



EPITHELIAL TISSUES (SIMPLE EPITHELIUM)



Curriculum: Phase 1/ Semester2/ TOB / Session 1

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SELECTED REFERENCES



1. Langman's Medical Embryology, 11th Edition *by, TW Sadler*, ISBN: 978-1-6054-7656-8, pages-385, Publisher: Lippincott.

2. Basic Histology, 12th Revised Edition, by *Luiz Junqueira*, ISBN 9780071630207,



LECTURE OBJECTIVES



- define epithelia as sheets of contiguous cells, of varied embryonic origin, that cover the external surface of the body and line internal surfaces.
- explain the position, structure and function of the basement membrane.
- describe the ways in which epithelia are classified, explaining what is meant by the classification terminology, simple



Feature of Epithelial Tissue

Epithelia are cellular sheets that line the cavities of organs and cover the body surface.

Epithelial tissues are composed of closely aggregated polyhedral cells with strong adhesion to one another and attached to a thin layer of extracellular matrix (ECM)



Describe the ways in which epithelia are classified, explaining what is meant by the classification terminology, simple

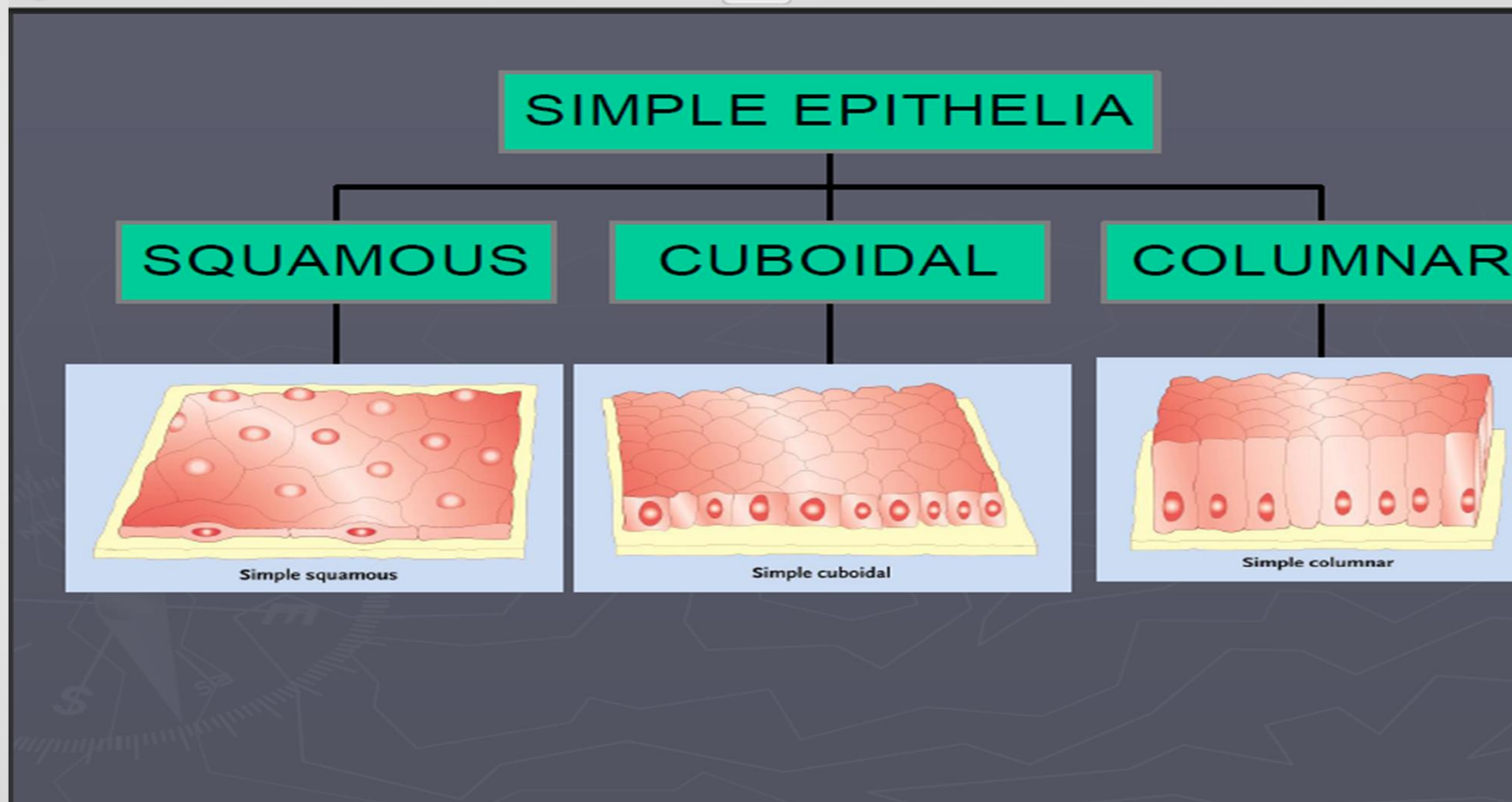
STRUCTURE OF EPITHELIAL TISSUES





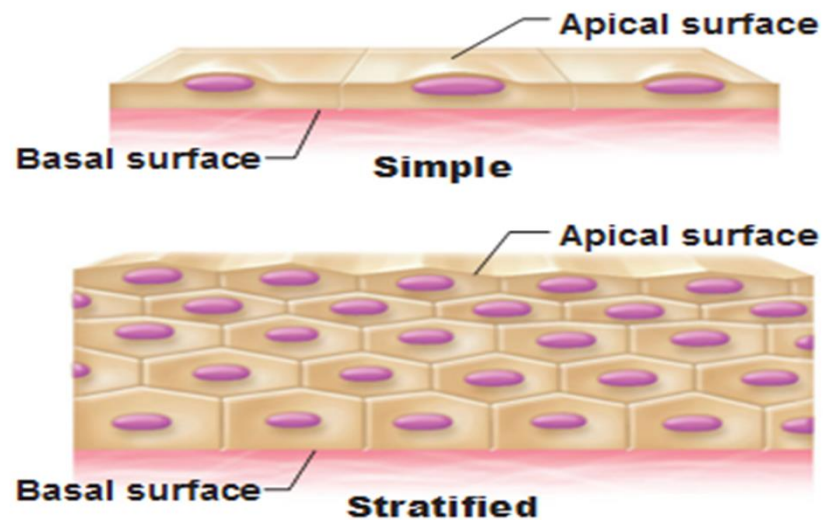
Cell shapes

Based on cell shape simple epithelia are classified as squamous (thin cell) , cuboidal (cell width and thickness), columnar (cells taller than they wide).



