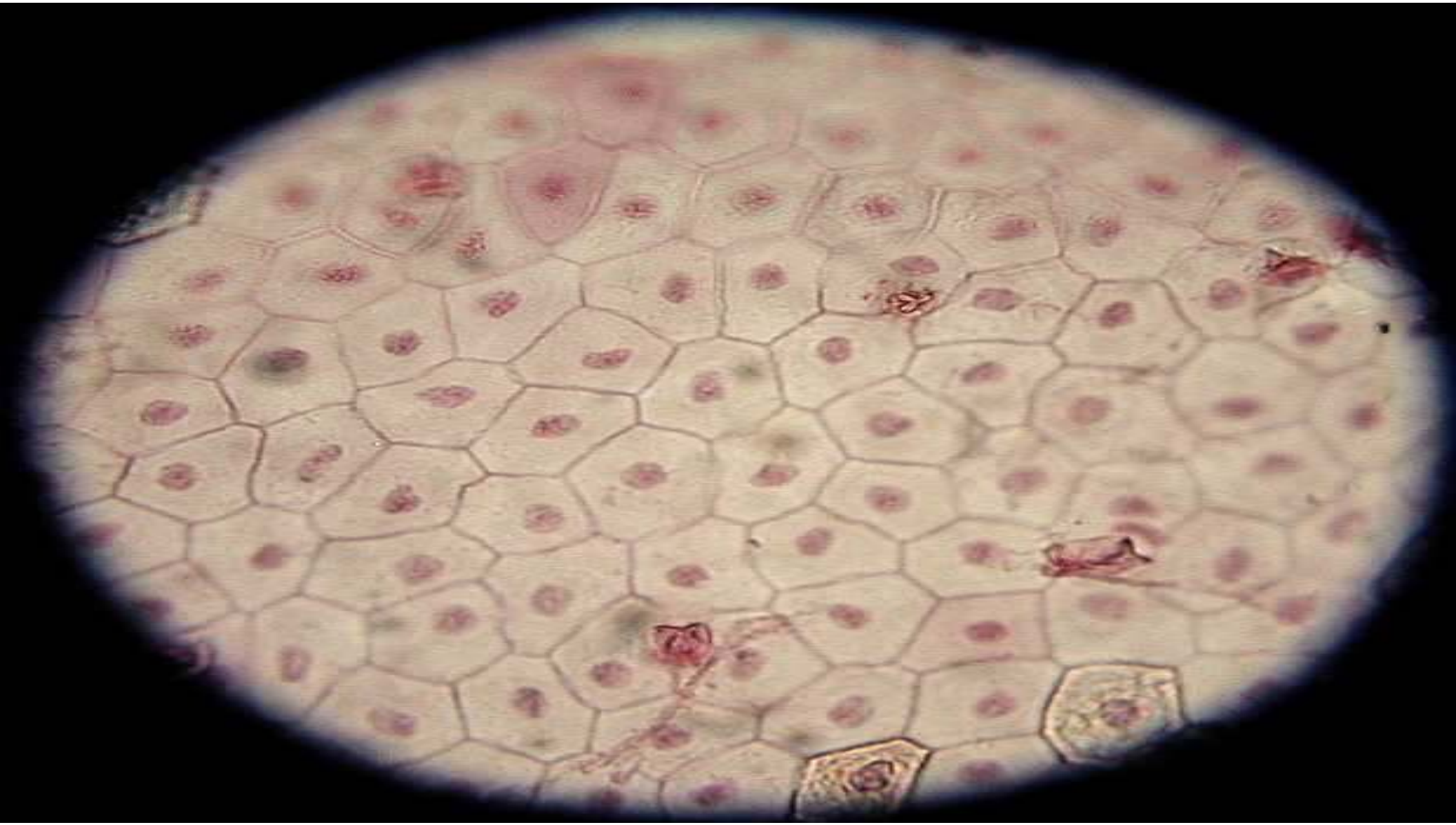
Figure 4.1b

Epithelia: Simple Squamous

- Single layer of flattened cells with disc-shaped nuclei and sparse cytoplasm

- *Functions*
  - *Diffusion and filtration*
  - *Provide a slick, friction-reducing lining in lymphatic and cardiovascular systems*

- Present in the
  - kidney glomeruli,
  - lining of heart,
  - blood vessels [endothelial cell],
  - lymphatic vessels,
  - and serosa [pleuretic,pericardial,peritoneal,meningial]



Lining of blood vessels (endothelium): Simple squamous epithelium forms the inner lining of blood vessels, known as the endothelium.

- This thin layer allows for the exchange of gases, nutrients, and waste products between the blood and surrounding tissues.

Alveoli of the lungs: The walls of the alveoli (air sacs) in the lungs are composed of simple squamous epithelium.

- This structure facilitates the diffusion of oxygen from the air into the bloodstream and the removal of carbon dioxide from the bloodstream into the air.

Serous membranes: Simple squamous epithelium lines the serous membranes that surround various organs within body cavities, such as the

  - **pleura (around the lungs),**
  - **pericardium (around the heart),**
  - **peritoneum (around the abdominal organs).**

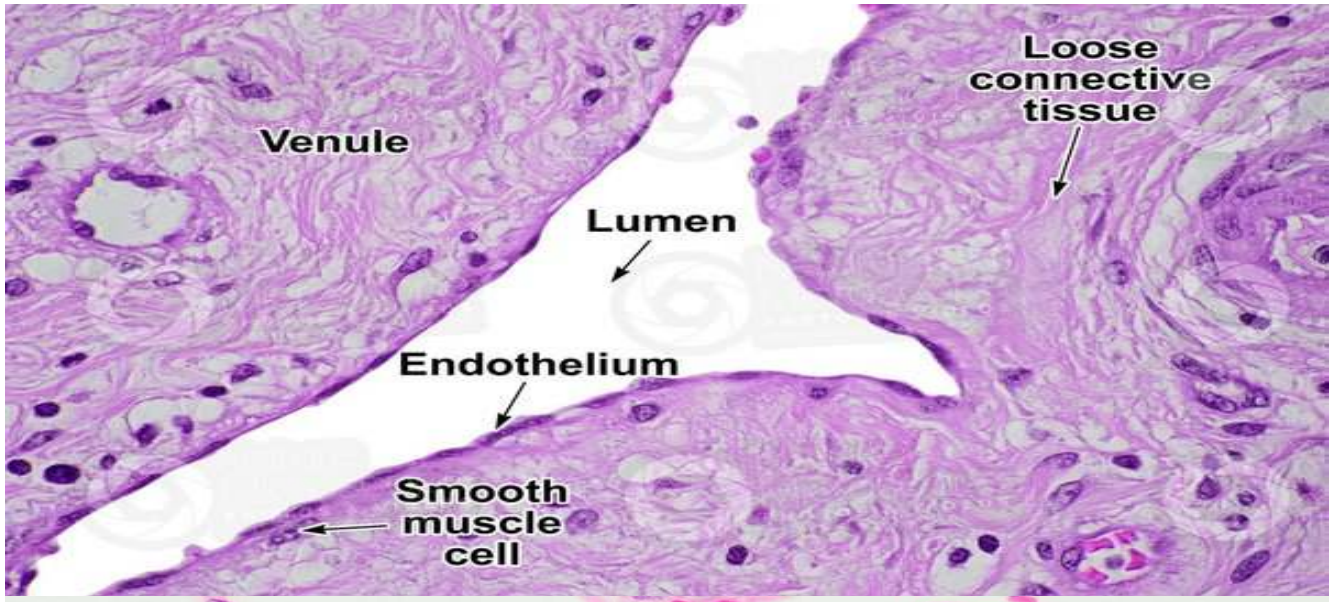
- These membranes secrete a lubricating fluid that reduces friction between organs during movement.

Kidney glomeruli: The glomeruli of the kidneys are composed of simple squamous epithelium. These structures are involved in the initial filtration of blood to form urine, allowing small molecules such as water, ions, and waste products to pass through while retaining larger molecules such as proteins.

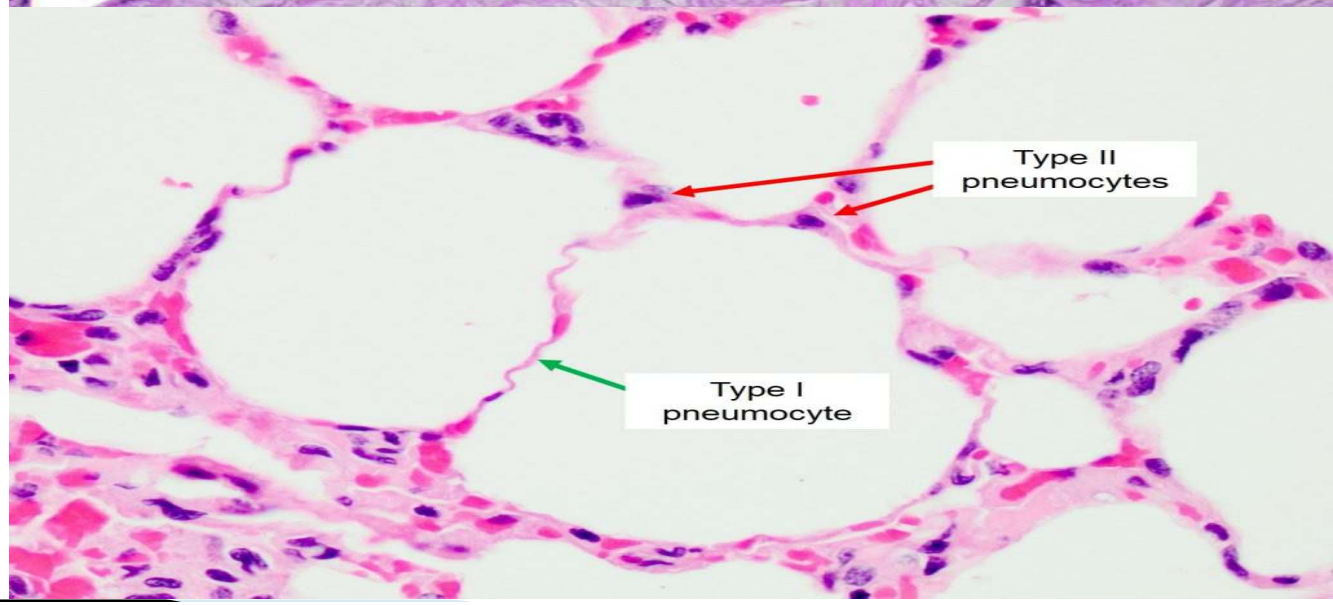
Inner surface of the tympanic membrane (eardrum): The inner surface of the tympanic membrane, which separates the external ear from the middle ear, is lined with simple squamous epithelium.

- This thin layer allows for the transmission of sound vibrations from the external environment to the middle ear.

Lining of blood vessels (endothelium):

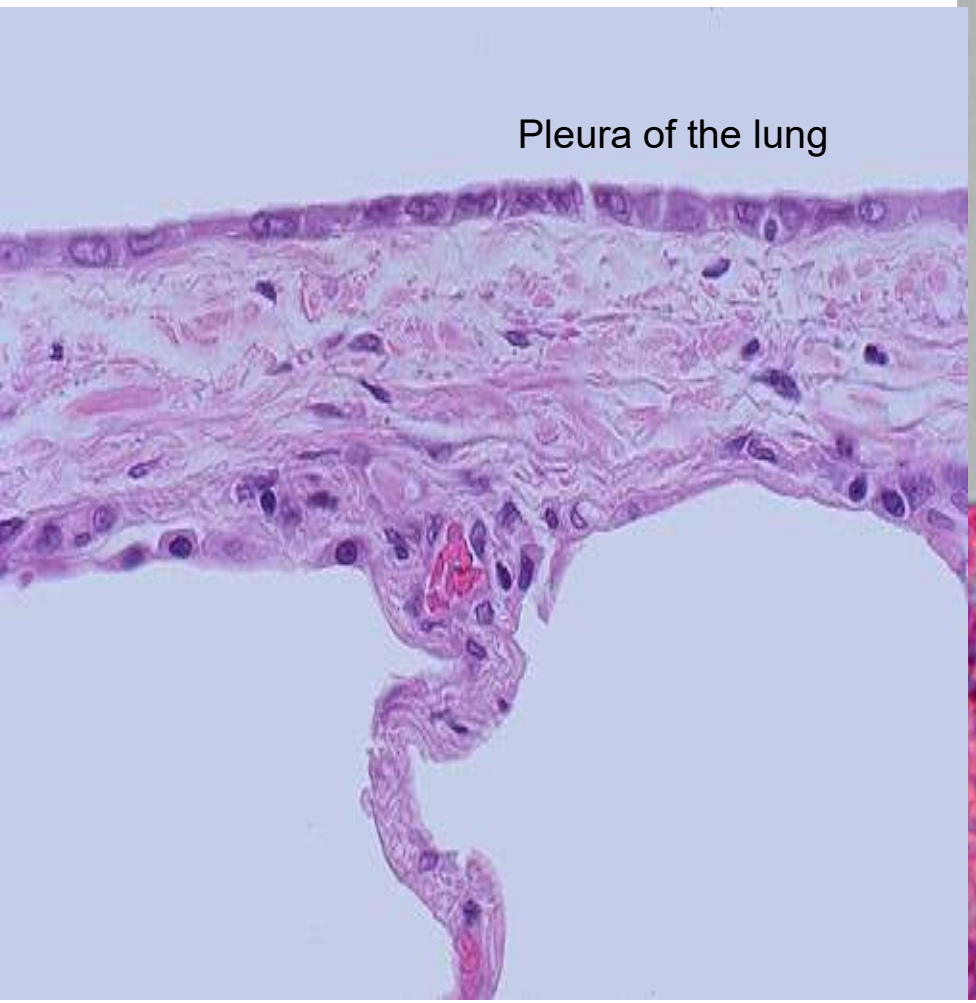


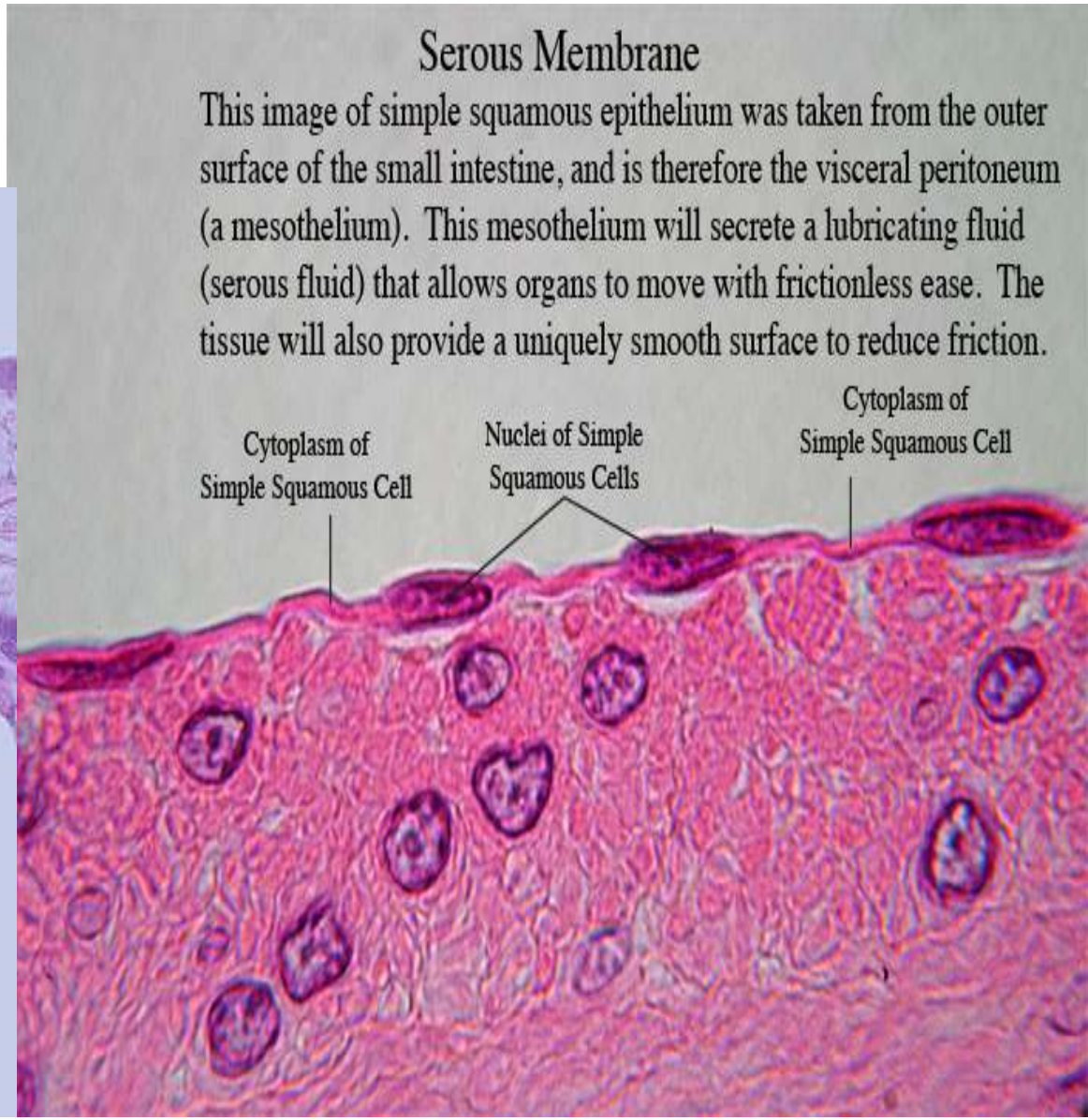
Alveoli of the lungs



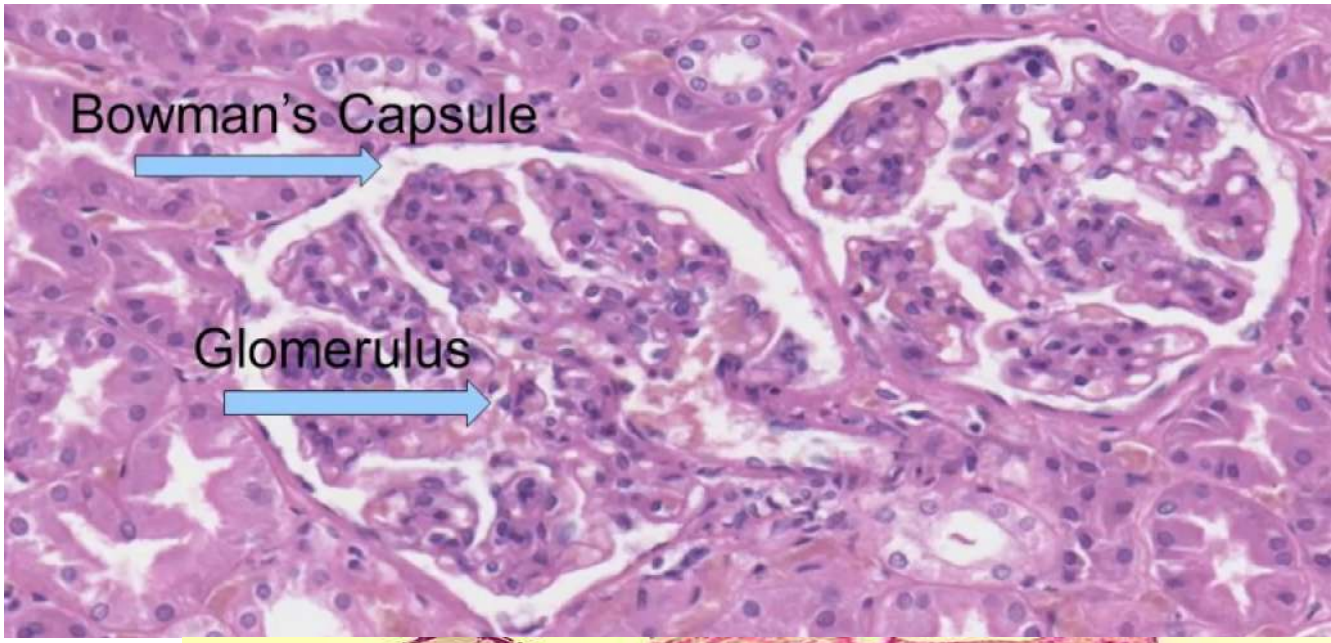
Serous membranes

Pleura of the lung

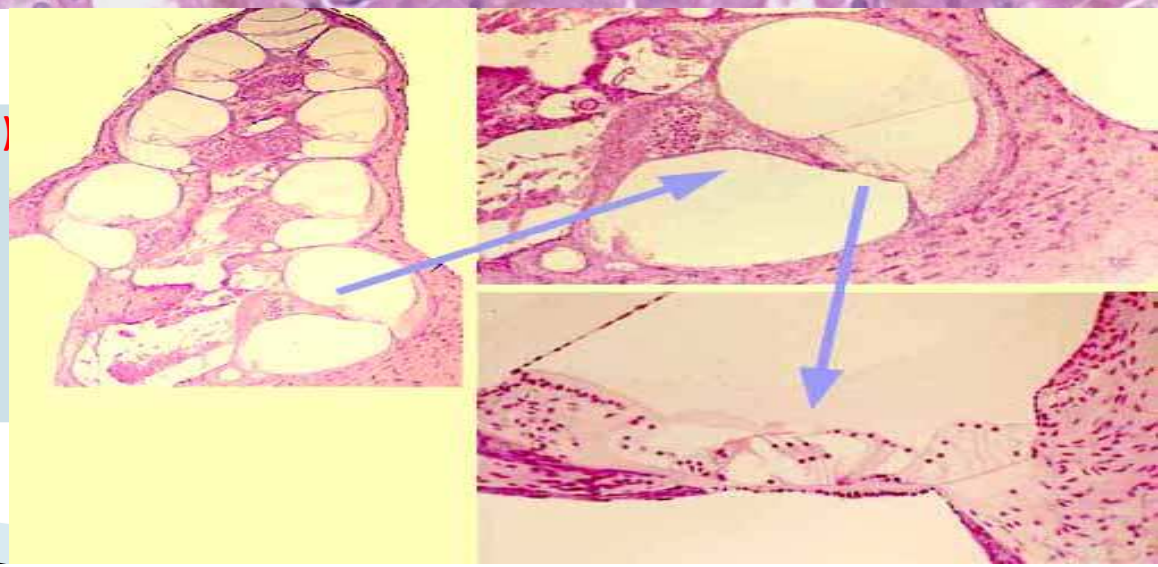




Kidney glomeruli



Inner surface of the tympanic membrane (eardrum)



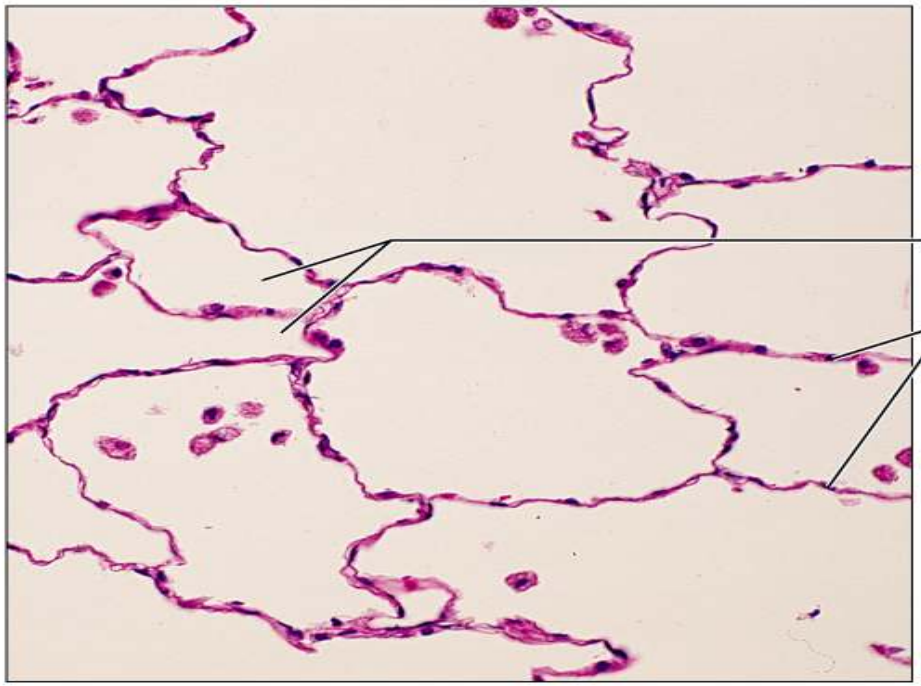
Epithelia: Simple Squamous

(a) 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 (400×).

Epithelia: Simple Cuboidal

- Single layer of cube-like cells with large, spherical central nuclei
- Function in secretion and absorption
- Present in
  - **kidney tubules,**
  - **ducts and secretory portions of small glands,**
  - **ovary surface**

- simple cuboidal epithelium is well-suited for locations where **secretion, absorption, and protection** are important functions.
- The cube-shaped cells provide a larger surface area for these activities while maintaining a relatively low profile compared to other types of epithelial tissue.

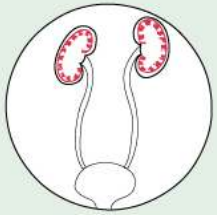
Epithelia: Simple Cuboidal

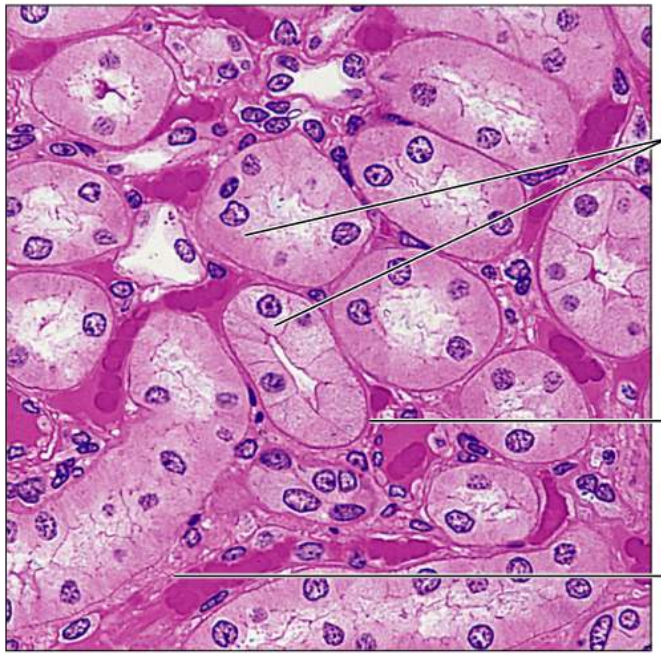
(b) Simple cuboidal epithelium

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 (400×).

Figure 4.2b

Kidney Tubules: Simple cuboidal epithelium lines the convoluted tubules and collecting ducts of the nephrons in the kidneys.

- These cells are involved in reabsorption and secretion of substances during the formation of urine.

Glands: Simple cuboidal epithelium lines the secretory portions of certain glands, such as the thyroid gland, salivary glands, and pancreatic ducts.

- These cells are responsible for producing and secreting various substances, such as hormones, saliva, and digestive enzymes.

Ovary Surface: The surface of the ovary is covered by a layer of simple cuboidal epithelium known as the ovarian surface epithelium.

- These cells are involved in the release of eggs (oocytes) during ovulation.

Terminal Bronchioles: Simple cuboidal epithelium lines the terminal bronchioles in the respiratory tract.

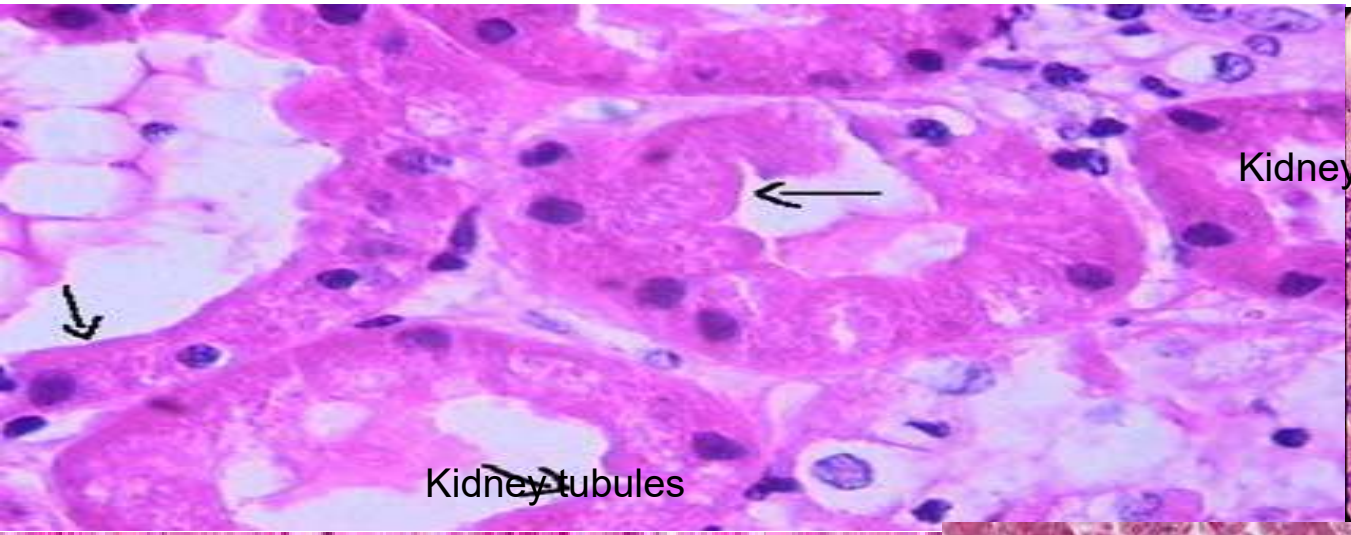
- These cells are involved in the secretion of mucus and the movement of particles out of the respiratory passages.

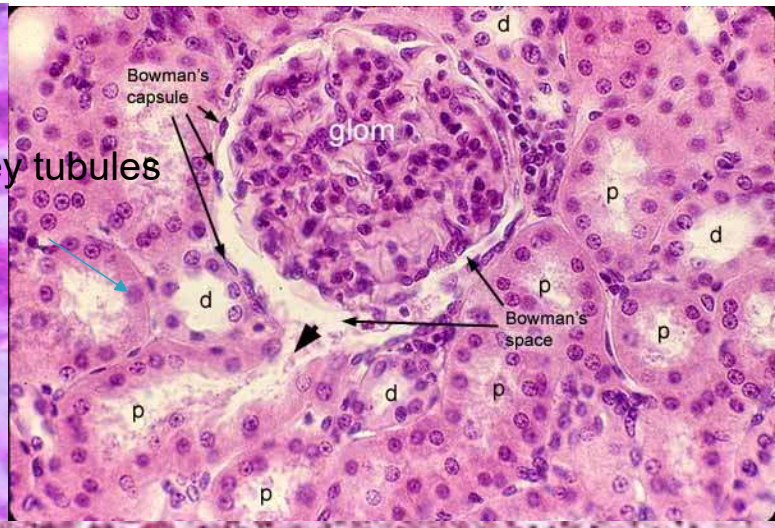
Thyroid Follicles: The thyroid gland contains spherical structures called thyroid follicles, which are lined by simple cuboidal epithelium.

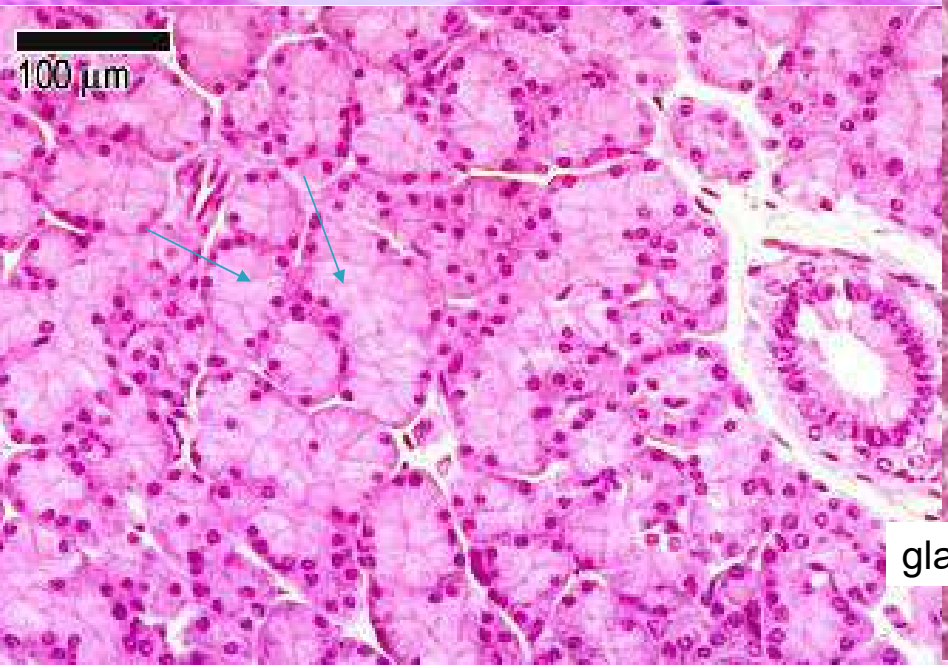
- These cells are involved in the production and storage of thyroid hormones.

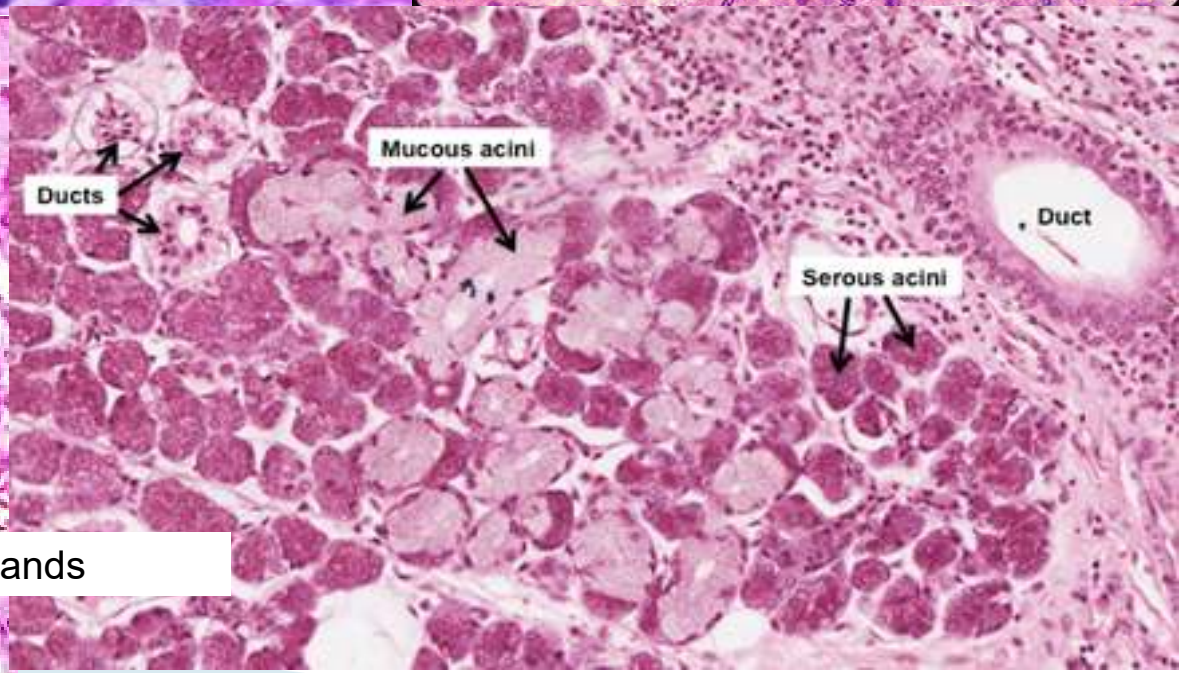
Mammary Glands: Simple cuboidal epithelium lines the ducts of the mammary glands in the breast tissue.

- These cells are responsible for producing and secreting milk during lactation.

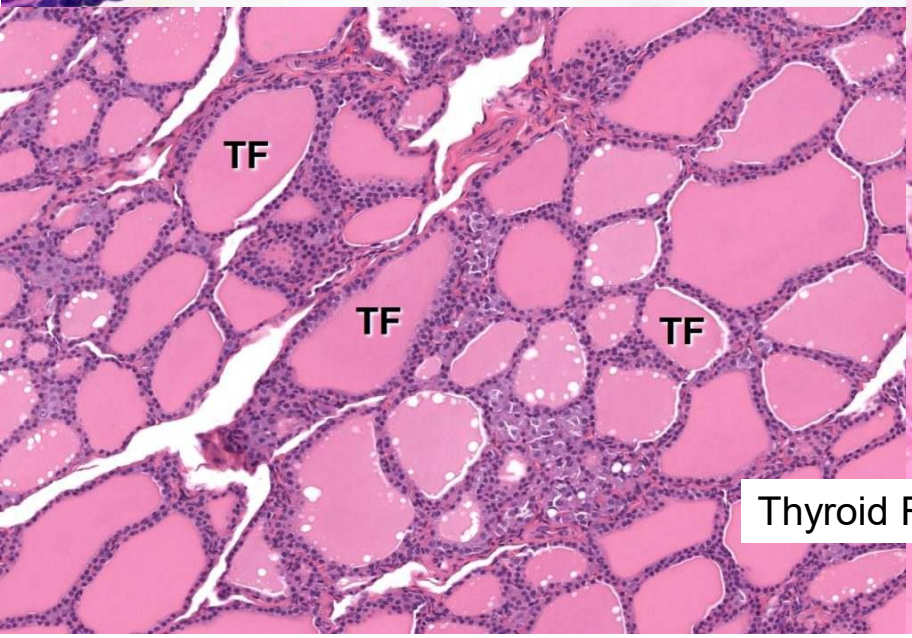

Kidney tubules

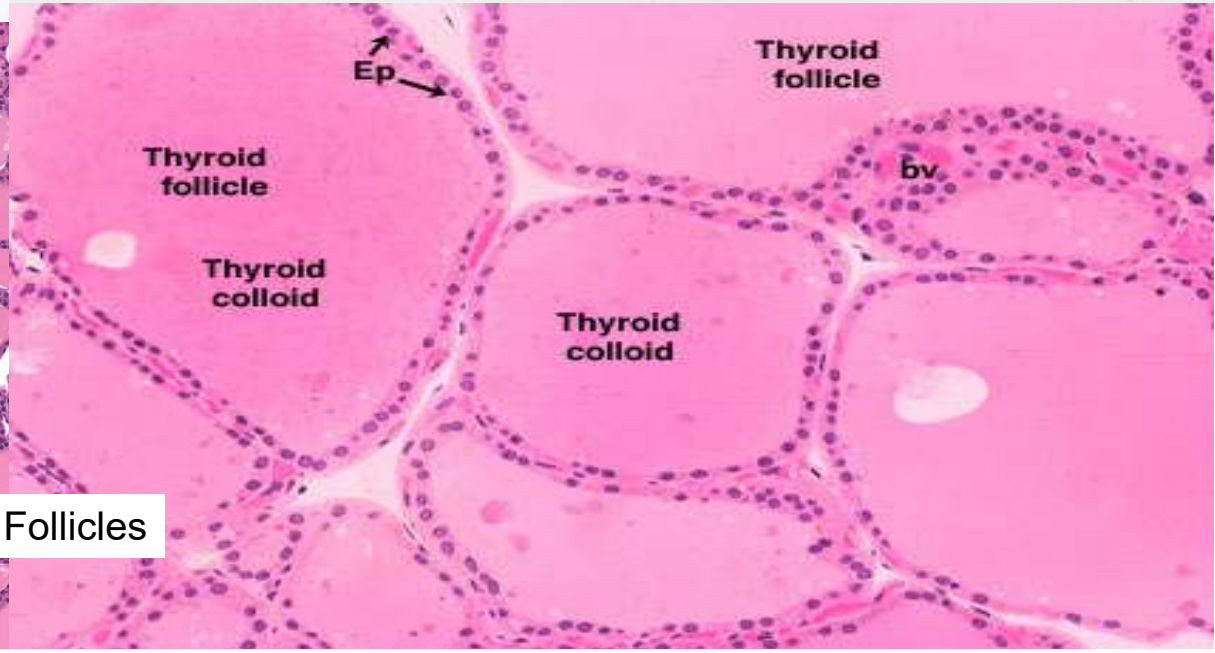

Kidney tubules
Bowman's capsule
glom
Bowman's space
d
p


100 µm
glands


Ducts
Mucous acini
Duct
Serous acini

Ovary Surface

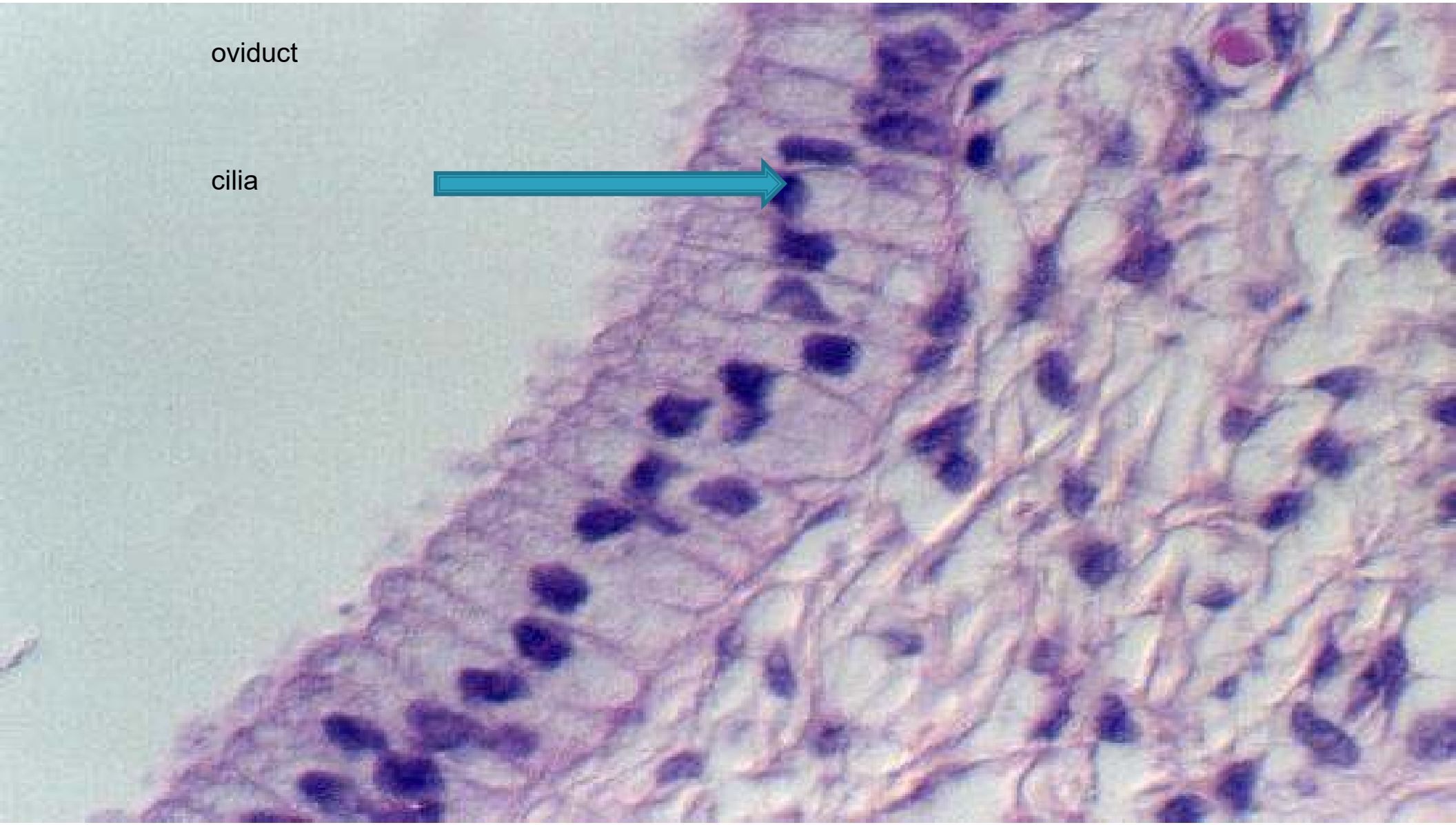


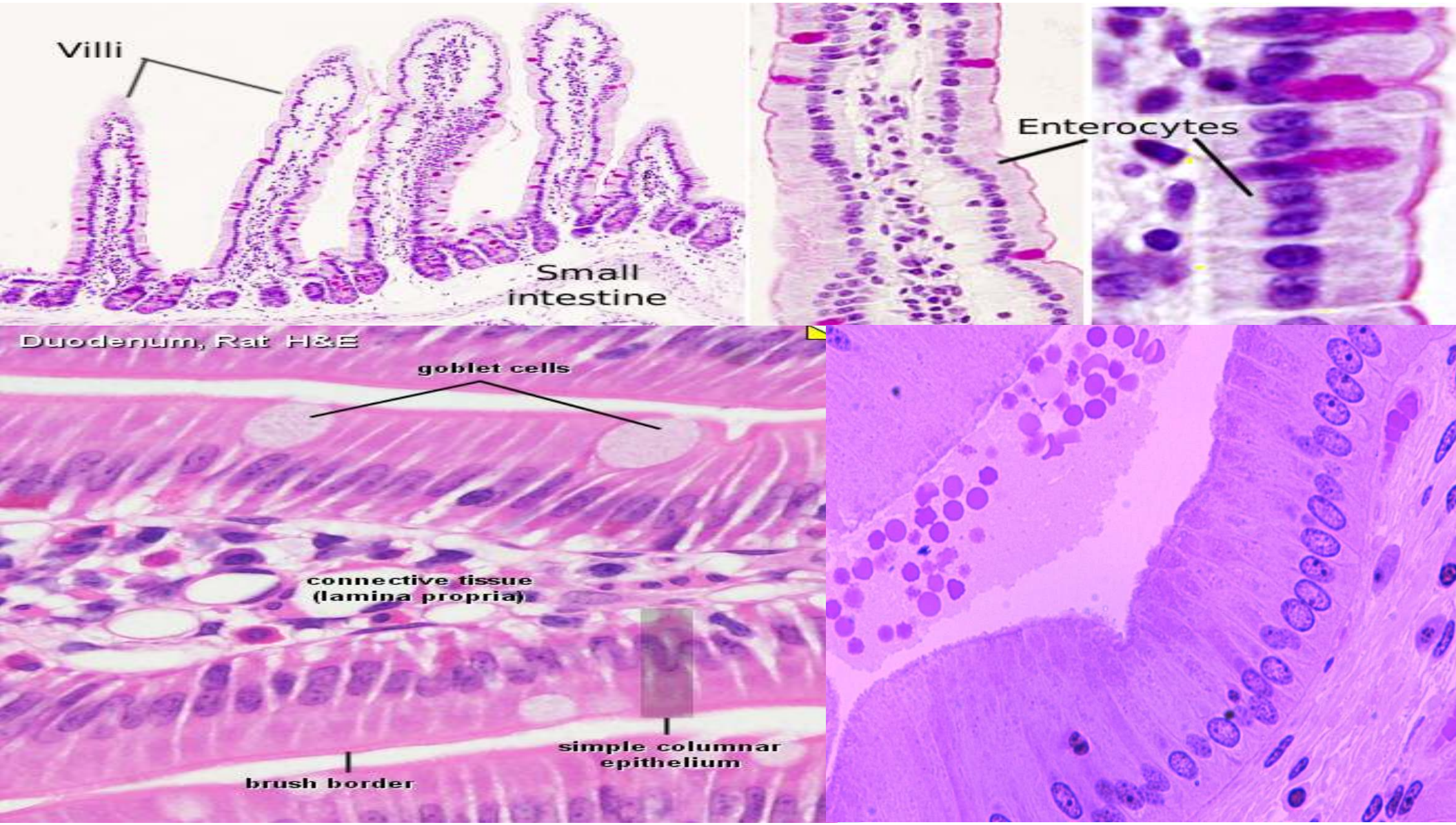


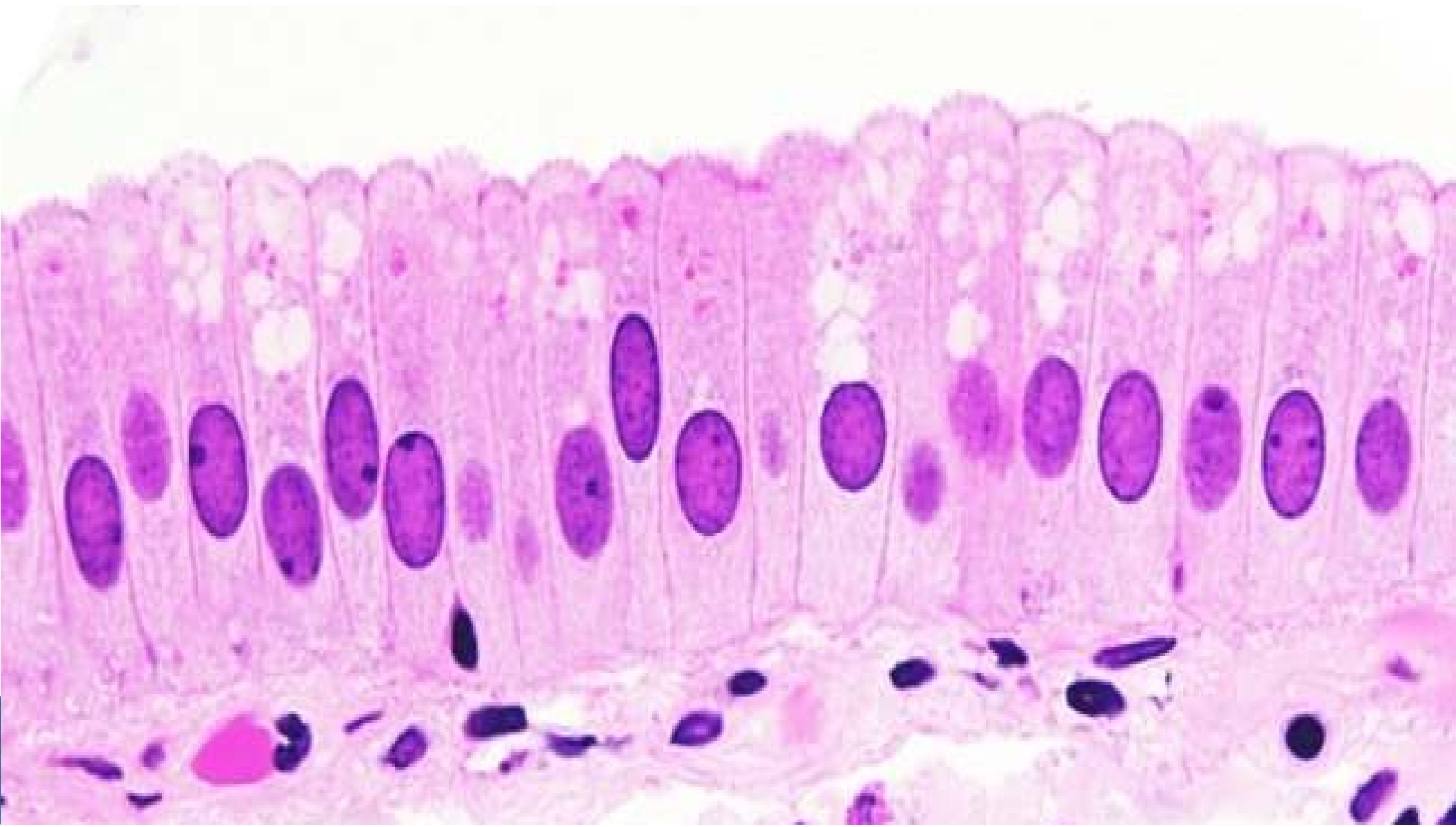
Thyroid Follicles

Epithelia: Simple Columnar

- Single layer of tall cells with oval nuclei; many contain cilia
- *Goblet cells* are often found in this layer
- Function in absorption and secretion
  - Nonciliated type line digestive tract and gallbladder
  - Ciliated type line small bronchi, uterine tubes, and some regions of the uterus
- Cilia help move substances through internal passageways


oviduct
cilia


Villi
Small intestine
Enterocytes
Duodenum, Rat H&E
goblet cells
connective tissue (lamina propria)
simple columnar epithelium
brush border



Digestive Tract: Simple columnar epithelium lines the entire length of the digestive tract, including the stomach, small intestine, and large intestine.

- In the small intestine, these cells are involved in absorption of nutrients from digested food. In the stomach, they secrete mucus and digestive enzymes.

Goblet Cells: Goblet cells, which are specialized secretory cells that produce mucus, are often interspersed among simple columnar epithelial cells in the digestive tract.

- The mucus produced by goblet cells helps lubricate and protect the lining of the digestive tract.

Respiratory Tract: Simple columnar epithelium lines parts of the respiratory tract, including the larger airways such as the trachea and bronchi.

- In these locations, the cells are involved in secretion of mucus and movement of particles out of the respiratory passages.