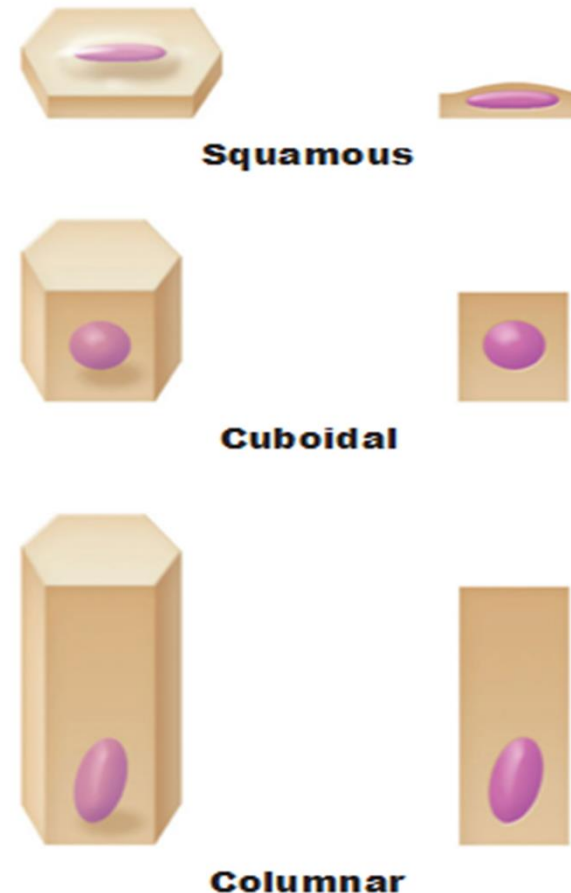
Cell shapes

Classifications of Epithelia

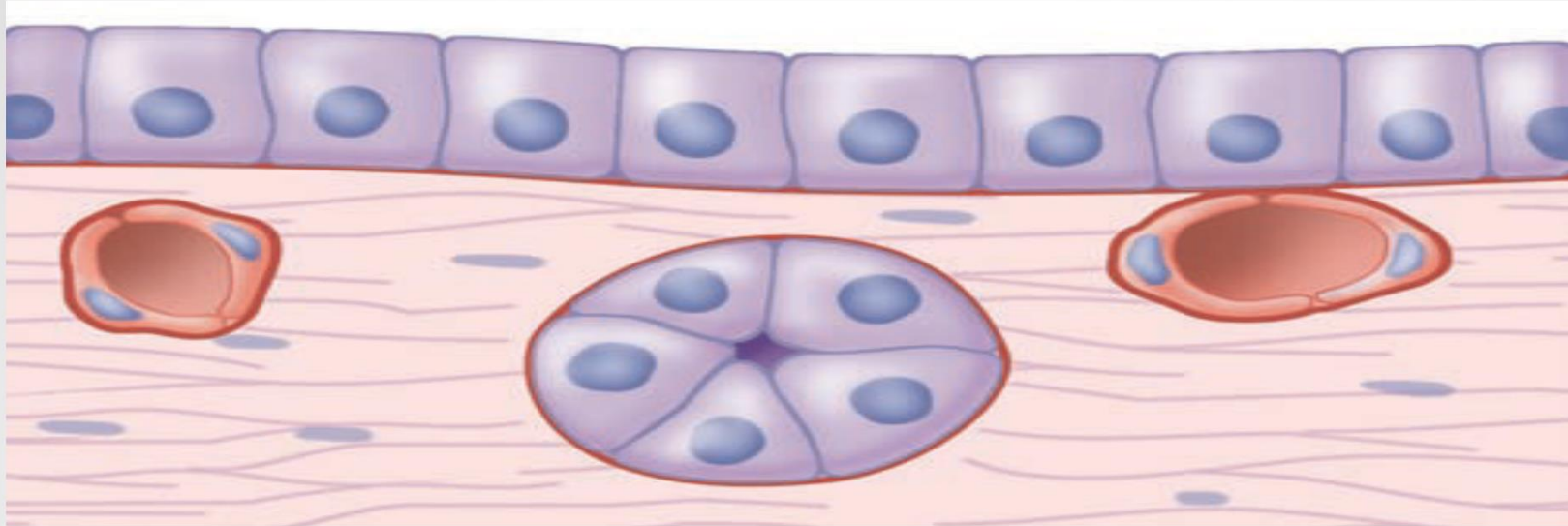


(a) Classification based on number of cell layers

Note that basal cells regenerate; as apical cells slough off, they are replaced by basal cells