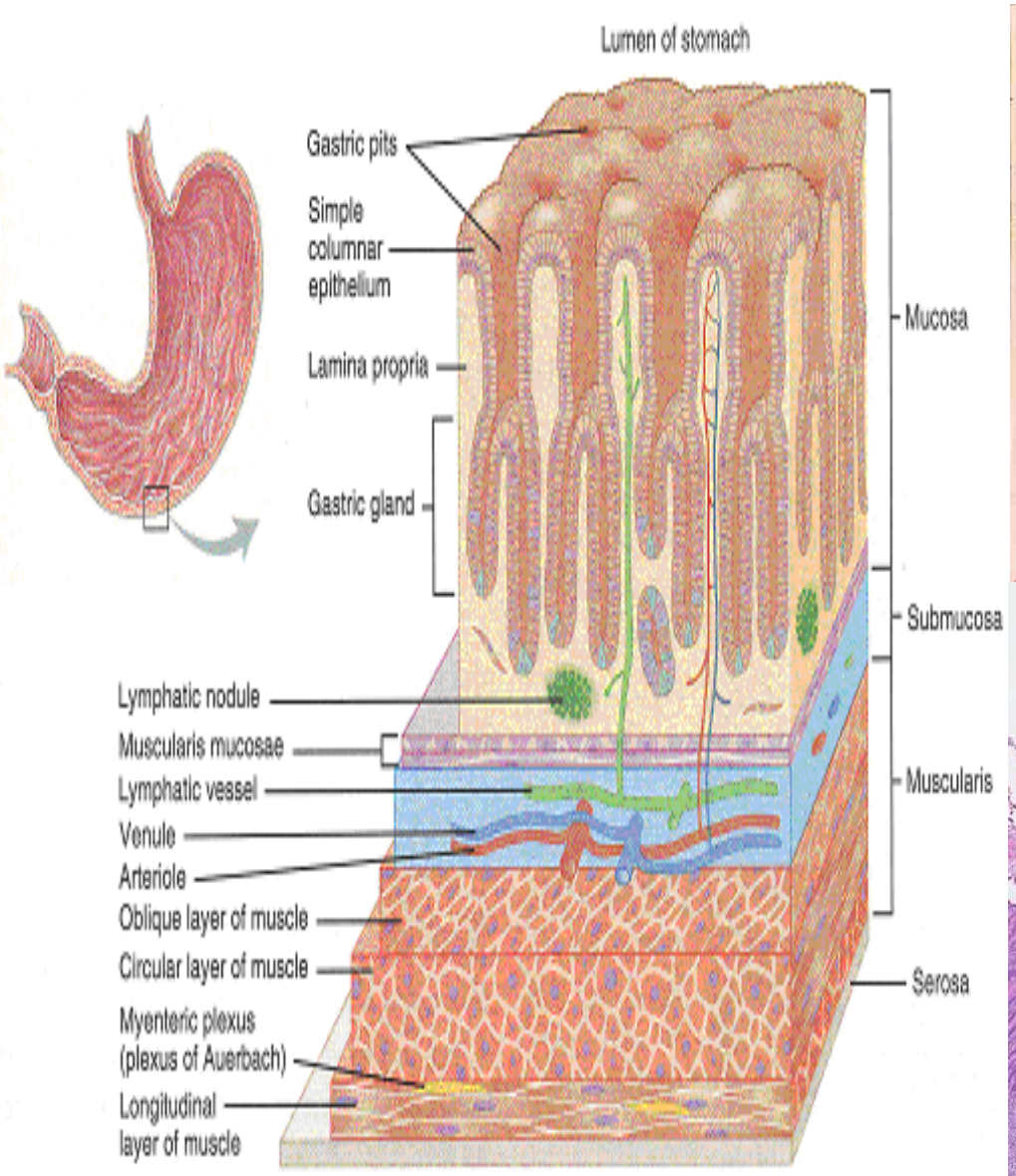
Uterus: The lining of the **uterus (endometrium)** is composed of simple columnar epithelium.

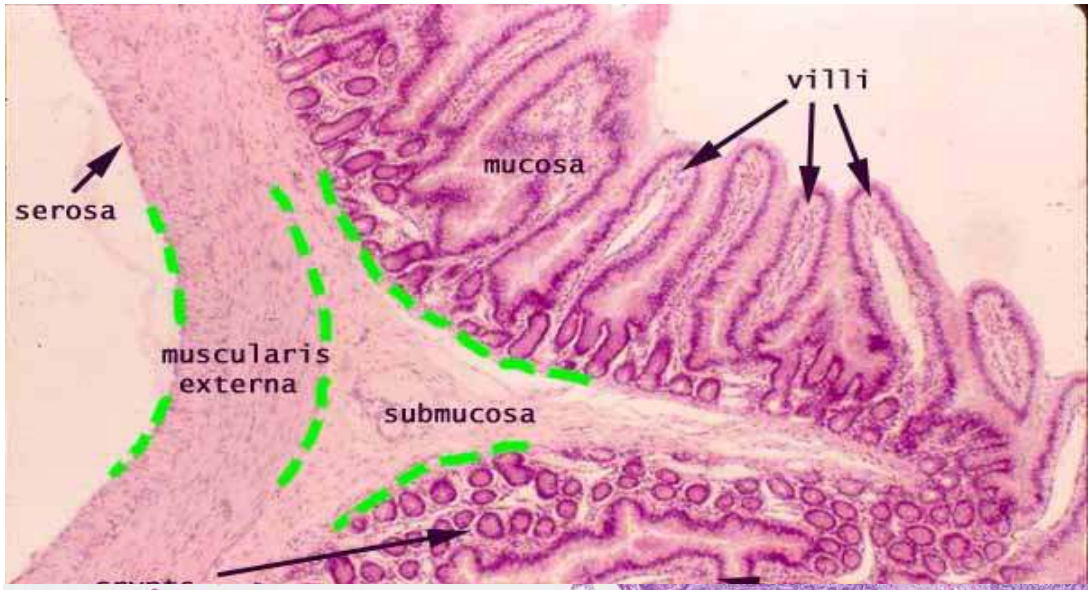
- These cells undergo changes during the menstrual cycle and are involved in implantation of a fertilized egg during pregnancy.

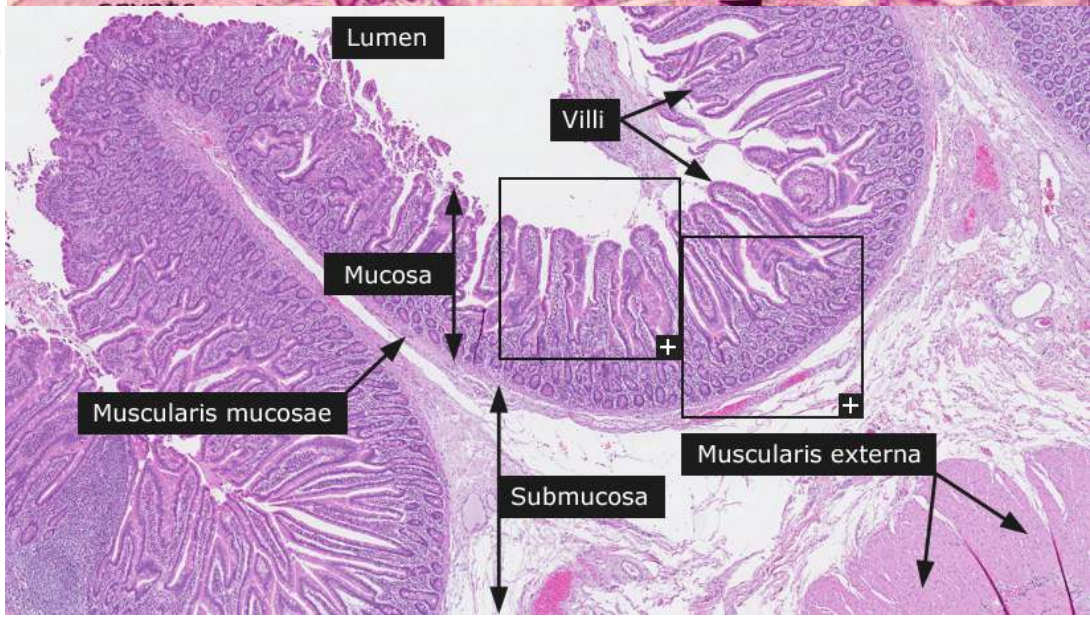
Fallopian Tubes: Simple columnar epithelium lines the fallopian tubes (oviducts), where it facilitates the movement of eggs (oocytes) from the ovaries to the uterus and provides a suitable environment for fertilization.

Gallbladder: Simple columnar epithelium lines the inner surface of the gallbladder.

- These cells are involved in the absorption of water and electrolytes from bile, which is stored in the gallbladder before being released into the small intestine.


Lumen of stomach
Gastric pits
Simple columnar epithelium
Lamina propria
Gastric gland
Lymphatic nodule
Muscularis mucosae
Lymphatic vessel
Venule
Arteriole
Oblique layer of muscle
Circular layer of muscle
Myenteric plexus (plexus of Auerbach)
Longitudinal layer of muscle
Mucosa
Submucosa
Muscularis
Serosa

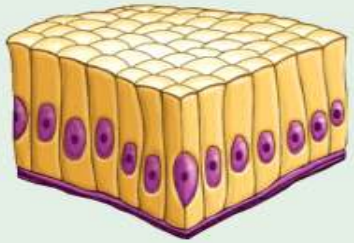

villi
mucosa
serosa
muscularis externa
submucosa


Lumen
Villi
Mucosa
Muscularis mucosae
Muscularis externa
Submucosa

Epithelia: Simple Columnar

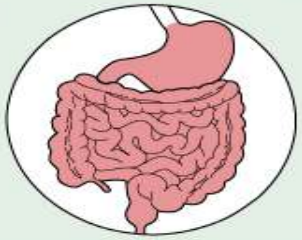
(c) Simple columnar epithelium

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

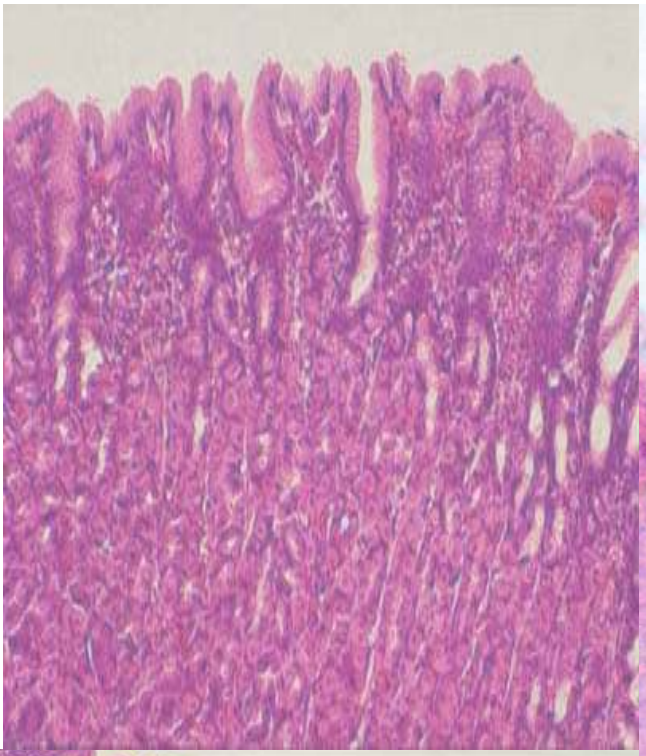


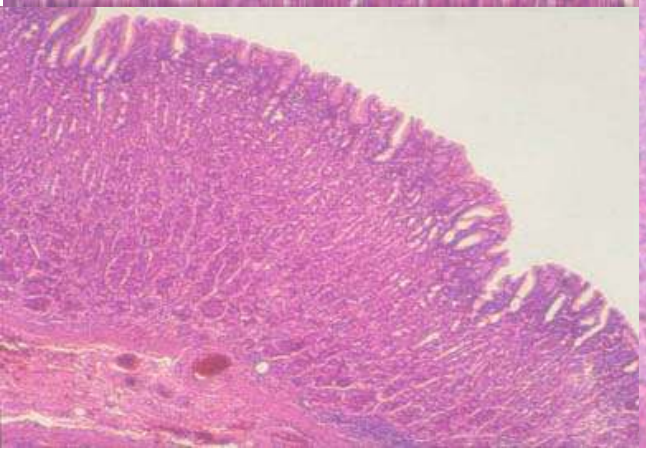
Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliary action.

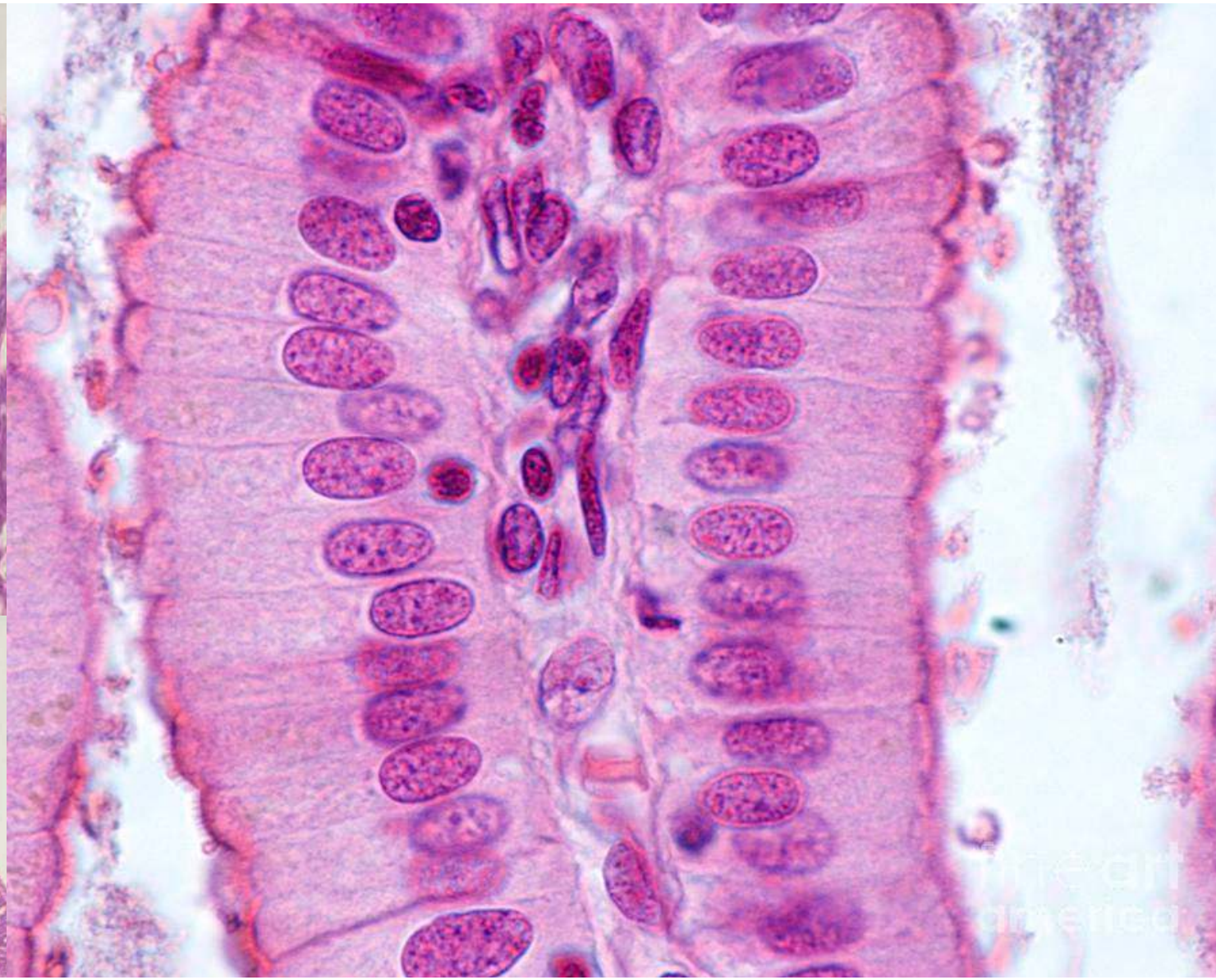
Location: Nonciliated type lines most of the digestive tract (stomach to anal canal), gallbladder, and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.



Photomicrograph: Simple columnar epithelium of the stomach mucosa (1300×).

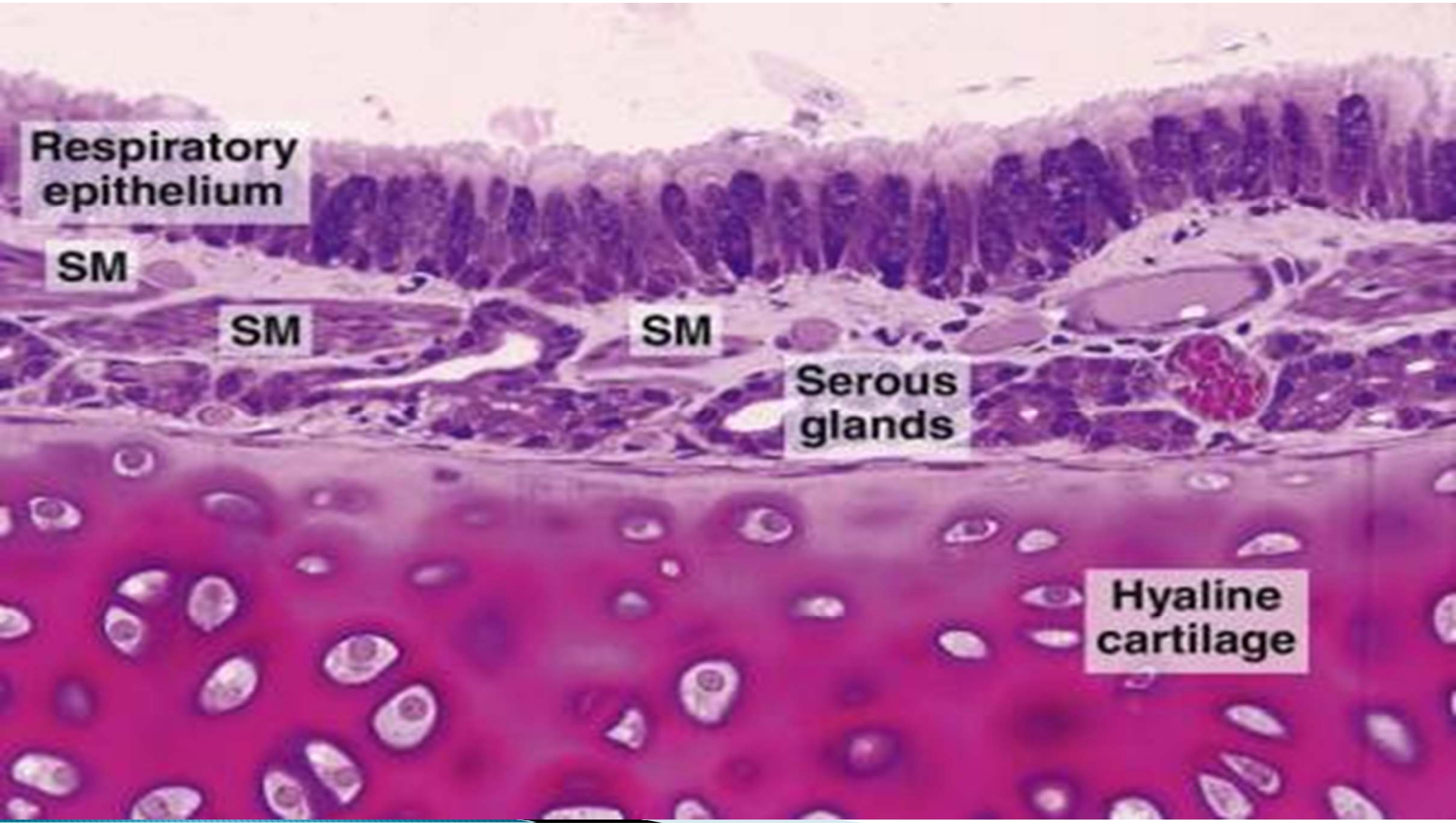


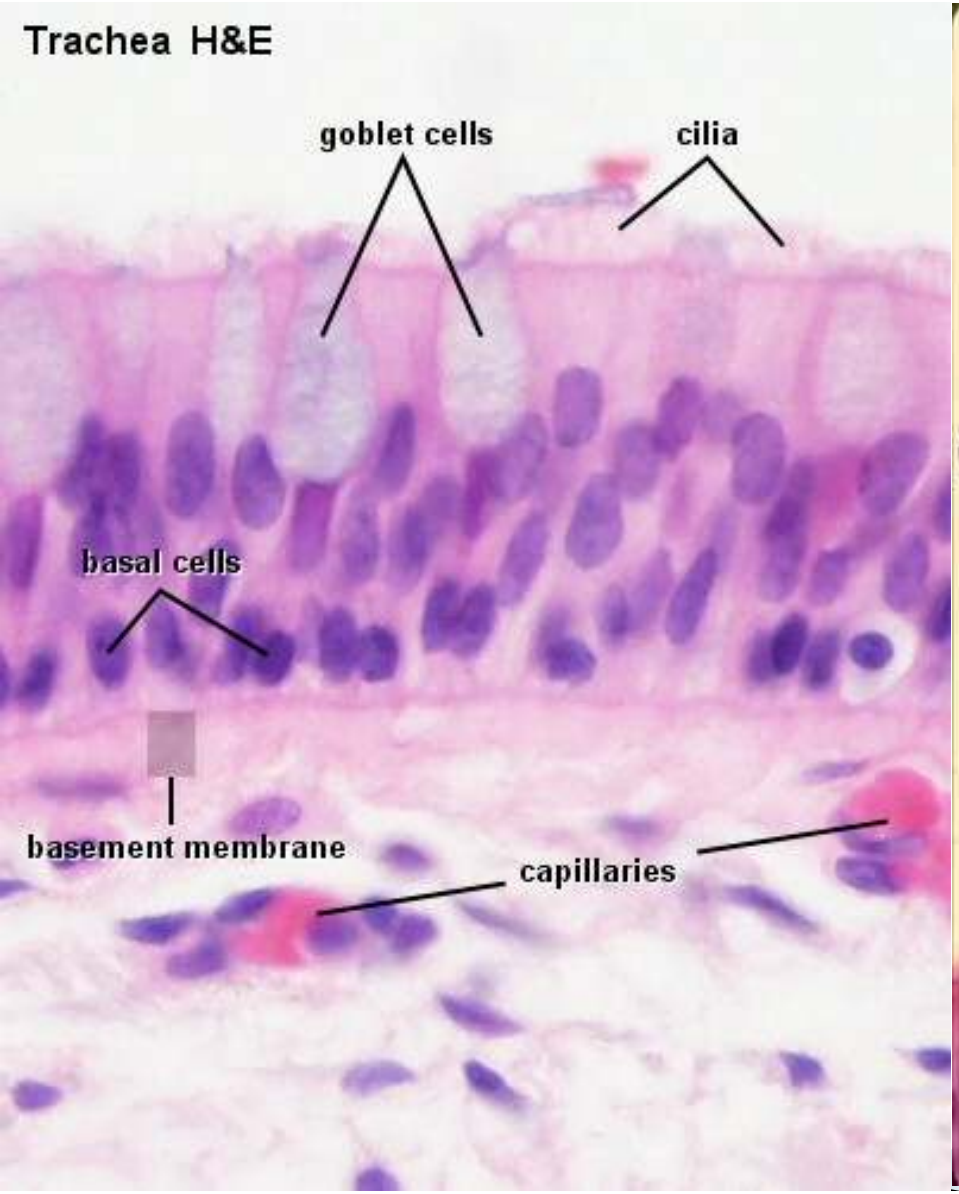


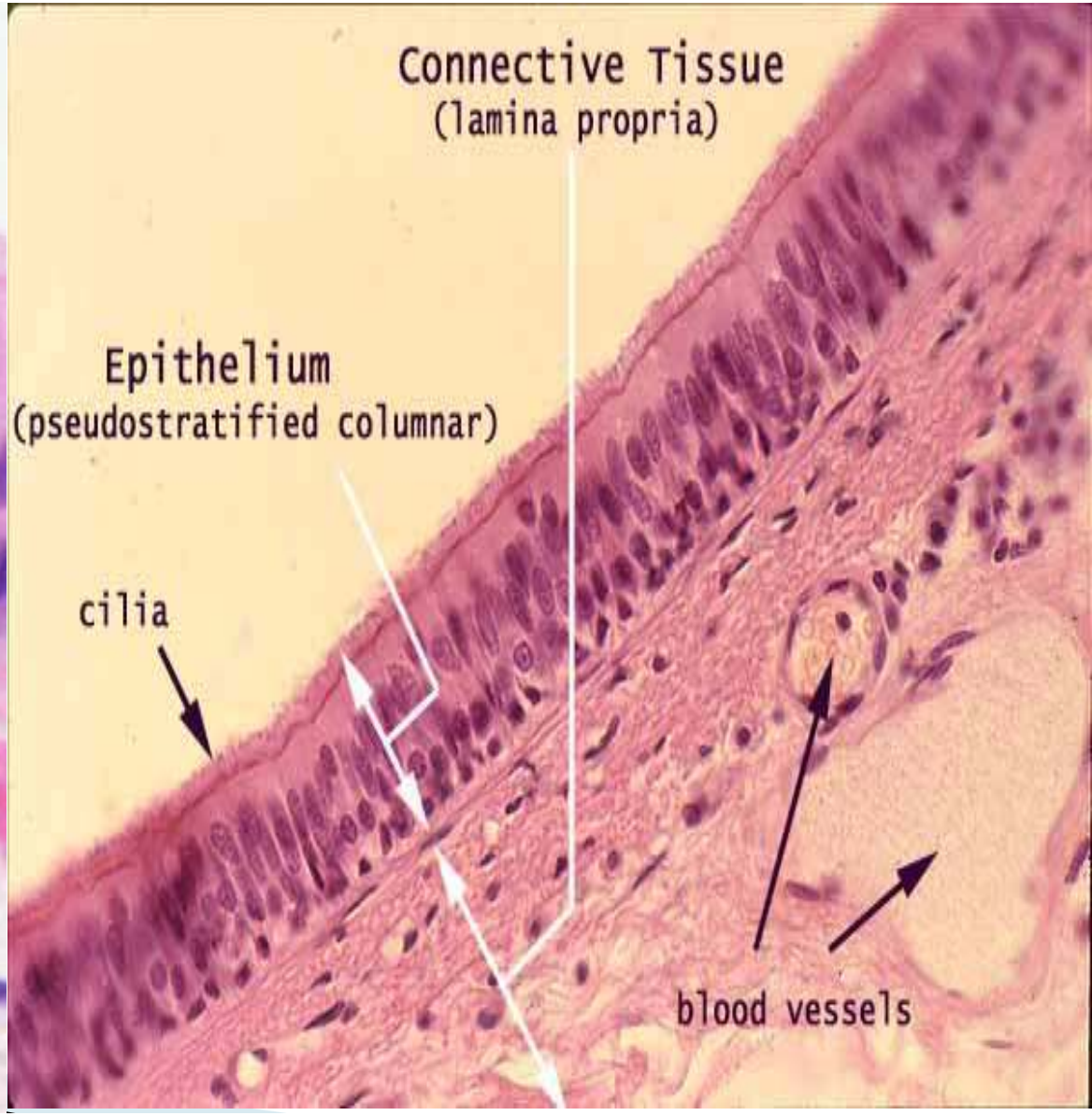


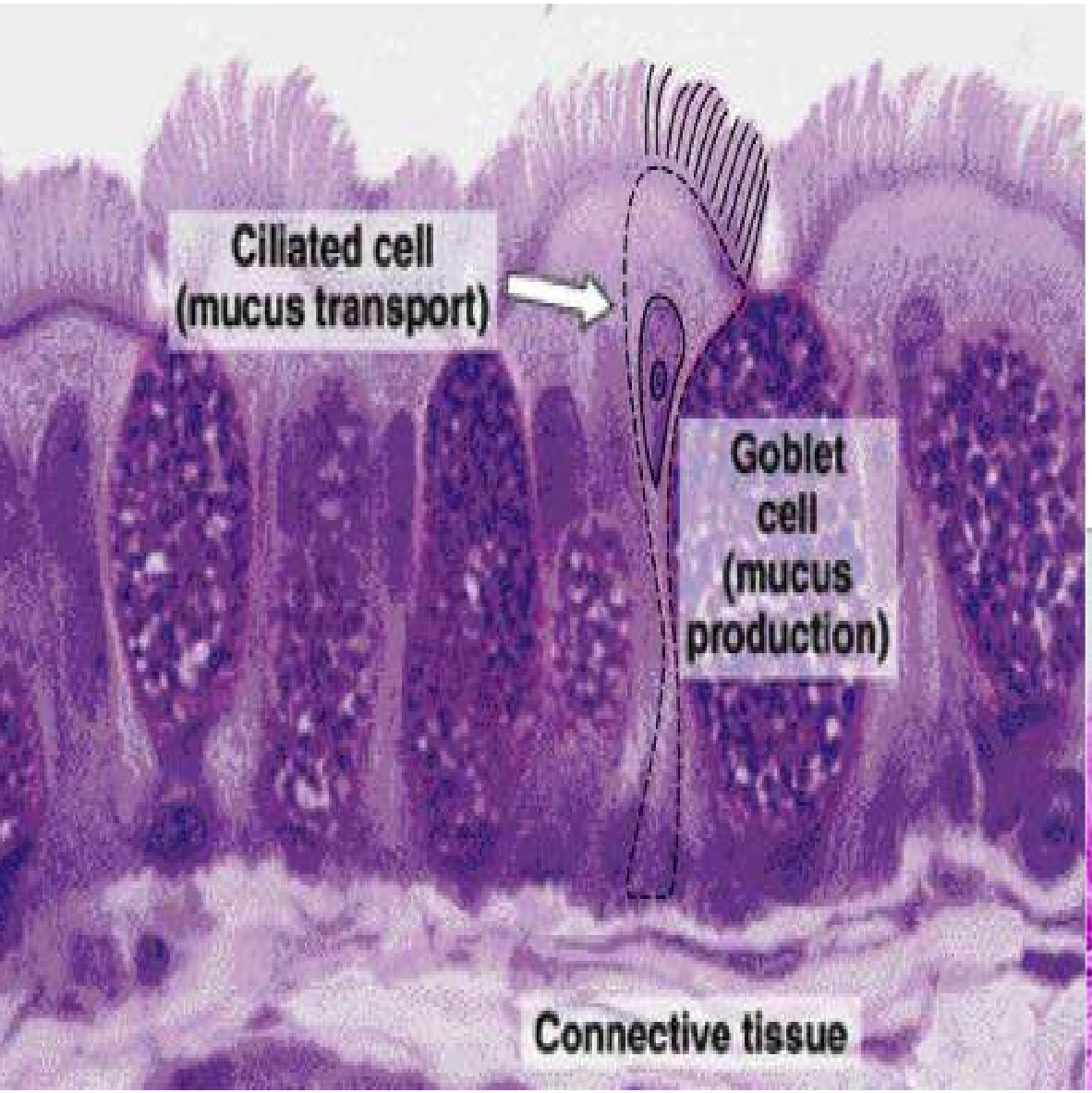
Epithelia: Pseudostratified Columnar

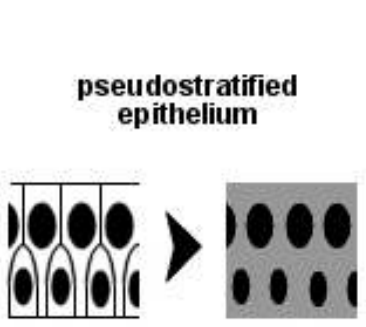
- Single layer of cells with different heights; some do not reach the free surface
- Nuclei are seen at different layers
- Function in **secretion and propulsion of mucus**
- **Present in the male sperm-carrying ducts (nonciliated) and trachea (ciliated)**

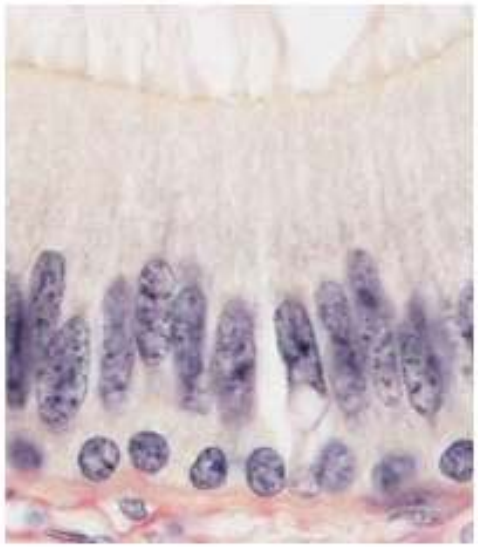

Respiratory epithelium
SM
SM
SM
Serous glands
Hyaline cartilage


Trachea H&E
goblet cells
cilia
basal cells
basement membrane
capillaries

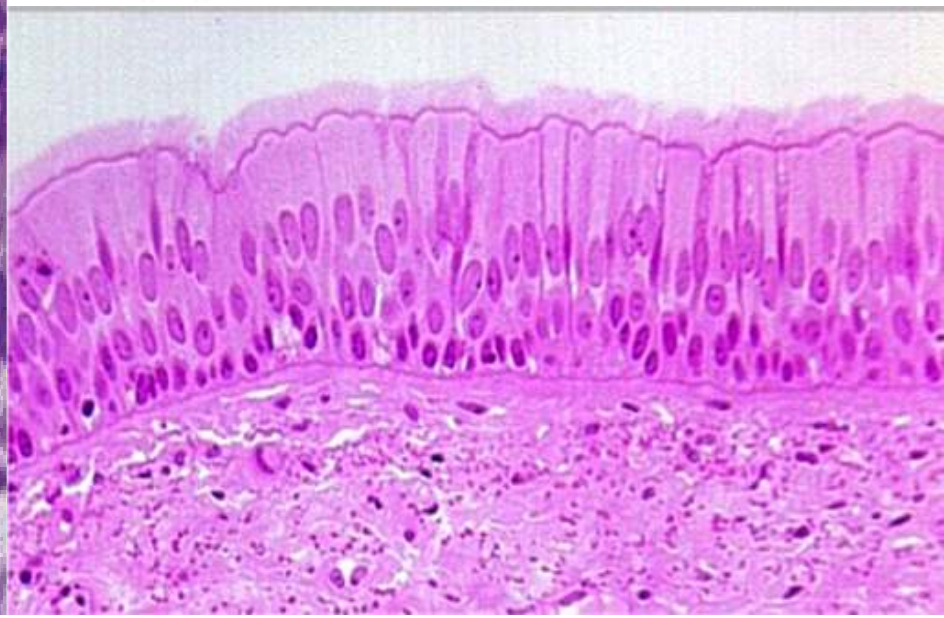

Connective Tissue
(lamina propria)
Epithelium
(pseudostratified columnar)
cilia
blood vessels

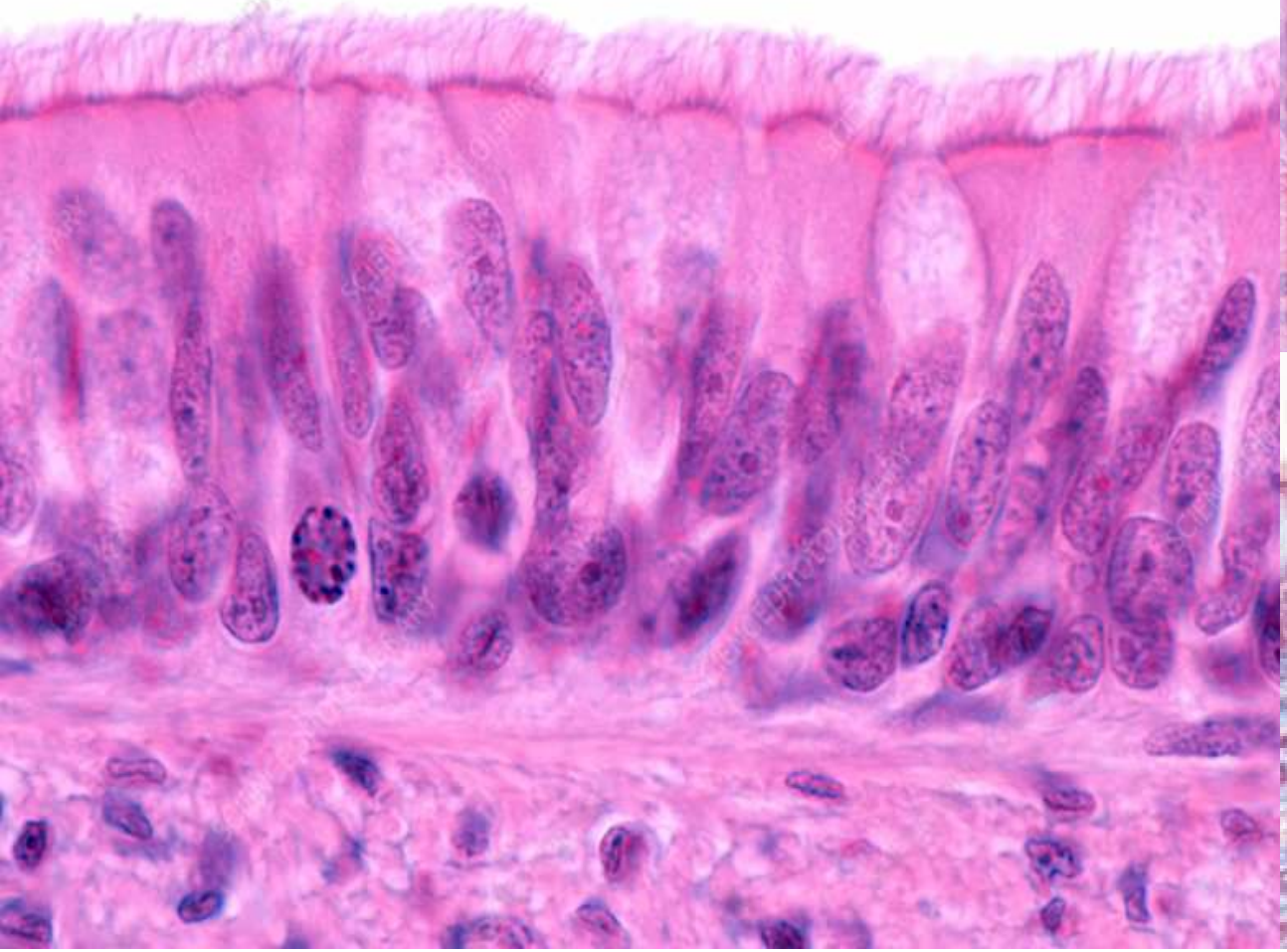


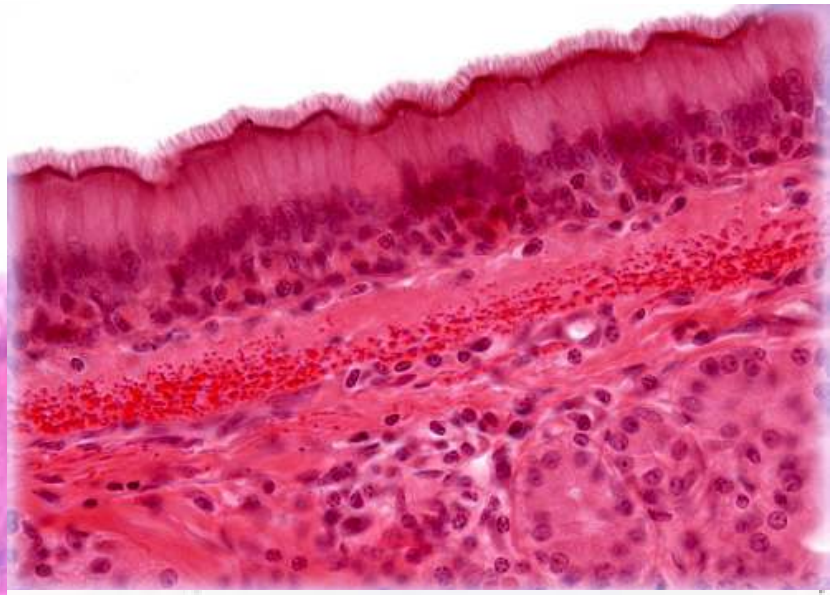


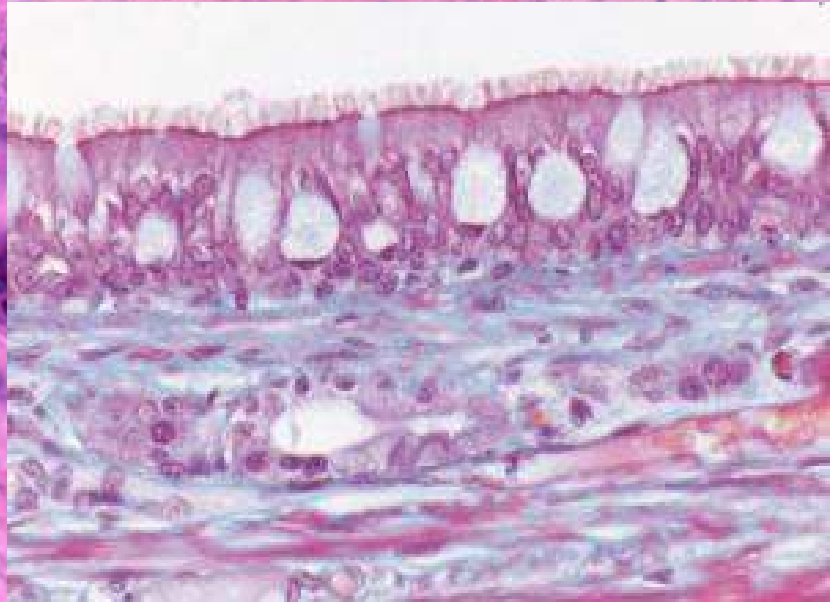


Epididymis van Gieson





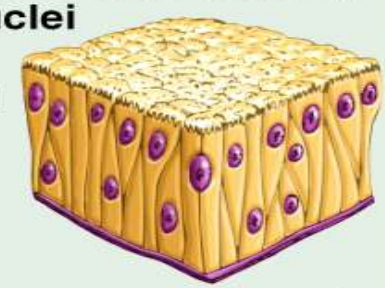




Epithelia: Pseudostratified Columnar

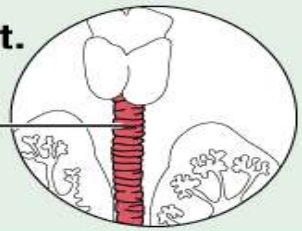
(d) Pseudostratified columnar epithelium

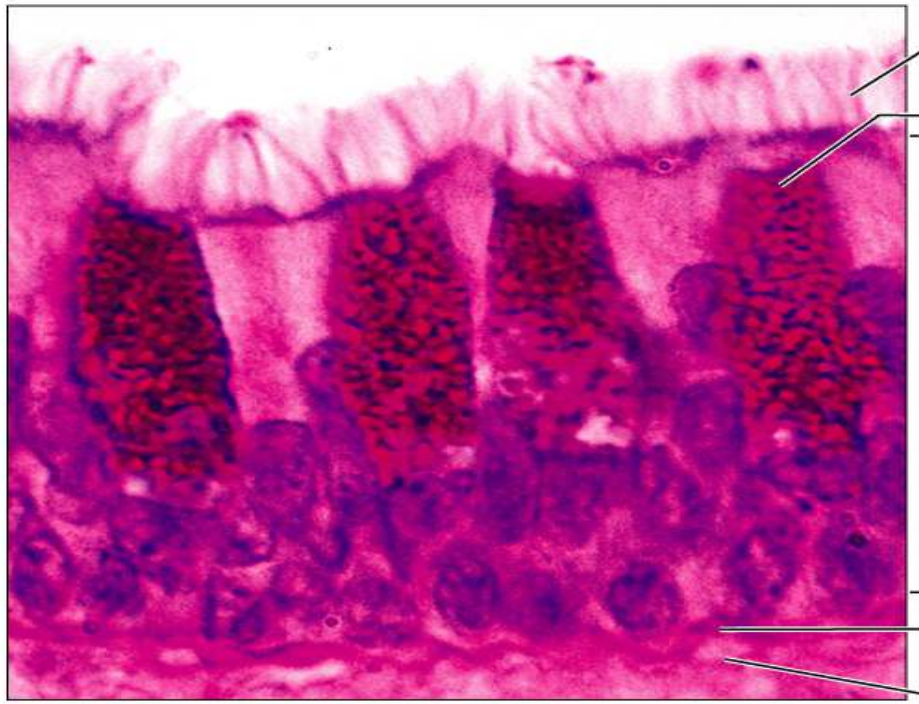
Description: Single layer of cells of differing heights, some not reaching the free surface; nuclei seen at different levels; may contain goblet cells and bear cilia.



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 (400×).

Respiratory Tract: Pseudostratified columnar epithelium lines the respiratory tract, including the nasal cavity, trachea, and bronchi.

- In these locations, it functions to trap and remove inhaled particles and microorganisms from the airways, as well as to produce and move mucus using cilia.

Trachea: The lining of the trachea is composed of pseudostratified columnar epithelium, which contains goblet cells that secrete mucus to trap debris and foreign particles.

- Cilia on the surface of these cells help to propel the mucus and trapped particles upward toward the throat, where they can be swallowed or expelled.

Male Reproductive Tract: Pseudostratified columnar epithelium lines parts of the male reproductive tract, including the epididymis and parts of the urethra.

- In these locations, it helps to facilitate the transport of sperm and provides protection for the underlying tissues.

Eustachian Tube: The lining of the Eustachian tube, which connects the middle ear to the nasopharynx, is composed of pseudostratified columnar epithelium.

- This epithelium helps to equalize air pressure between the middle ear and the atmosphere and protects the middle ear from pathogens.

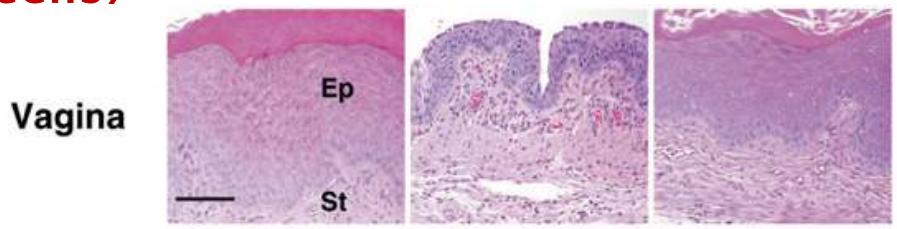
Olfactory Epithelium: Pseudostratified columnar epithelium lines the olfactory epithelium in the nasal cavity, where it contains specialized sensory cells called olfactory receptor cells.

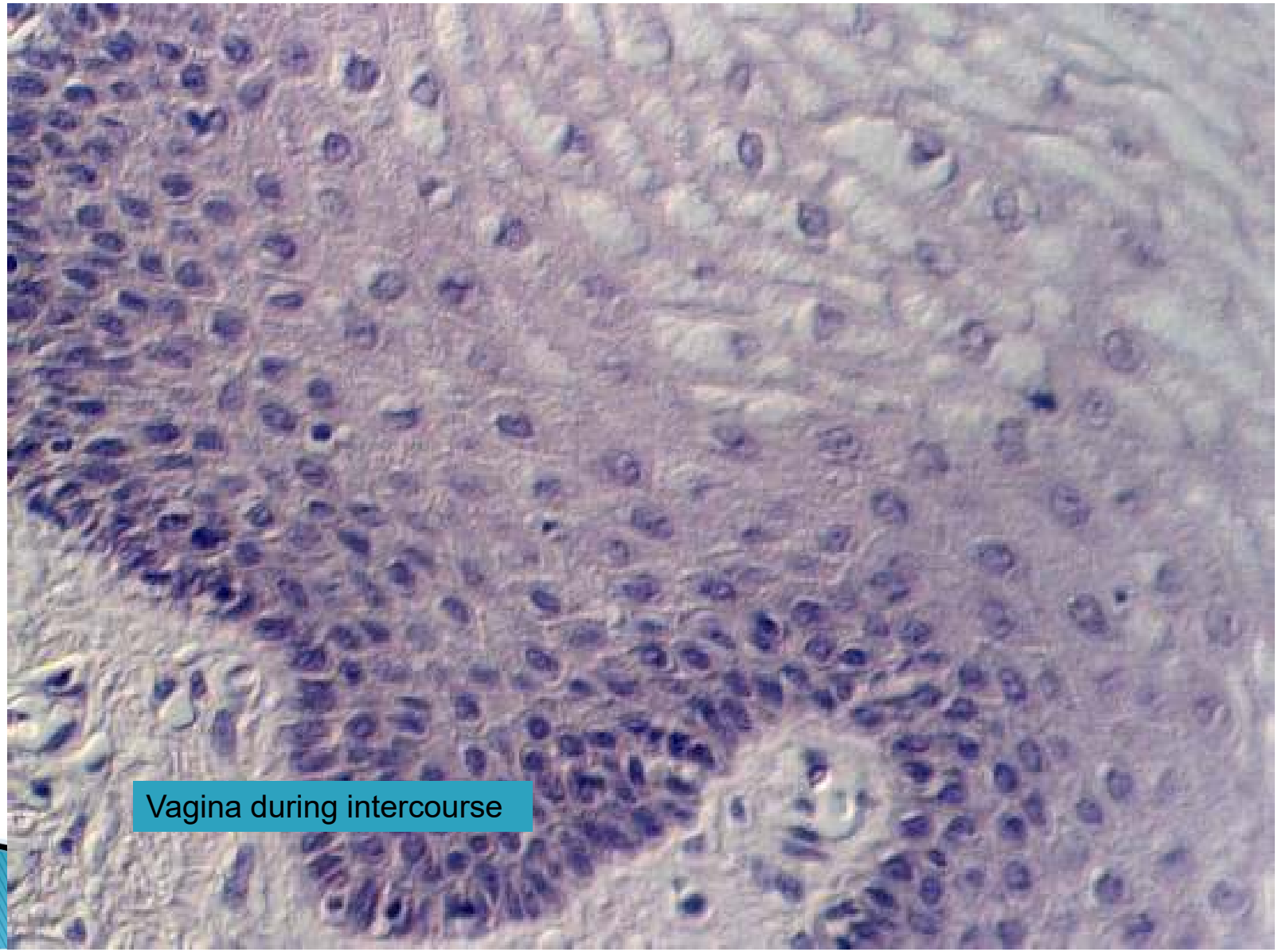
- These cells detect odors in the air and transmit signals to the brain for interpretation.

Male Urethra: Parts of the male urethra are lined with pseudostratified columnar epithelium, which provides protection and lubrication for the passage of urine and semen.