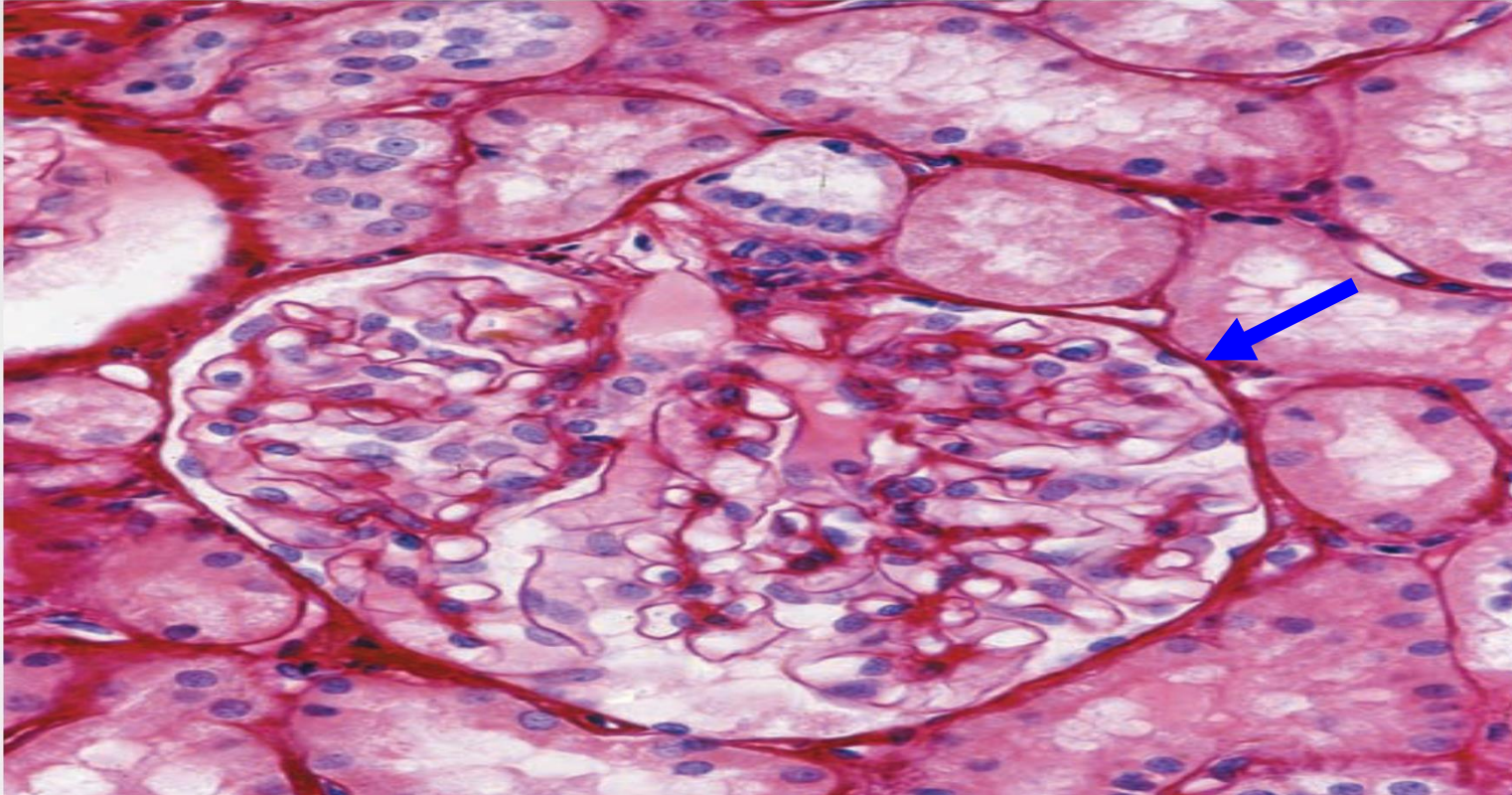


(b) Classification based on cell shape

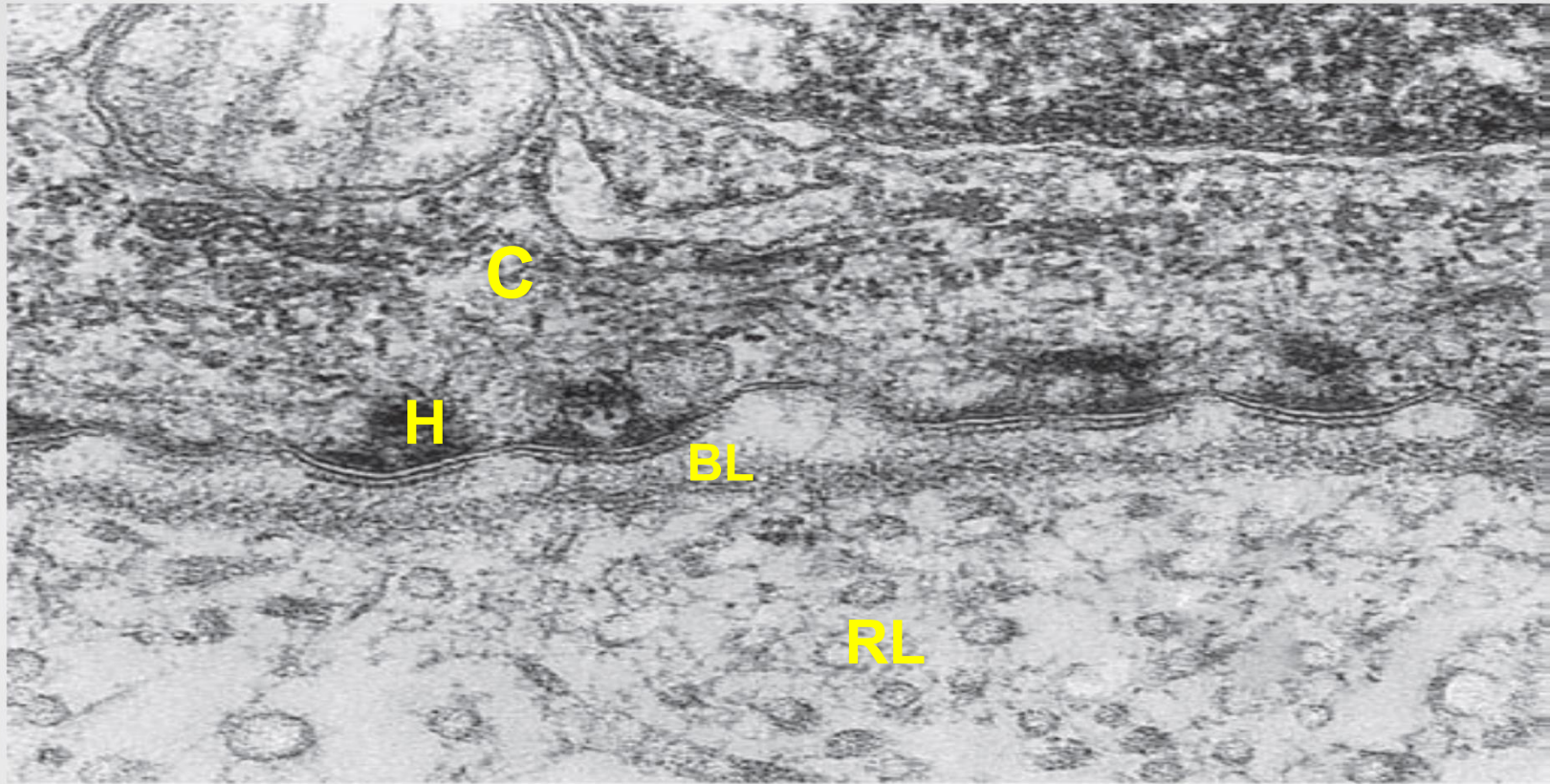


Cuboidal cells of epithelia generally have spherical nuclei. An extracellular basement membrane (red) always lies at the interface of epithelial cells and connective tissue. Nutrients for epithelial cells must diffuse across the basement membrane.

Basement membranes have many functions: They provide structural support and polarity to epithelial cells and attach epithelia to underlying connective tissue.



This section of kidney shows the well-stained basement membranes (arrows) of epithelia forming structures within the large, round renal glomerulus and its surrounding tubules. In kidney glomeruli the basement membrane, besides having a supporting function, has a highly developed role as a filter that is key to renal function.



TEM revealed The dense basal lamina (BL) may appear with thin clear zones on each side and is anchored to a thicker, more diffuse reticular lamina (RL) containing collagen III reticular fibers. Hemidesmosomes (H) bind the basal surface of the epithelial cell (C) to the basal lamina.



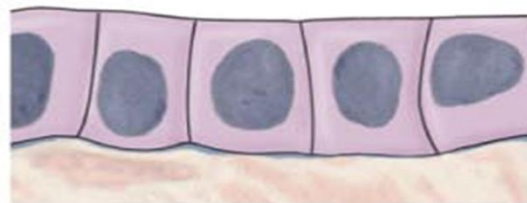
Nucleus of Epithelial Cells

Epithelial cell nuclei vary in shape and may be (oval), spherical, or flattened. Nuclear shape corresponds to cell shape; tall cells have elongated nuclei and squamous cells have attenuated nuclei. Cuboidal cells usually have more spherical nuclei.