Epithelia: Stratified Squamous

- Thick membrane composed of several layers of cells
- Function in protection of underlying areas subjected to abrasion
- Forms the external part of
  - the skin's epidermis (keratinized cells),
  - and linings of the esophagus,
  - mouth,
  - and vagina (nonkeratinized cells)

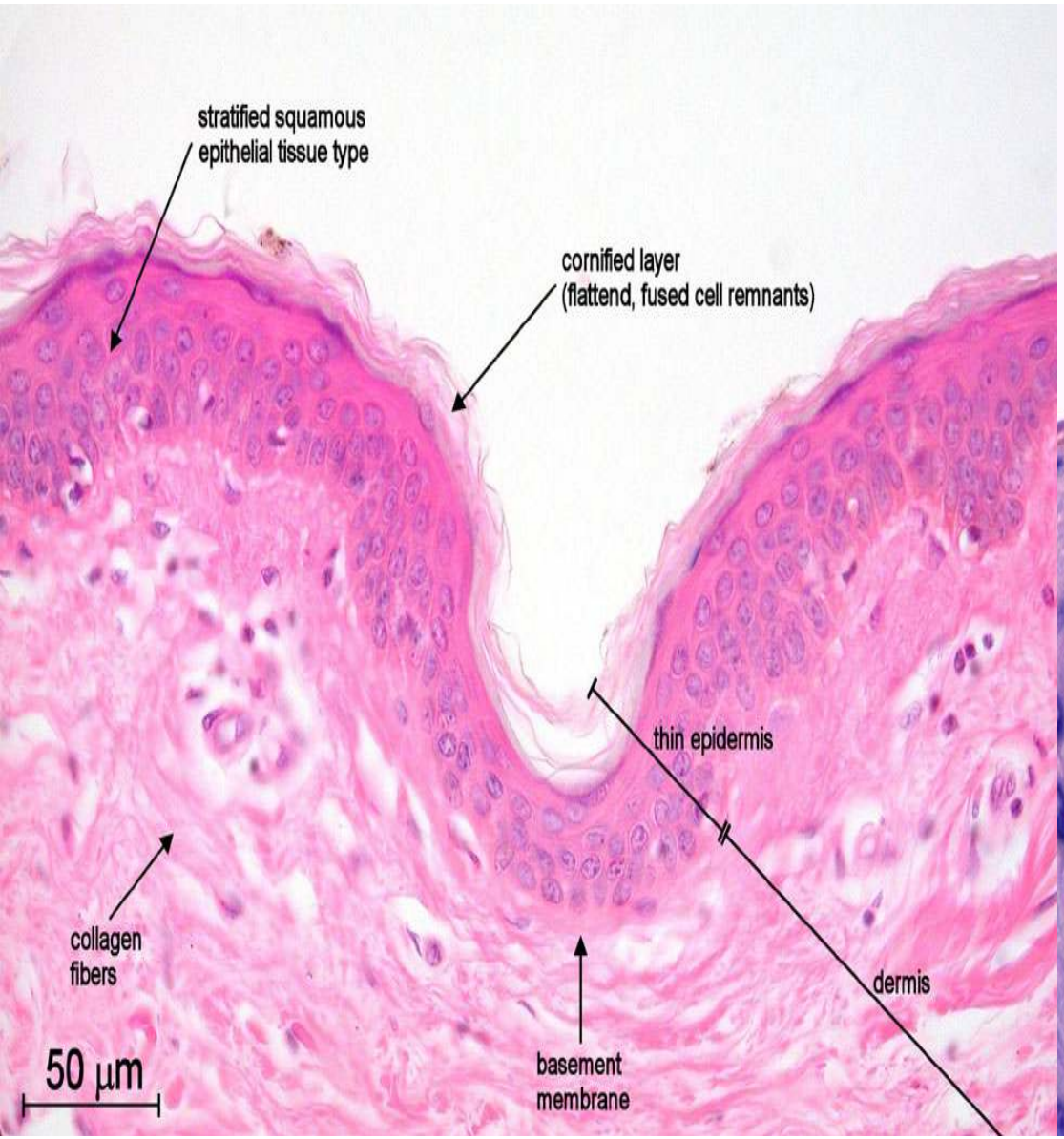


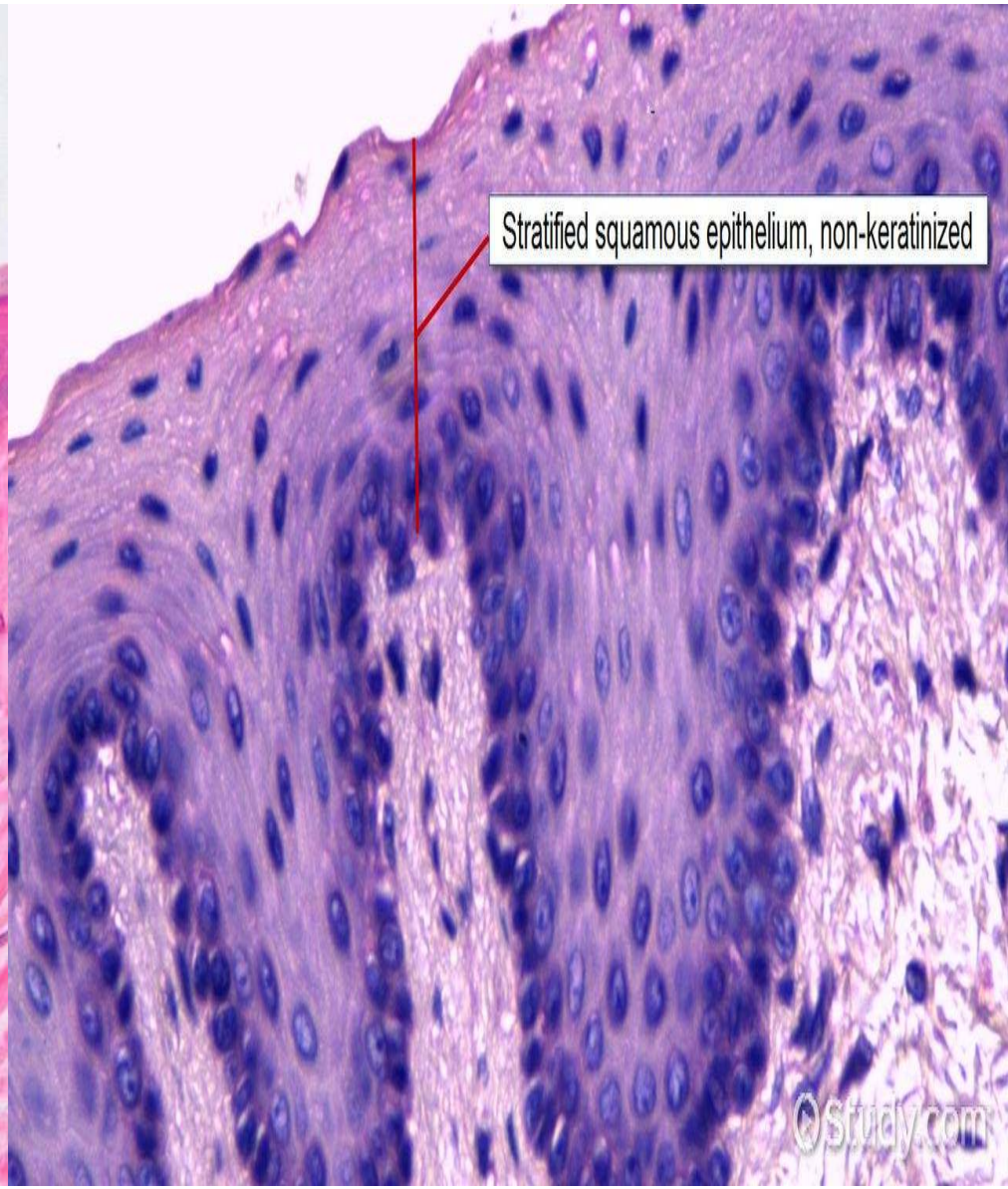


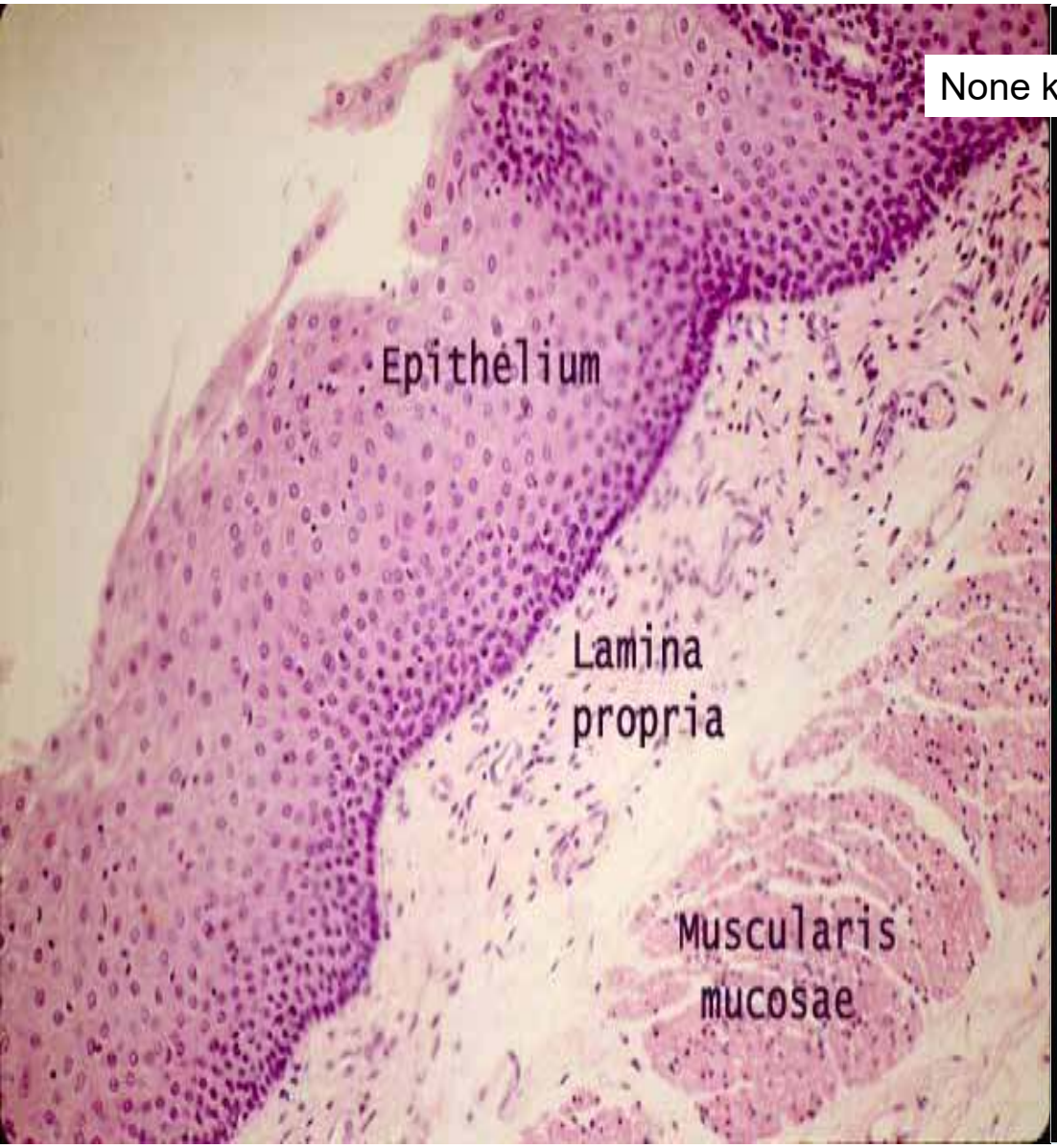
Vagina during intercourse


Oesophagus H&E
squamous (plate-like) cells
stratified squamous epithelium
basal cell layer


skin


stratified squamous
epithelial tissue type
cornified layer
(flattend, fused cell remnants)
thin epidermis
collagen
fibers
dermis
50 µm
basement
membrane


Stratified squamous epithelium, non-keratinized
Study.com

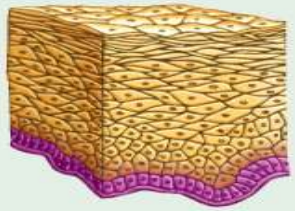


None keratinized

Epithelia: Stratified Squamous

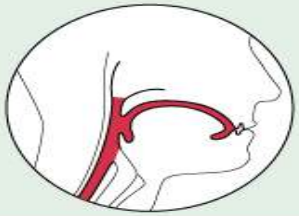
(e) Stratified squamous epithelium

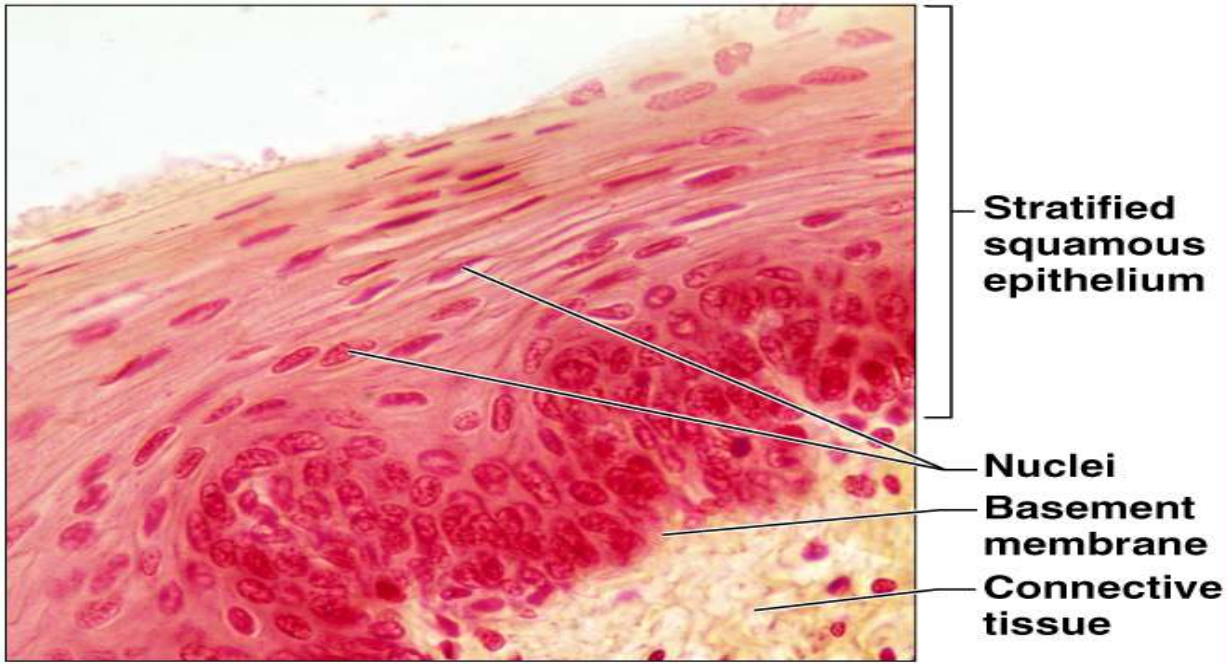
Description: Thick membrane composed of several cell layers; basal cells are cuboidal or columnar and metabolically active; surface cells are flattened (squamous); in the keratinized type, the surface cells are full of keratin and dead; basal cells are active in mitosis and produce the cells of the moresuperficial 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 (425×).

Epidermis of the Skin: The outermost layer of the skin, known as the epidermis, is composed of stratified squamous epithelium. This tissue provides protection against mechanical injury, pathogens, and dehydration.

- The outer layers of the epidermis consist of dead, keratinized cells that provide additional strength and waterproofing.

Oral Cavity: The lining of the oral cavity, including the lips, cheeks, gums, and the back of the throat (pharynx), is composed of stratified squamous epithelium.

- This tissue protects against abrasion from food particles and provides a barrier against pathogens.

Esophagus: The lining of the esophagus is composed of non-keratinized stratified squamous epithelium.

- This tissue protects against the abrasive action of swallowed food and facilitates the movement of food from the mouth to the stomach through peristalsis.

Vagina: The vaginal canal is lined with non-keratinized stratified squamous epithelium.

- This tissue provides protection against mechanical abrasion during sexual intercourse and childbirth, as well as a barrier against infection.

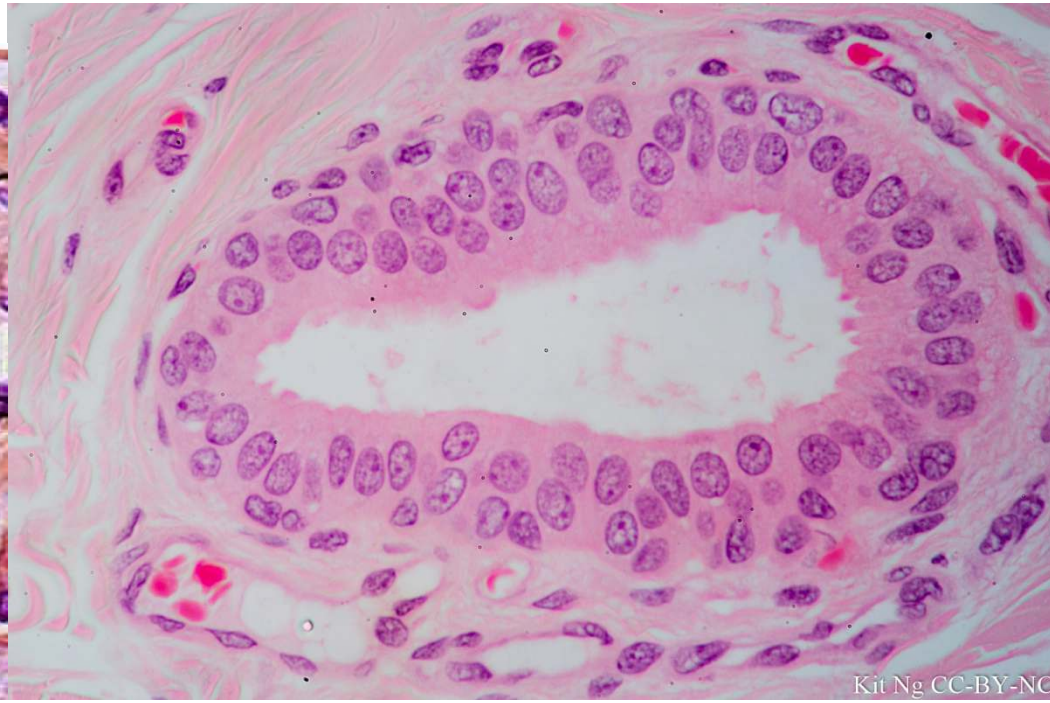
Anus: The lining of the anal canal is composed of stratified squamous epithelium.

- This tissue provides protection against abrasion from fecal matter during defecation.

Cornea: The outer layer of the cornea, the transparent front part of the eye, is composed of stratified squamous epithelium. This tissue protects the eye from mechanical injury and pathogens while allowing light to pass through.

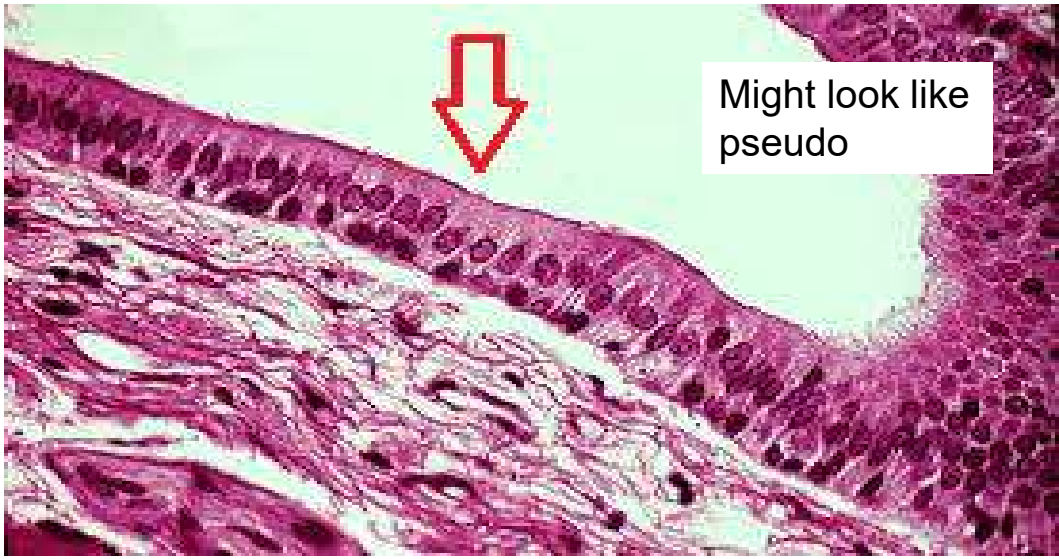
Epithelia: Stratified Cuboidal and Columnar

- Stratified cuboidal
  - Quite rare in the body
  - Found in some sweat and mammary glands
  - Typically two cell layers thick



Epithelia: Stratified Cuboidal and Columnar

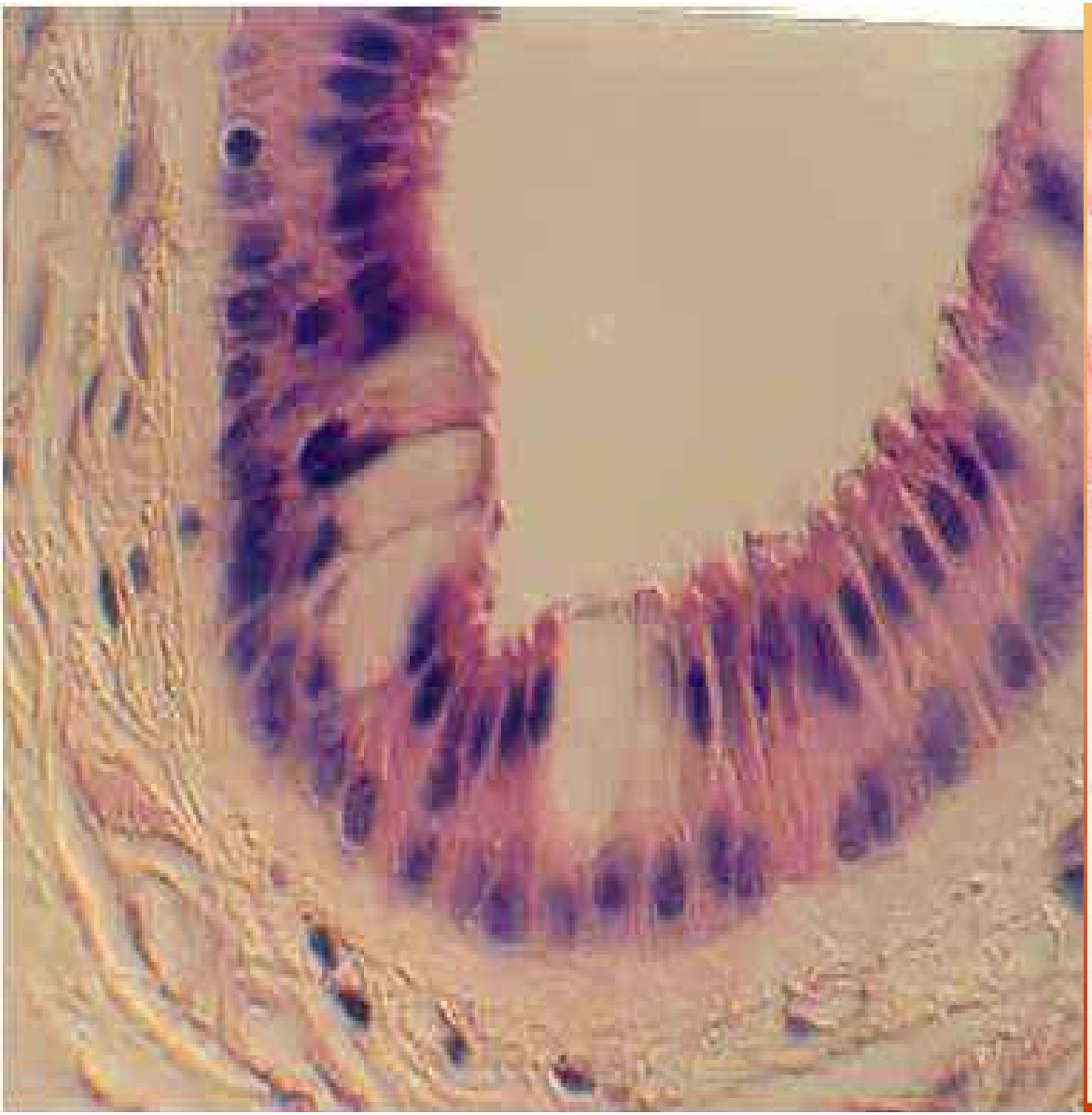
- Stratified columnar
  - Limited distribution in the body
  - **Found in**
    - **the pharynx,**
    - **male urethra,**
    - **Large Ducts of Salivary Glands**



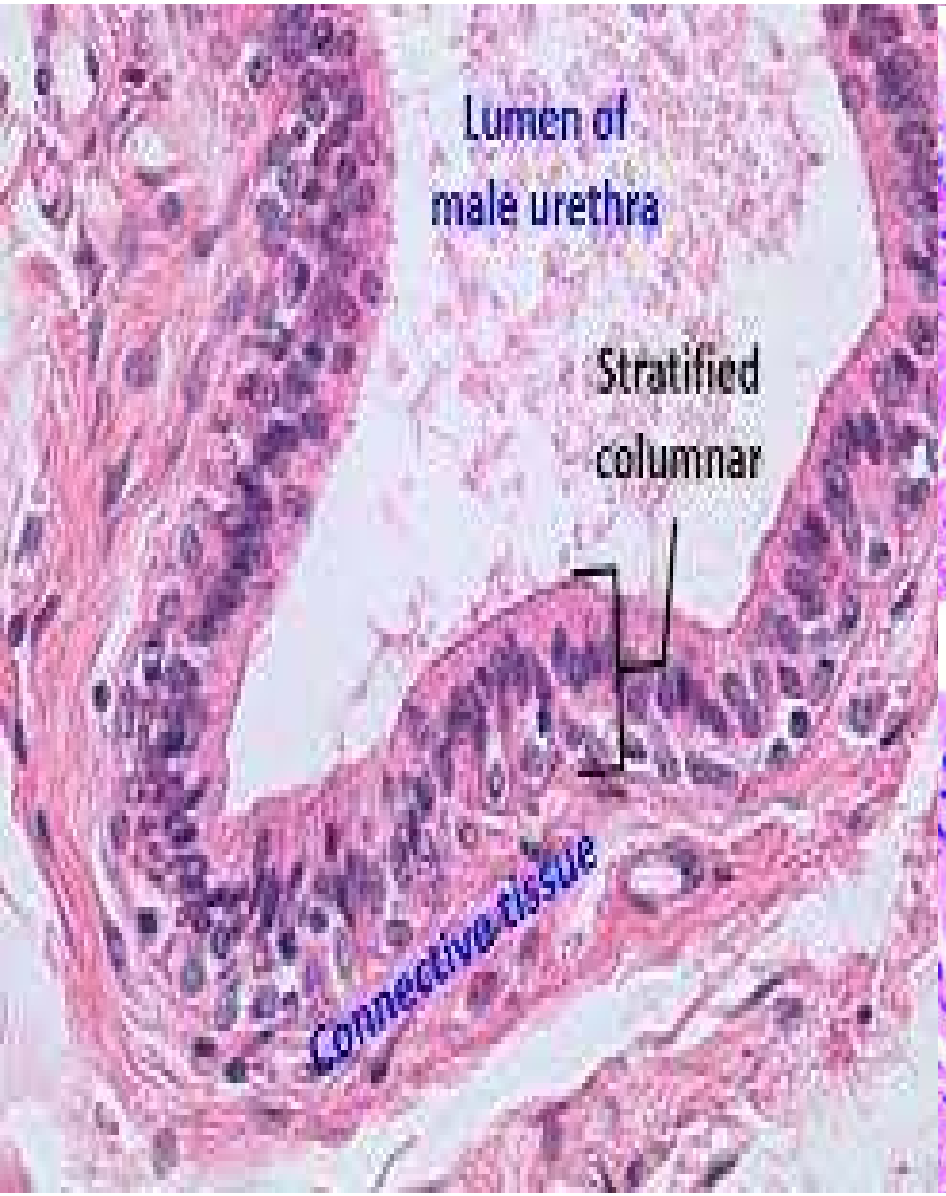
  - Also occurs at transition areas between two other types of epithelia

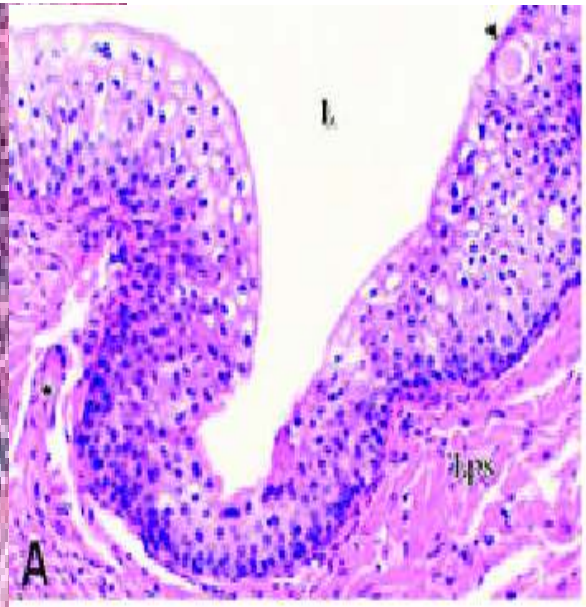
These types of epithelia are less common and are usually found in areas where protection against mechanical stress and abrasion is important.

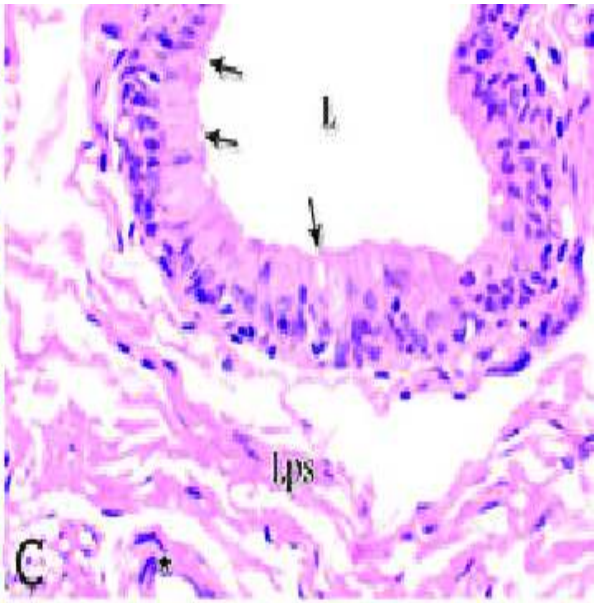
The stratified arrangement of cells provides additional strength and support compared to simple epithelia.

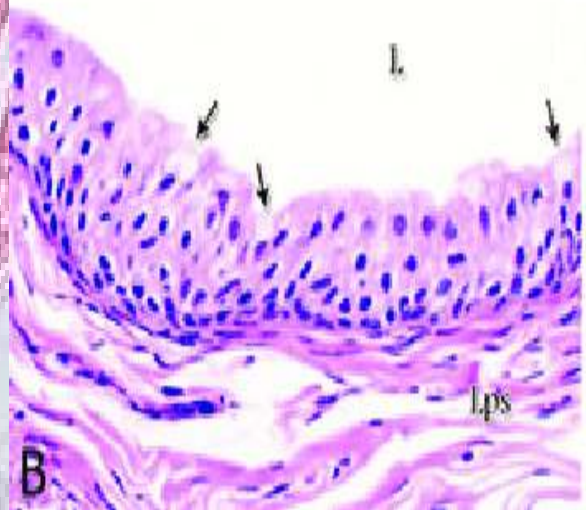


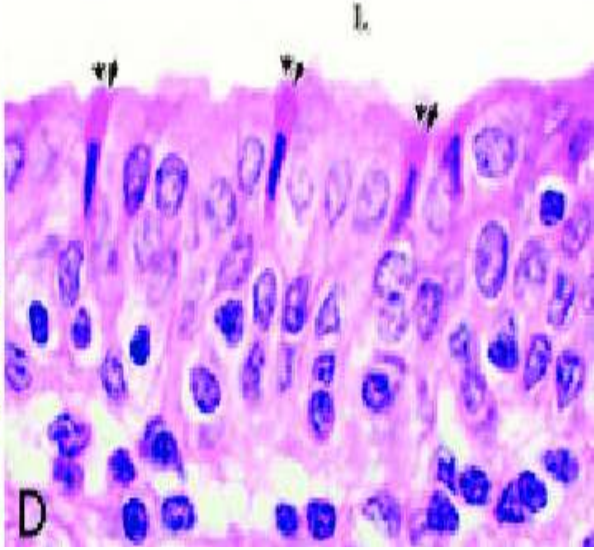
Stratified Columnar Epithelium


Lumen of
male urethra
Stratified
columnar
Connective tissue

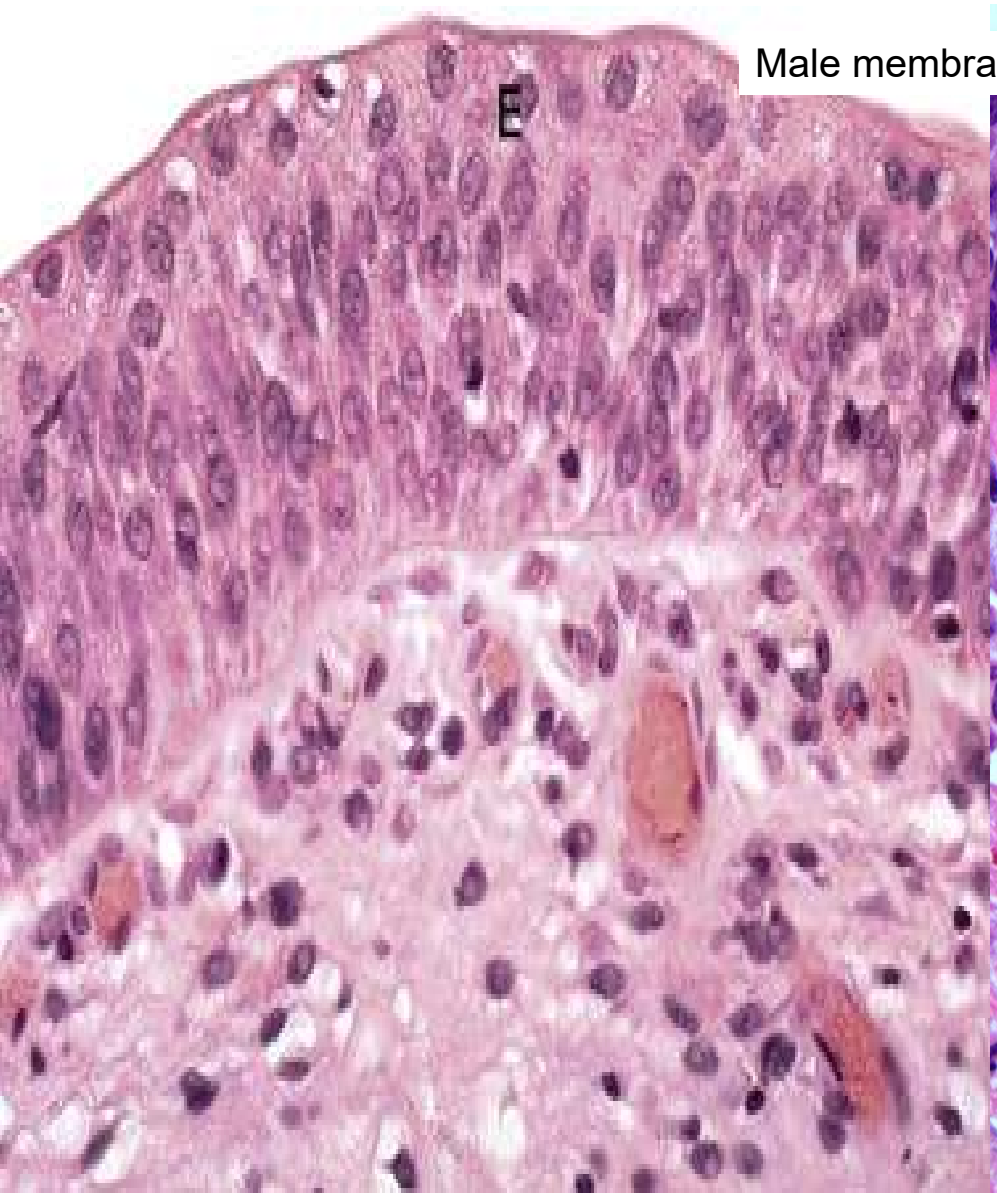

L
lps
A

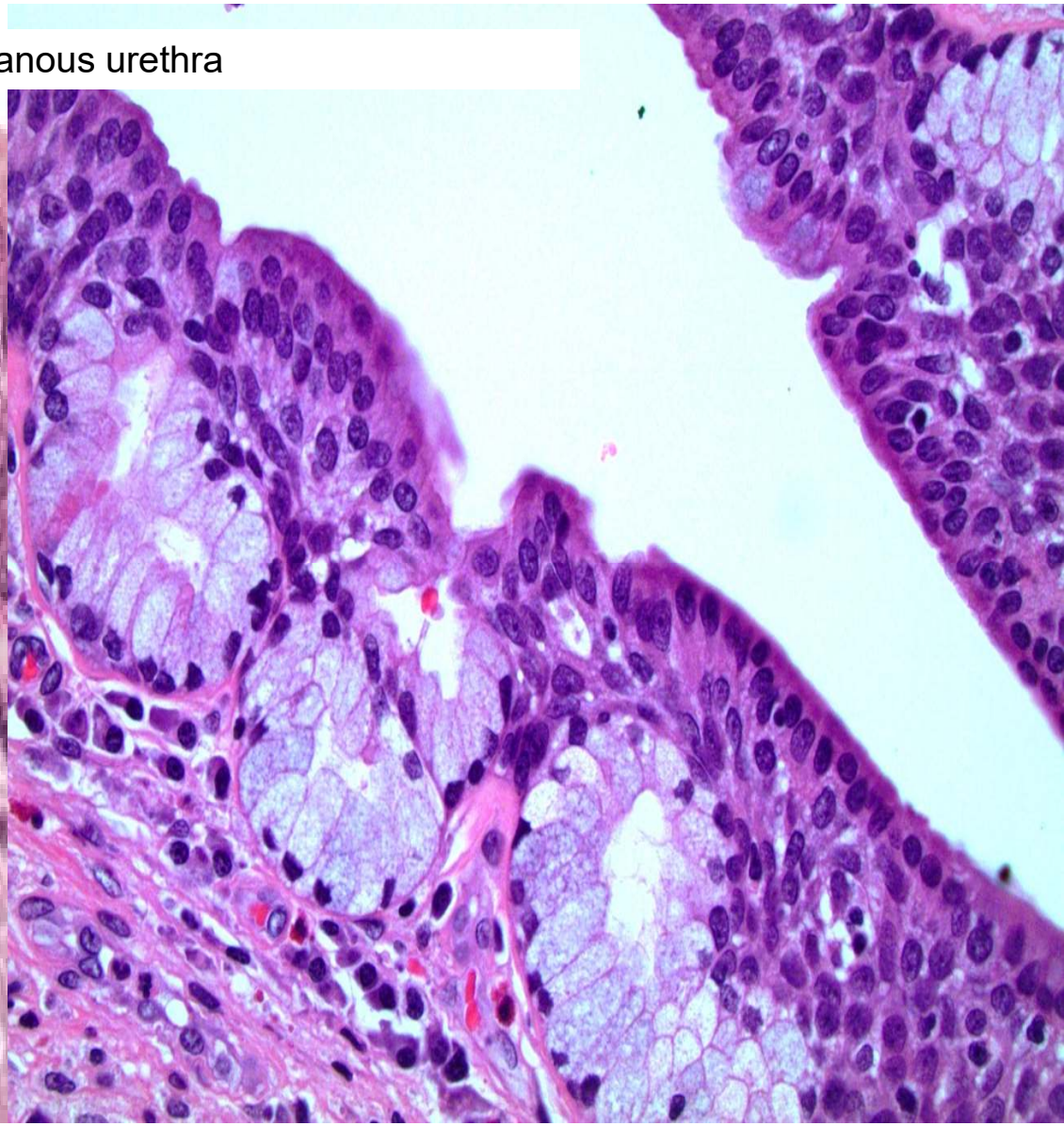

L
lps
C


L
lps
B


L
D

Male membranous urethra





Epithelia: Transitional

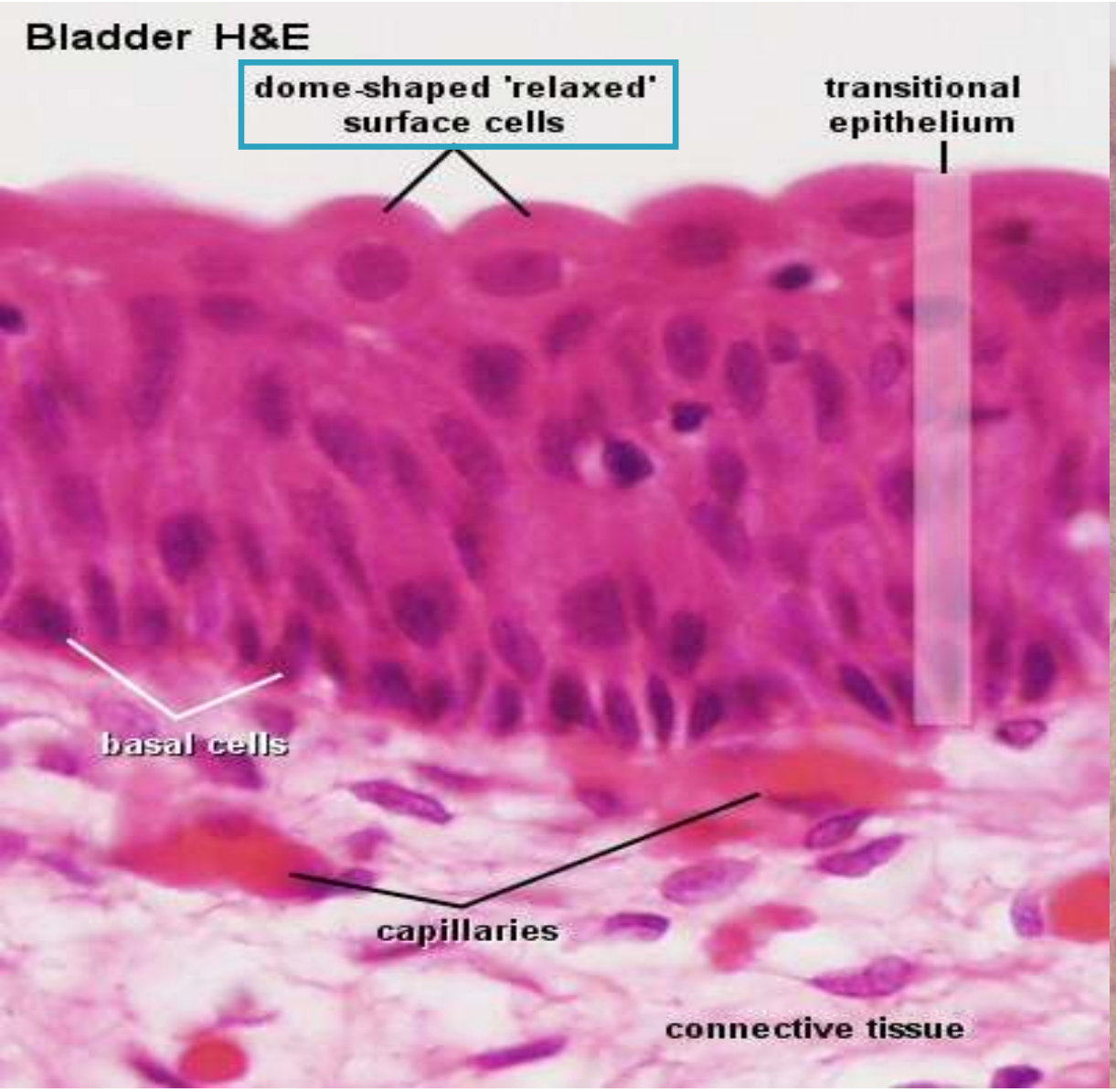
- Several cell layers,
  - **basal cells are cuboidal,**
  - **surface cells are dome shaped**
- remarkable ability to change its shape depending on the level of stretch or distension.
- Stretches to permit the distension of the urinary bladder
- Deeper layers can be cuboidal or columnar
- **Lines the**
  - **urinary bladder,**
  - **ureters,**
  - **and part of the urethra**

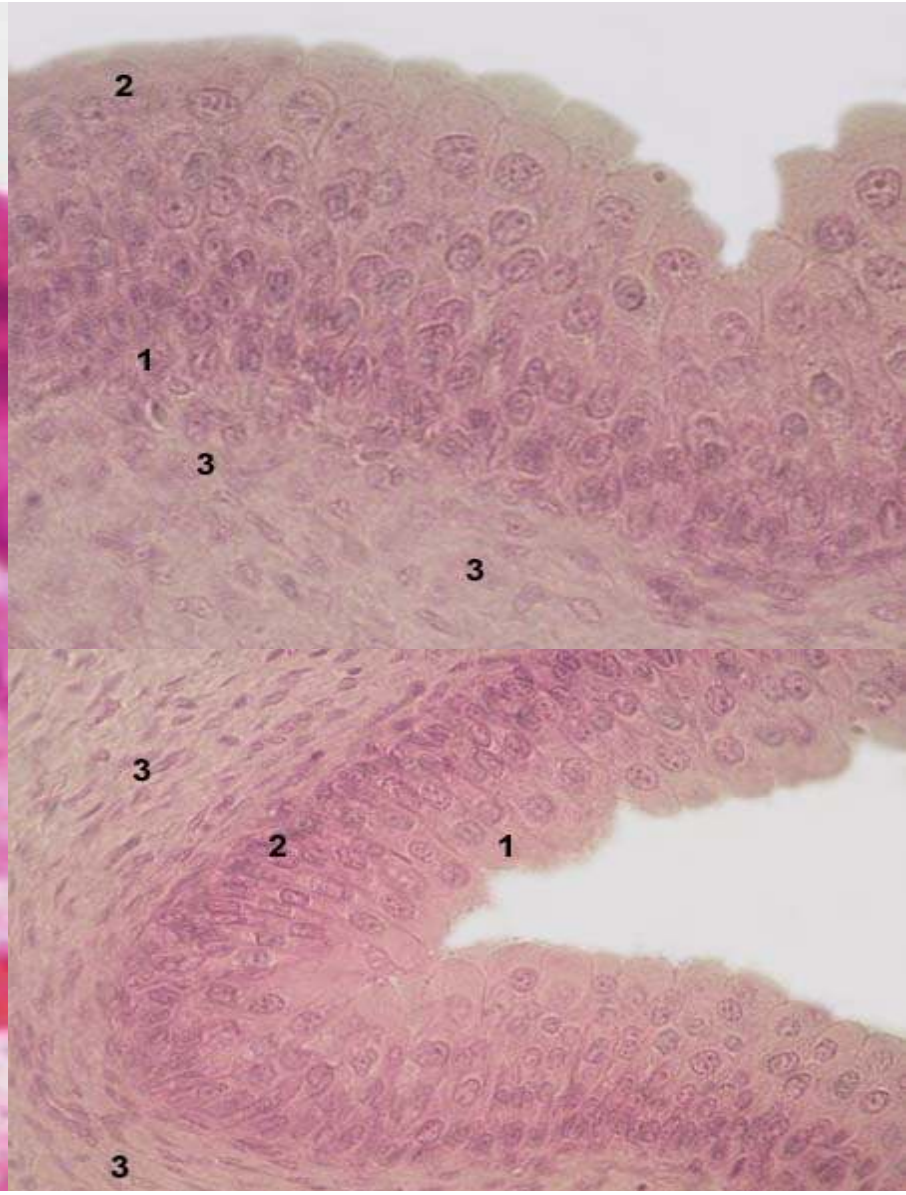
- **Shape-Shifting Ability:**
- When the organ is empty or relaxed, the **superficial cells appear cuboidal or rounded**, offering a smooth surface.

- As the organ fills and stretches (e.g., bladder filling with urine), the superficial cells **flatten** significantly, allowing for expansion without tearing.

- **This elasticity is crucial for organs like the bladder and ureters to accommodate fluctuating volumes of fluid.**

- More impermeable than other epithelia, preventing leakage of urine back into the bloodstream.

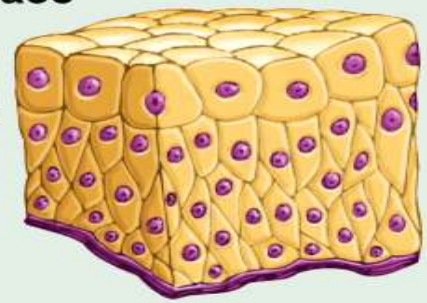

Bladder H&E
dome-shaped 'relaxed' surface cells
transitional epithelium
basal cells
capillaries
connective tissue


2
1
3
3
3
2
1
3

Epithelia: Transitional

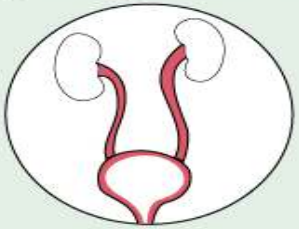
(f) Transitional epithelium

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, bladder, and part of the urethra.



Photomicrograph: Transitional epithelium lining the bladder, relaxed state (500×); 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.

Urinary Bladder: The urinary bladder is a major location where transitional epithelium is found.

- The tissue allows the bladder to stretch as it fills with urine and then recoil back to its original shape after voiding.
- This ability to expand and contract is essential for bladder function and urinary continence.

Ureters: Transitional epithelium also lines the ureters, the tubes that carry urine from the kidneys to the bladder.

- Like the urinary bladder, the ureters need to accommodate changes in urine volume and pressure as it moves through them.

Proximal Urethra: The proximal portion of the male and female urethra may also be lined with transitional epithelium.

- This part of the urethra is involved in the storage and passage of urine.

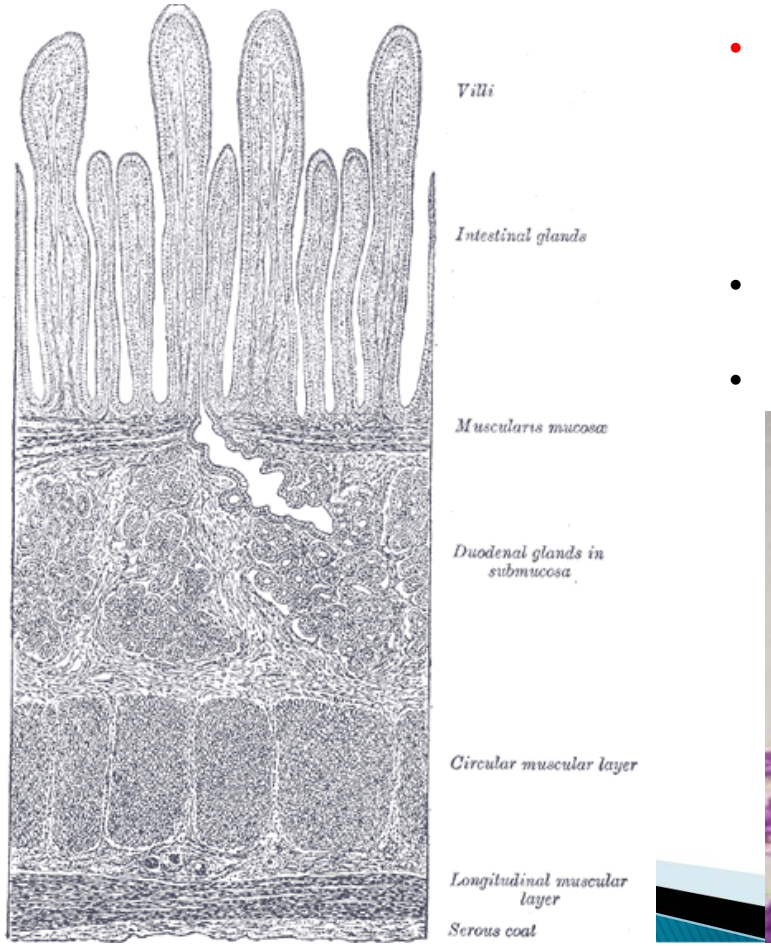
Renal Pelvis: The renal pelvis, which is the expanded upper portion of the ureter where urine collects before entering the bladder, is lined with transitional epithelium.

- This lining allows the renal pelvis to accommodate changes in urine volume produced by the kidneys.

Urethral Bladder Junction: In the male urethra, transitional epithelium is present at the junction between the bladder and the urethra.

- This transitional zone helps to prevent reflux of urine back into the bladder during micturition (urination).