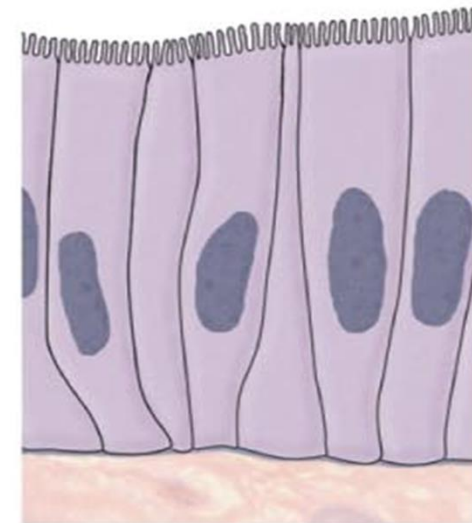
Simple epithelia



Squamous



Cuboidal



Columnar



Covering and lining epithelium



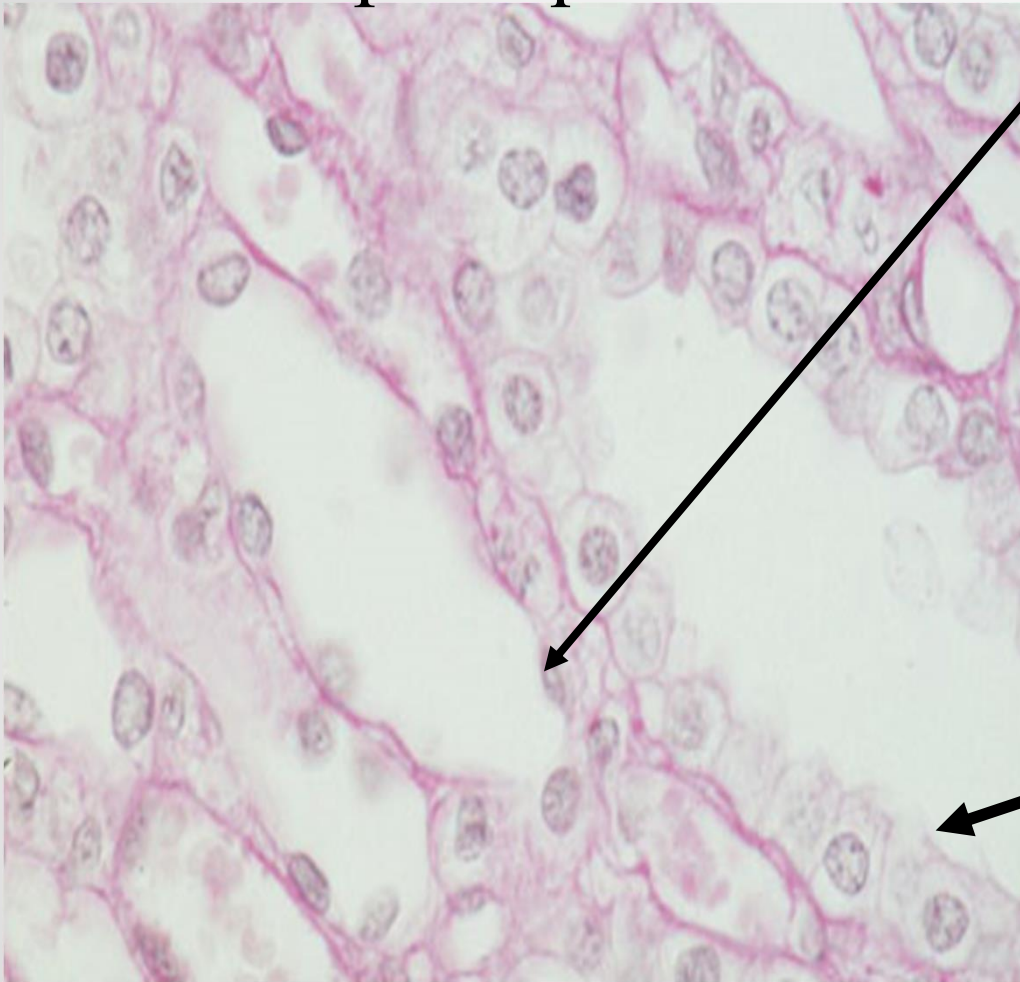
Epithelial cells have an apical (free) surface , which is exposed to body cavity , lining of internal organ or exterior of body

Mesothelium: Epithelia, form continuous layers that cover surfaces (e.g. skin) and line cavities of the body. The cavities include the 'closed' peritoneal, pleural and pericardial cavities.

Endothelium :Epithelium also lines the chambers of the heart and blood and lymphatic vessels .