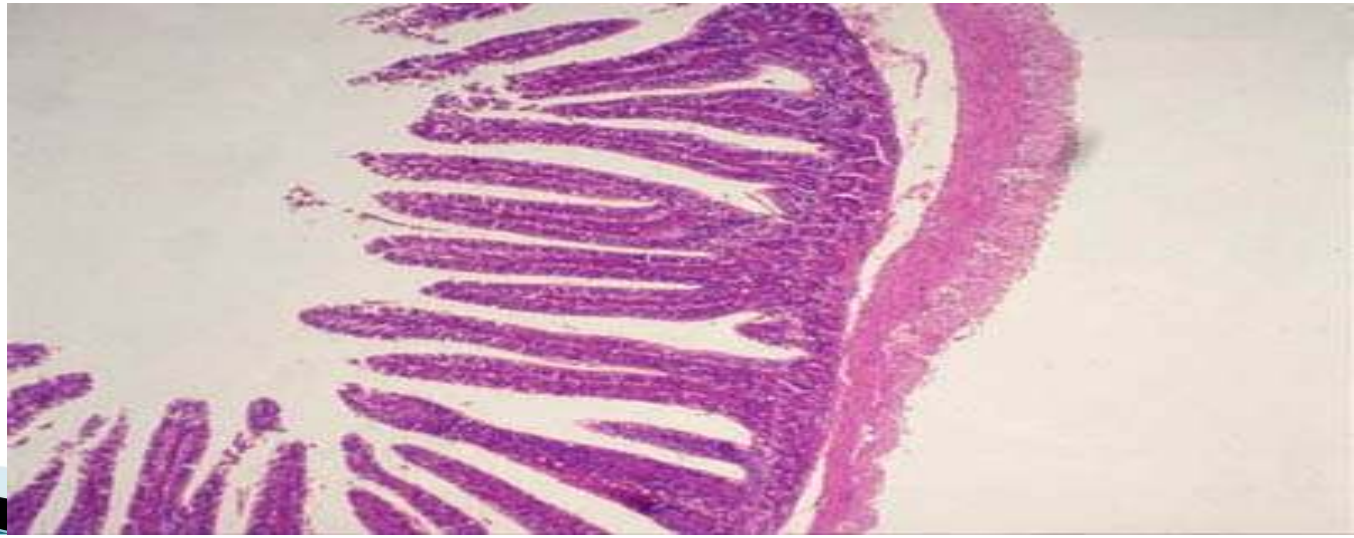
Villi and cilia

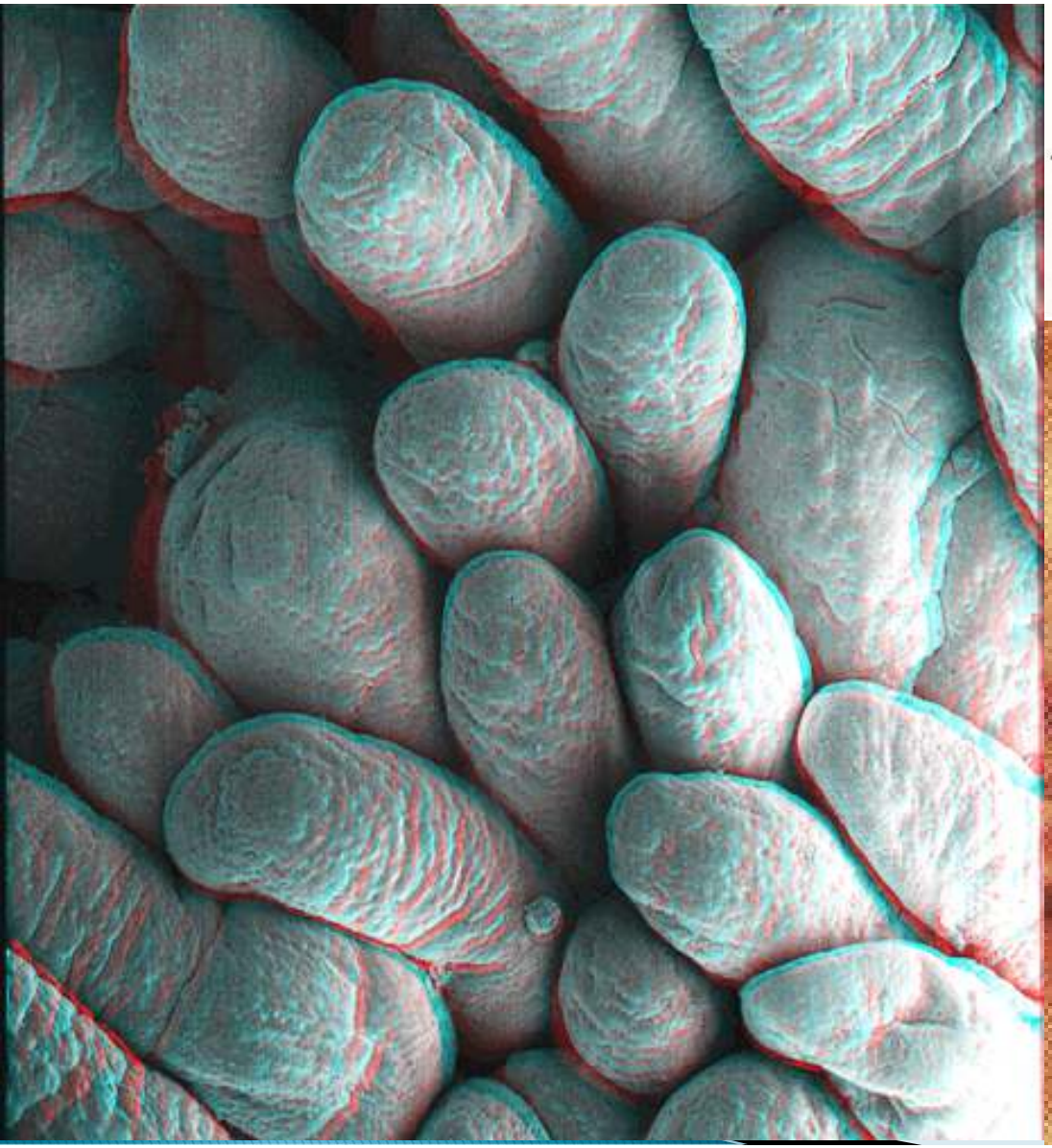


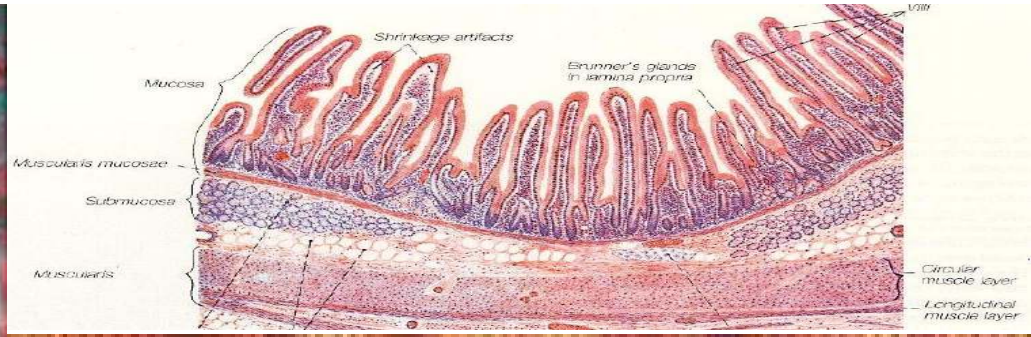
Intestinal villi (singular: **villus**)

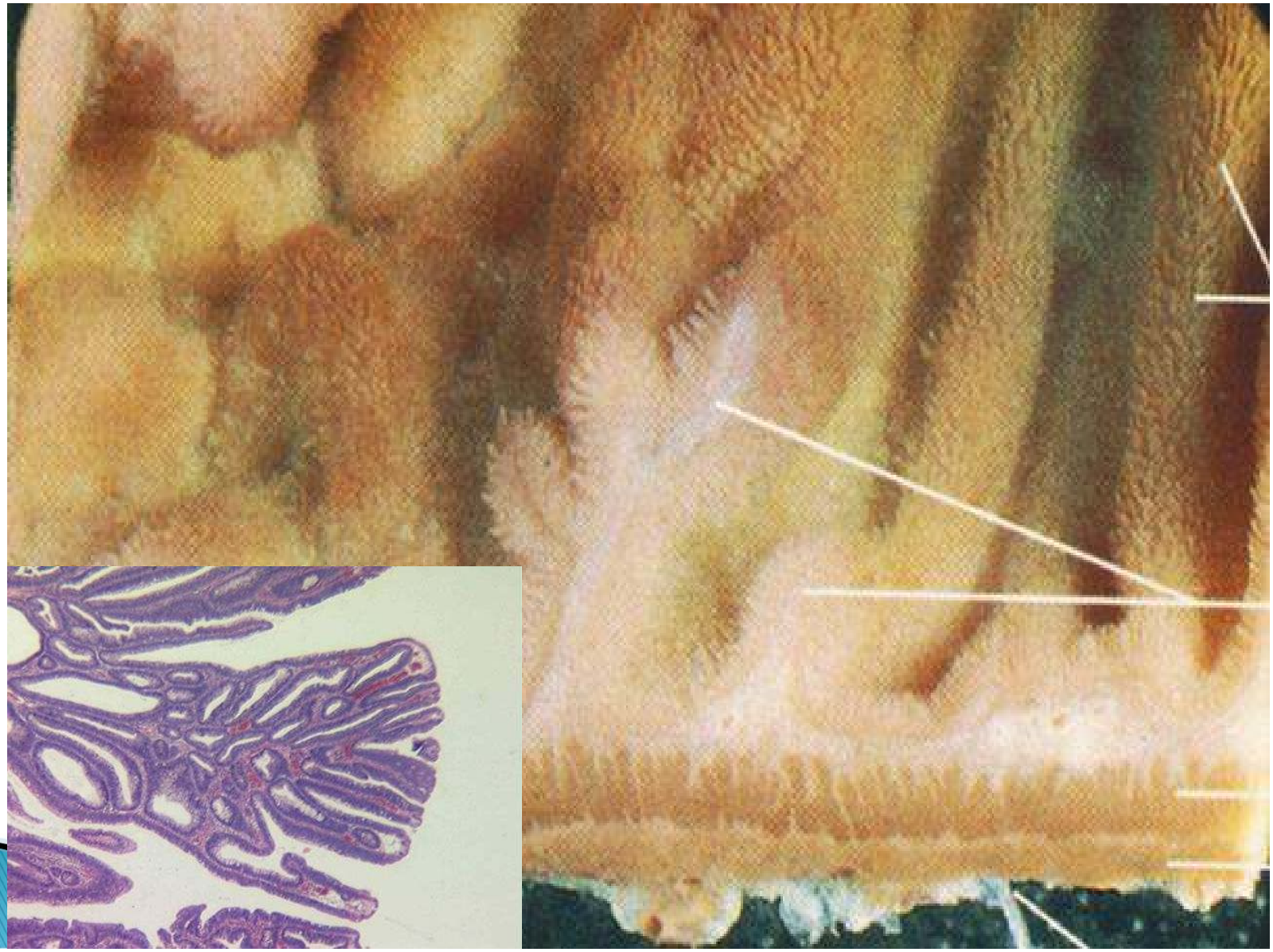
- are tiny, finger-like structures that protrude from the wall of the intestine and have additional extensions called microvilli (singular: microvillus) which protrude from epithelial cells lining villi.

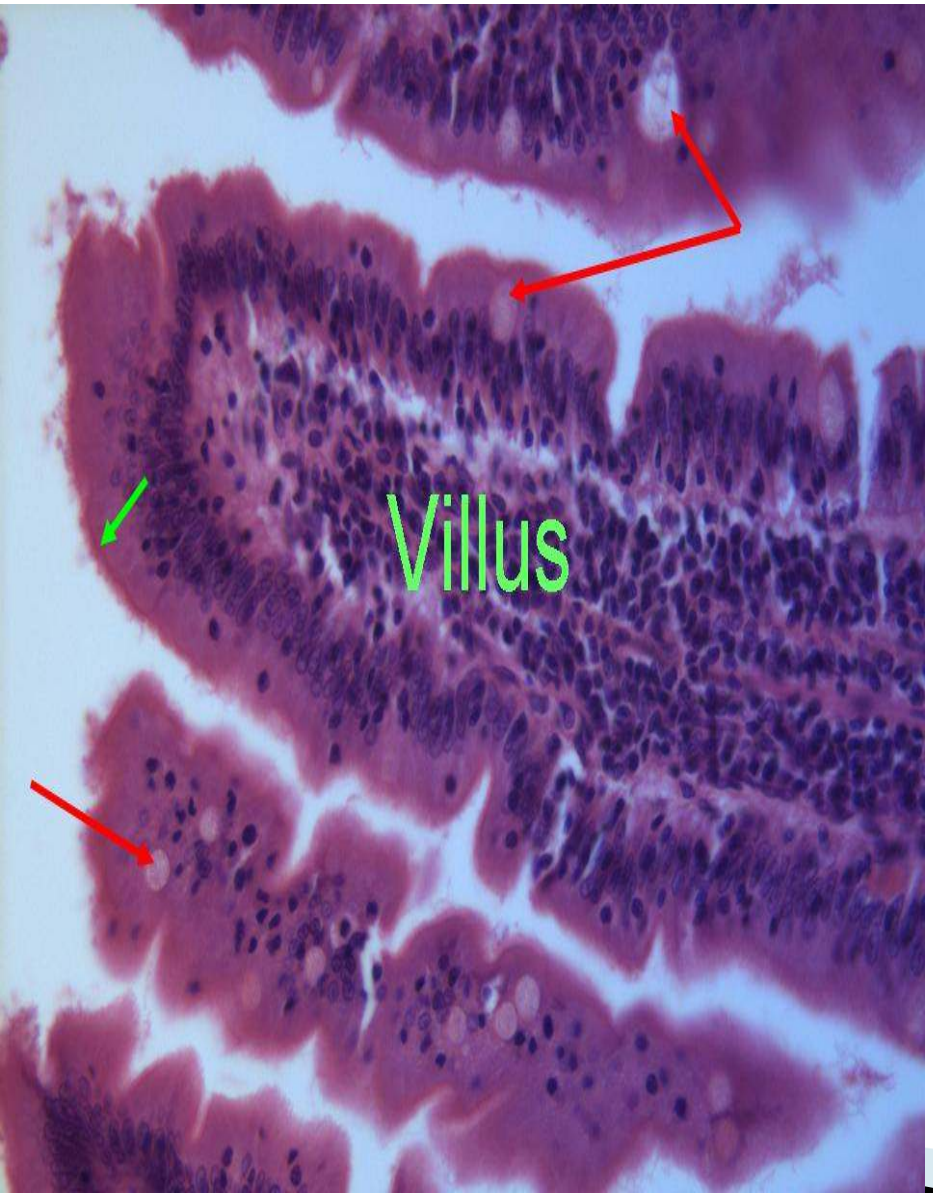
- They increase the absorptive area of the intestinal wall.
    - It is important that the food is absorbed at a considerably fast rate so as to allow more food to be absorbed.(If the process is too slow, the concentration of the blood in the blood vessels and the food will be equal, thus, diffusion will not occur.)
- Digested nutrients (including sugars and amino acids) pass into the villi through diffusion.
- Circulating blood then carries these nutrients away






Villi
Shrinkage artifacts
Brunner's glands in lamina propria
Mucosa
Muscularis mucosae
Submucosa
Muscularis
Circular muscle layer
Longitudinal muscle layer





functions of villi in the small intestine:

1.Increased Surface Area: Villi greatly increase the surface area available for absorption in the small intestine. Their numerous folds and projections effectively increase the surface area by several hundred times compared to a flat surface. This large surface area allows for more efficient absorption of nutrients.

2.Absorption of Nutrients: The primary function of villi is to absorb nutrients from the digested food in the intestinal lumen. Microvilli, which are even smaller projections on the surface of the epithelial cells covering the villi, further increase the surface area for absorption. Nutrients such as glucose, amino acids, fatty acids, vitamins, and minerals are absorbed across the epithelial cells of the villi and enter the bloodstream for distribution to the rest of the body.

3.Secretion of Enzymes and Mucus: Villi contain specialized cells called goblet cells that secrete mucus, which helps to lubricate the intestinal lining and protect it from mechanical damage and harmful substances. Additionally, cells within the villi secrete various digestive enzymes and hormones that aid in the digestion and absorption of nutrients.

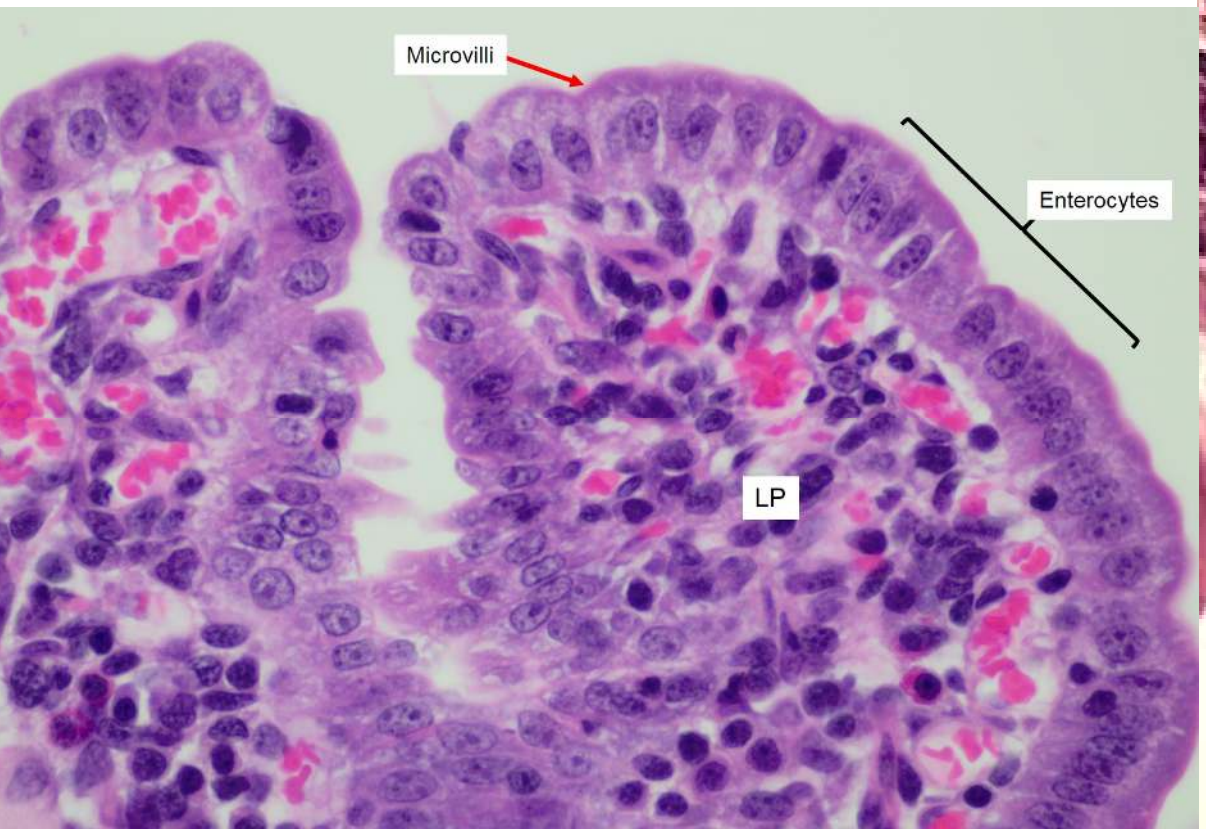
4.Transport of Absorbed Nutrients: Once absorbed, nutrients pass through the epithelial cells of the villi into the blood or lymphatic vessels located in the core of each villus. From there, they are transported to various tissues and organs throughout the body to support cellular functions, growth, and energy production.

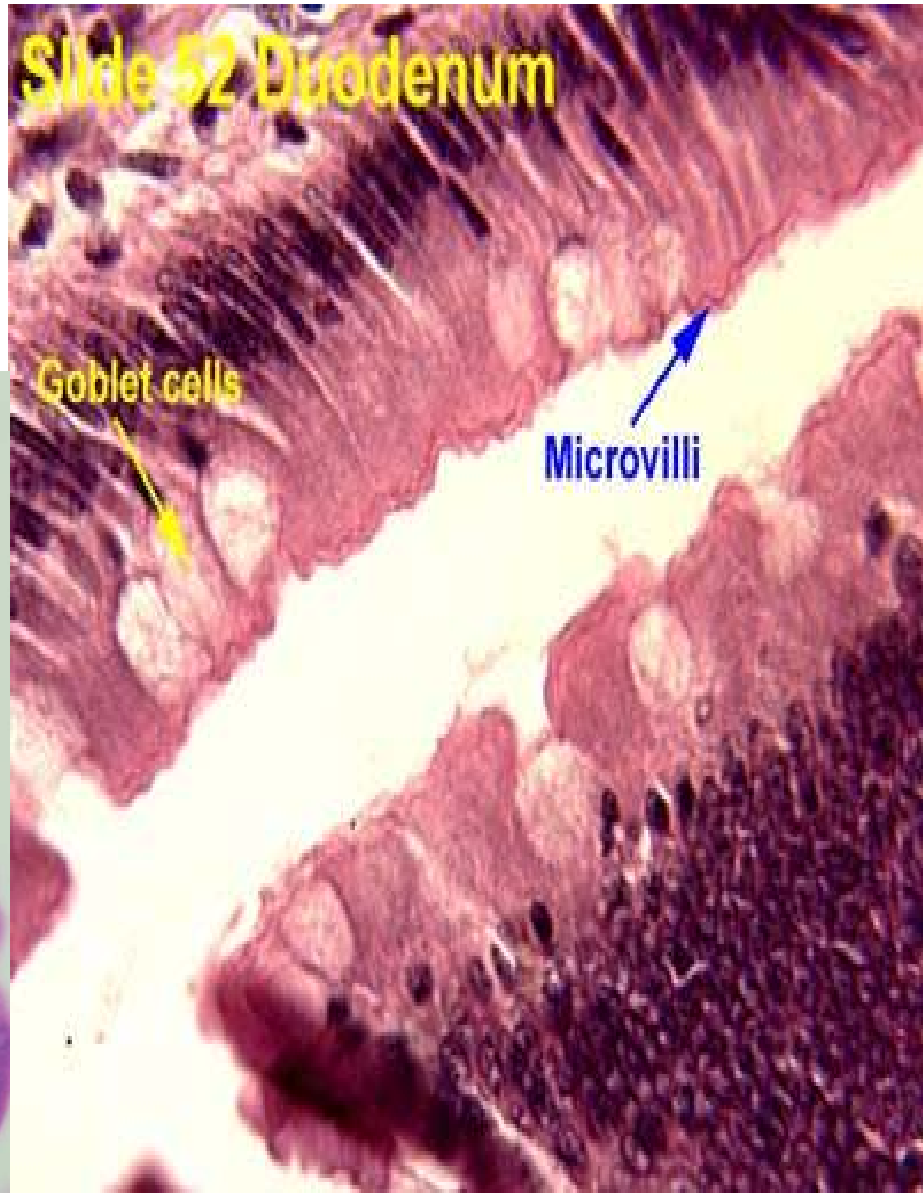
Microvilli:

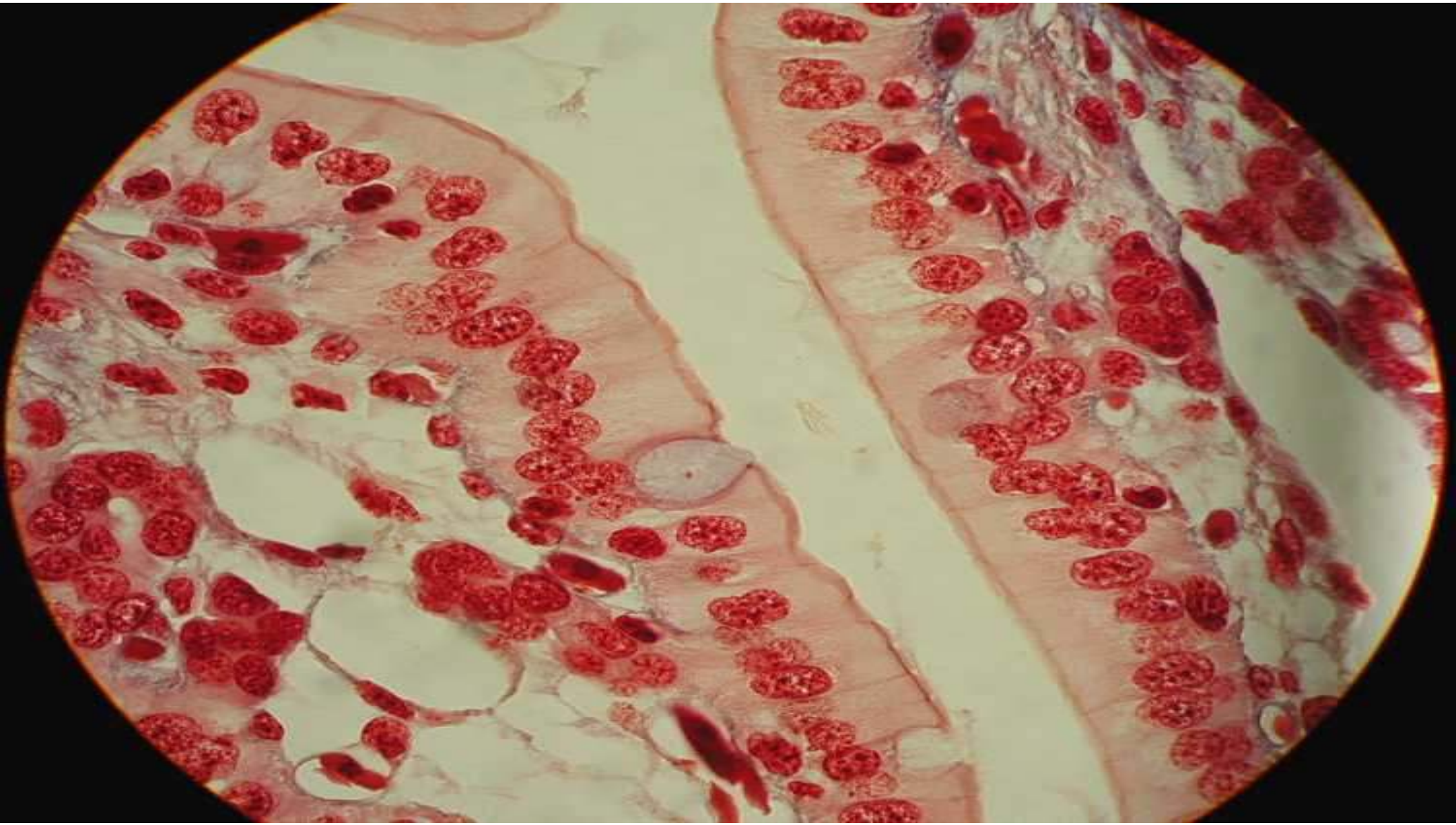
•Closely packed, finger-like projections of cytoplasm that **increase the surface area of the cell's apical surface, resulting in more effective absorption or secretion of substances**.

•Number and shape on cell surface correlate with absorptive capacity.

•Can be seen under LM ("brush border" or "striated border").







Microvilli are predominantly present in cells lining the

- small intestine,
- kidney tubules,
- certain cells in the respiratory
- reproductive systems.

- They play a crucial role in these areas,
  - **facilitating the absorption of nutrients, ions, and water,**
  - **secretion of waste products and hormones**.
- In some specialized cells, microvilli play a role in mechanosensation, the ability to detect touch or pressure.
- For instance, hair cells in the inner ear have microvilli that help convert mechanical stimuli into electrical signals.

microvilli are present:

1.Small Intestine: Microvilli are most abundant in the small intestine, particularly in the mucosal lining of the intestinal villi.

- They cover the surface of the epithelial cells, forming a brush border that greatly increases the surface area available for absorption of nutrients.

2.Large Intestine: Microvilli are also found in the lining of the large intestine, although they are less abundant compared to the small intestine.

- They contribute to the absorption of water and electrolytes from the intestinal contents.

3.Kidney Tubules: Microvilli are present on the surface of the epithelial cells lining the renal tubules in the kidneys.

- They increase the surface area available for reabsorption of water and solutes from the urine back into the bloodstream.

4.Gallbladder: Microvilli are present on the surface of the epithelial cells lining the gallbladder, where they facilitate the absorption of water and electrolytes from bile.

5.Uterine Tubes (Fallopian Tubes): Microvilli are found on the surface of the epithelial cells lining the uterine tubes. They aid in the movement of the egg and the absorption of nutrients from the surrounding fluid.

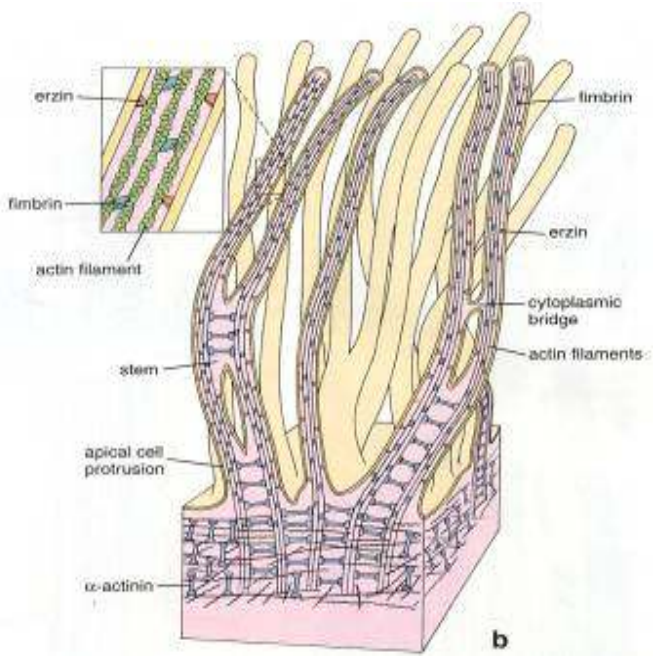
6.Inner Ear: Microvilli are present on the sensory hair cells of the inner ear, where they contribute to the detection of sound waves and maintenance of balance.

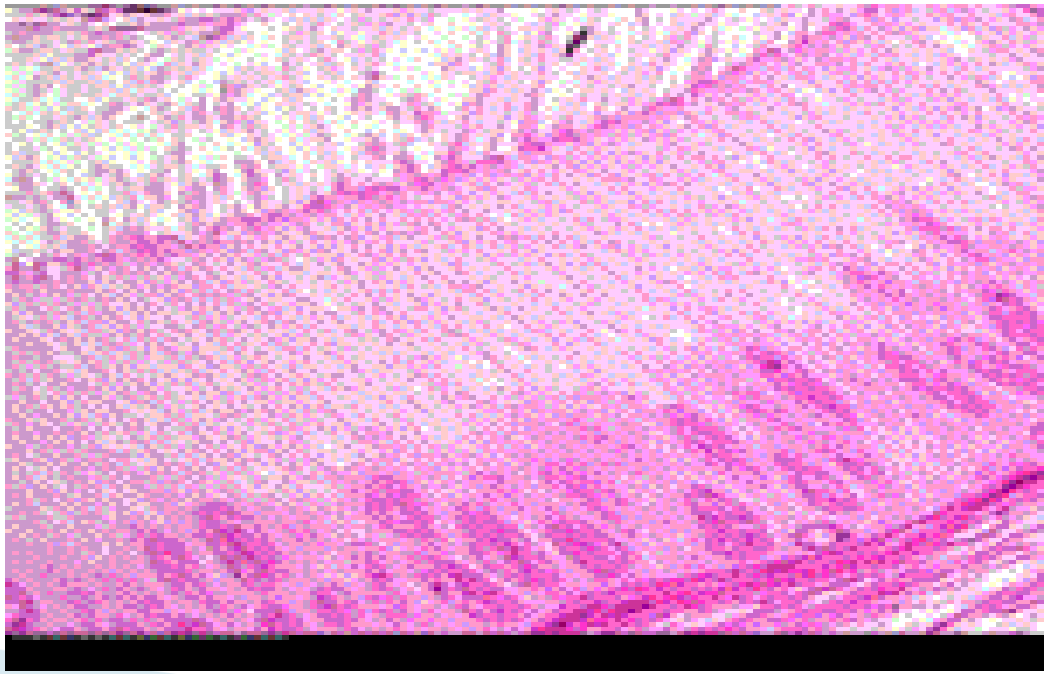
Stereocilia:

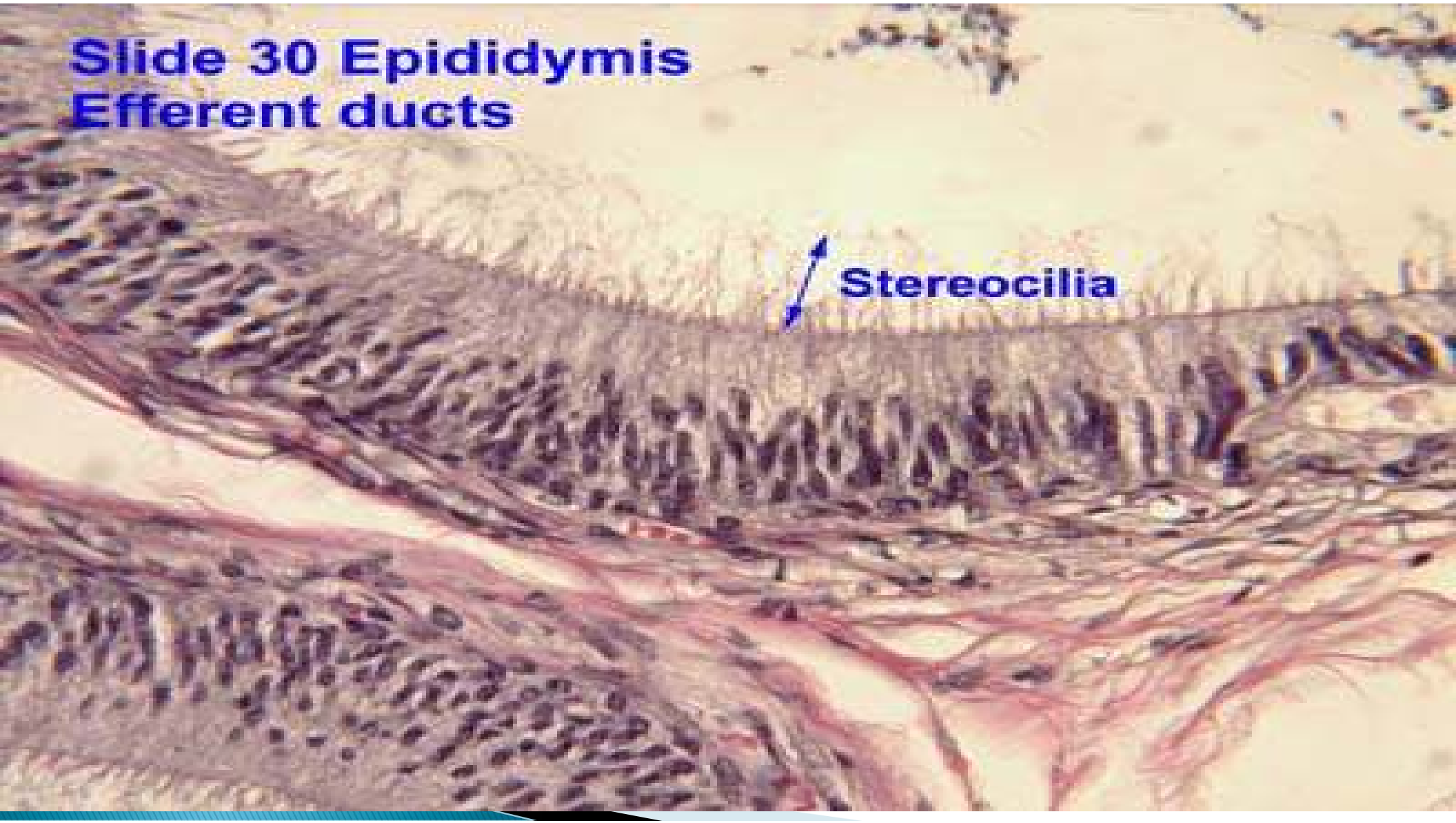
•Long microvilli.

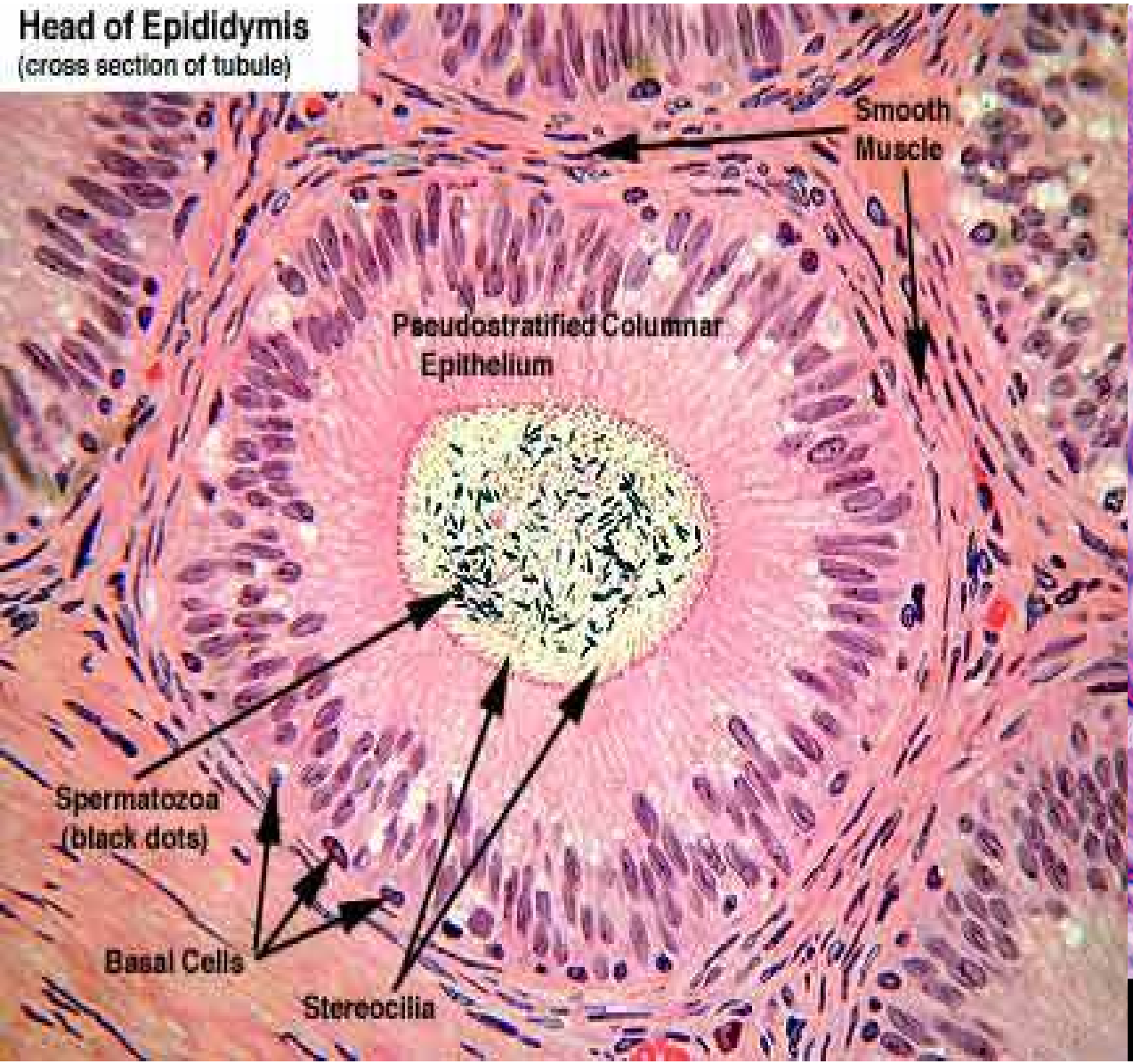
•Apical cytoplasmic protrusions, with intermingling thin and thick regions.

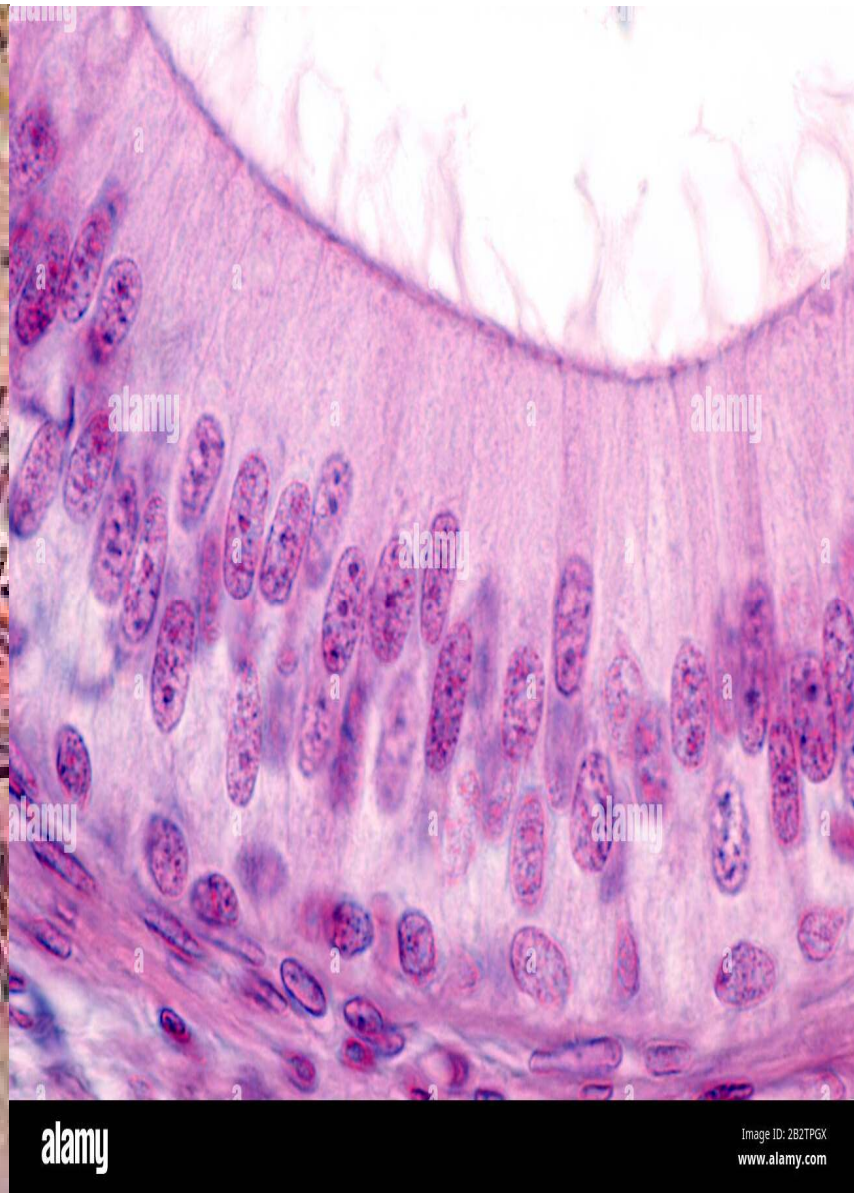
•*Where found*: limited to the male reproductive tract (epididymis and ductus deferens) and the receptor hair cells in the ear.






Slide 30 Epididymis
Efferent ducts
Stereocilia


Head of Epididymis
(cross section of tubule)
Smooth
Muscle
Pseudostratified Columnar
Epithelium
Spermatozoa
(black dots)
Basal Cells
Stereocilia


alamy
Image ID: 2B2TPGX
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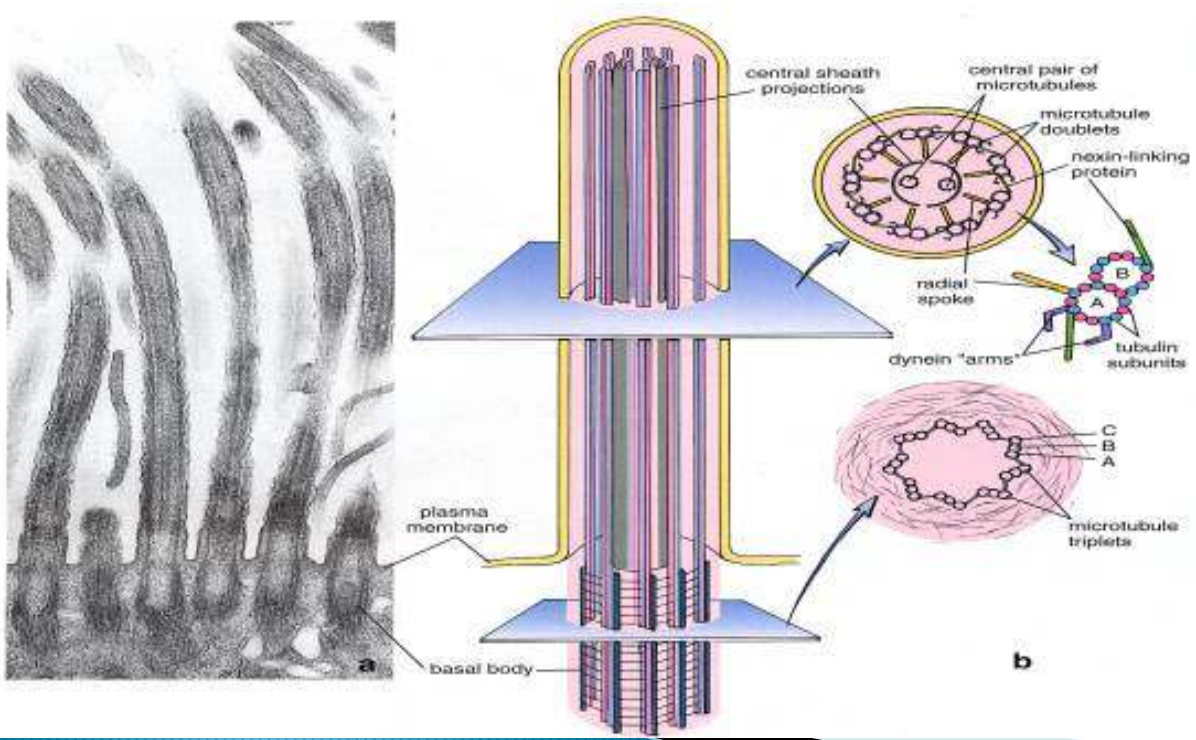
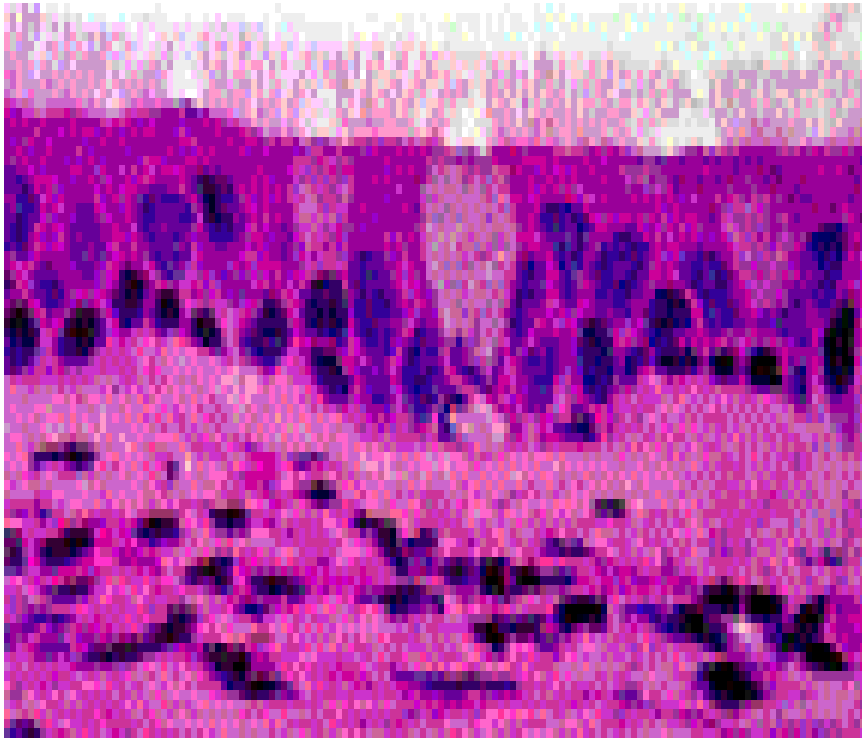
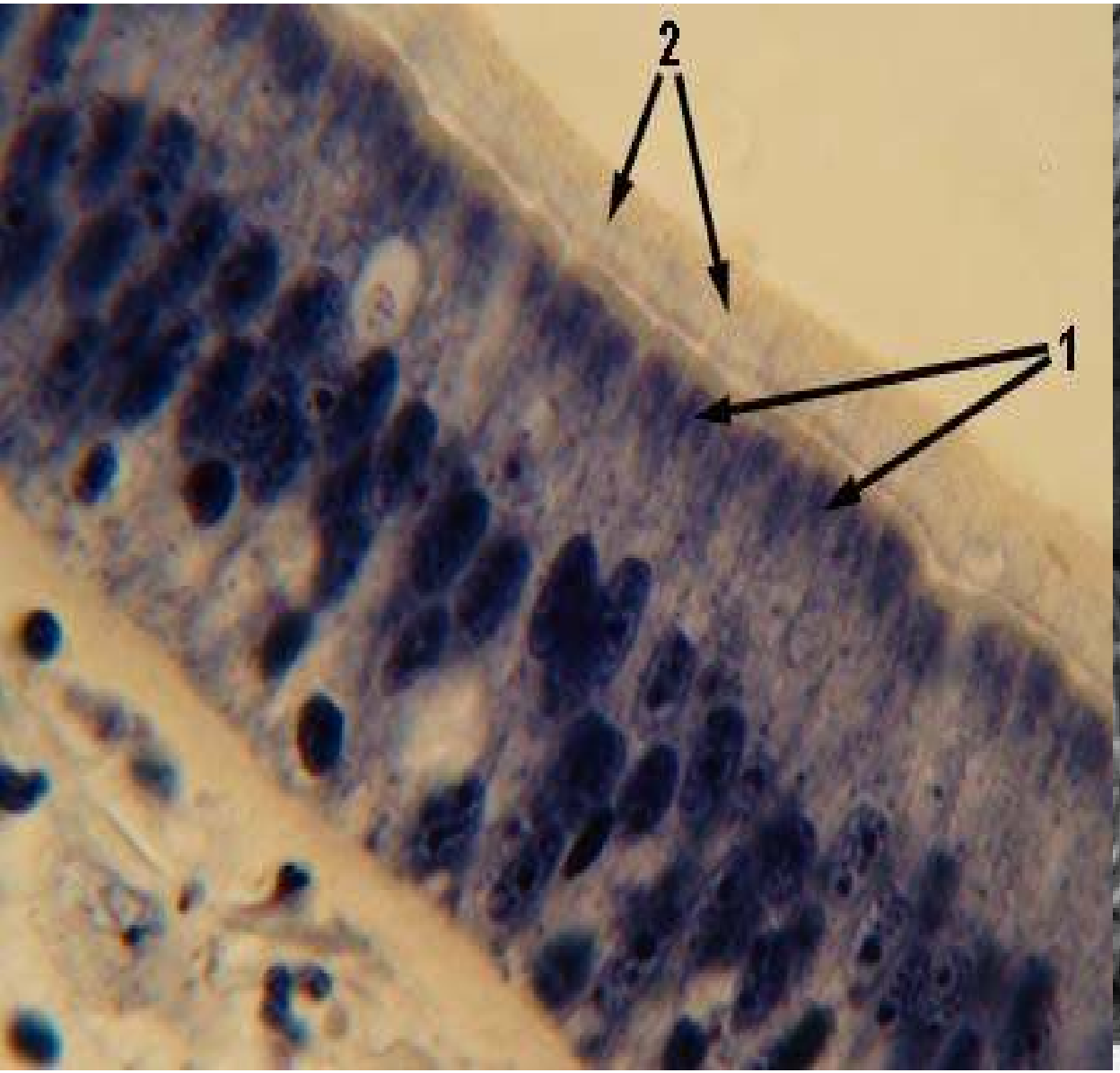
Cilia:

•Motile cytoplasmic structures capable of actively propelling particles along cell surface.

•***Where found*:** respiratory epithelium-nasal cavity, trachea, bronchus, oviducts.



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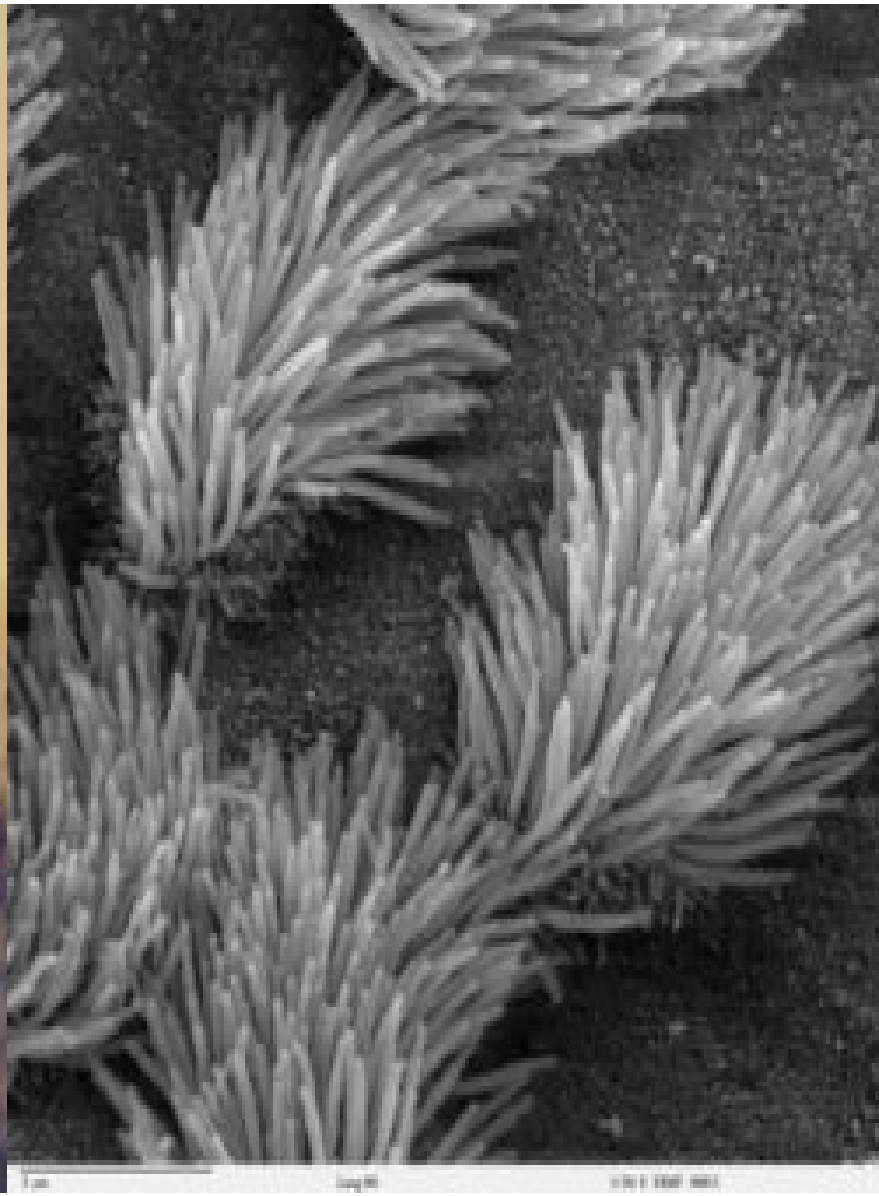

1.Respiratory Tract: Ciliated pseudostratified columnar epithelium lines the respiratory tract, including the nasal cavity, trachea, and bronchi.

- The cilia on the surface of these epithelial cells beat in a coordinated manner to move mucus and trapped particles upward toward the throat, where they can be swallowed or expelled.

2.Fallopian Tubes (Uterine Tubes): Ciliated simple columnar epithelium lines the fallopian tubes (uterine tubes) in the female reproductive system.

- The cilia in the fallopian tubes help to create a current that moves the egg (ovum) from the ovary toward the uterus, where fertilization can occur.

3.Epididymis: Ciliated pseudostratified columnar epithelium lines the epididymis, a coiled tube located on the surface of the testis.

- The cilia in the epididymis help to move spermatozoa from the testis toward the vas deferens.

4.Central Nervous System (Ependymal Cells): Ependymal cells, a type of epithelial cell that lines the ventricles of the brain and the central canal of the spinal cord, have cilia that help to circulate cerebrospinal fluid (CSF) within the central nervous system.

5.Oviducts of Invertebrates: In some invertebrates, such as certain species of mollusks and arthropods, ciliated epithelial cells line the oviducts and play a role in transporting eggs or larvae.

Recommended site:

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