Epithelial functions include

Simple Squamous & Cuboidal Epithelia

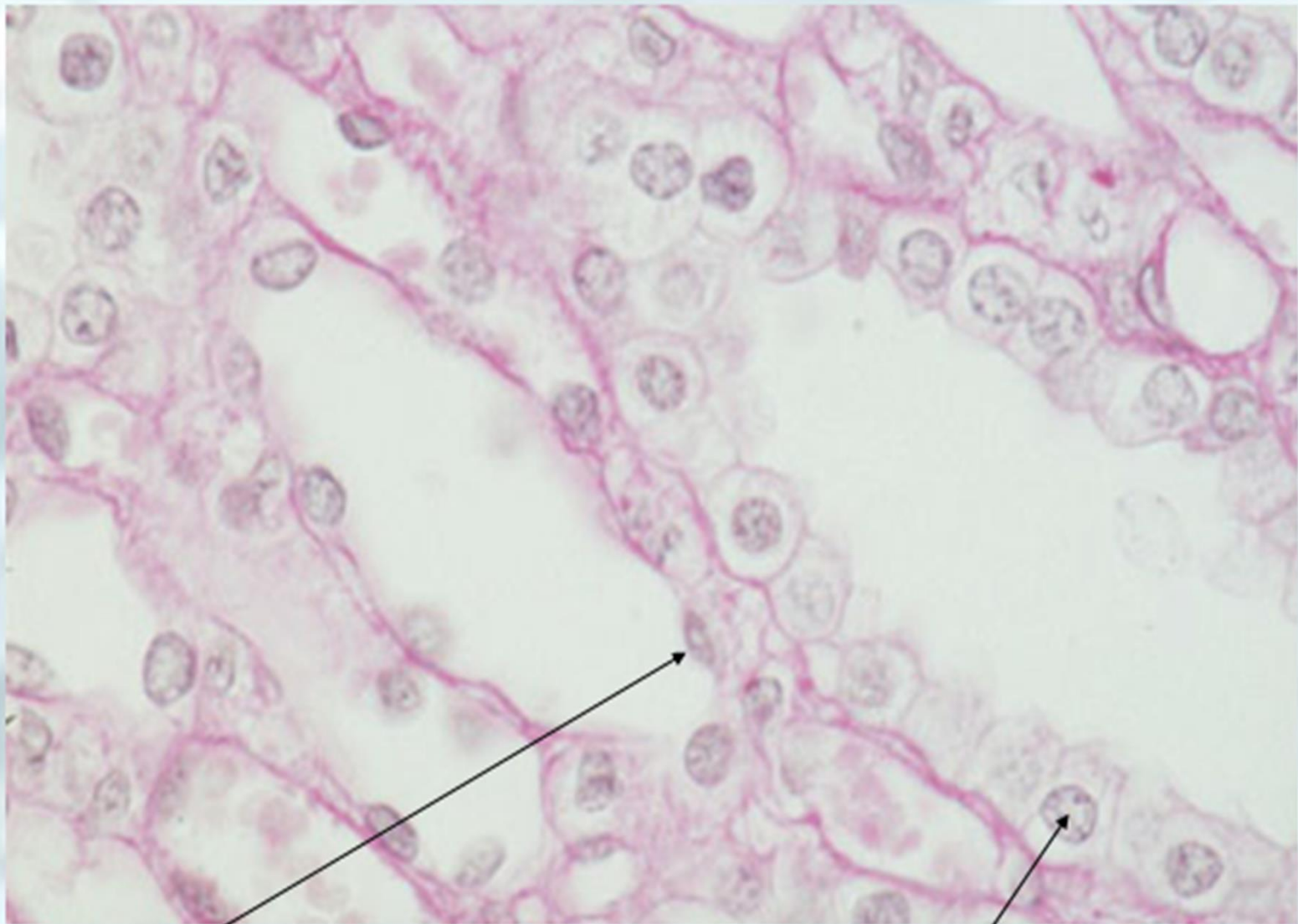


Squamous (single arrow)

- Formed by flattened cells whose nuclei often appear to bulge outwards.
- Found in places where there is movement of materials and even cells across the epithelium. Example here is from the loop of thin segment of Henle in the kidney, also found lining all blood vessels, forming Bowman's capsule in the renal cortex.

Cuboidal (double arrows)

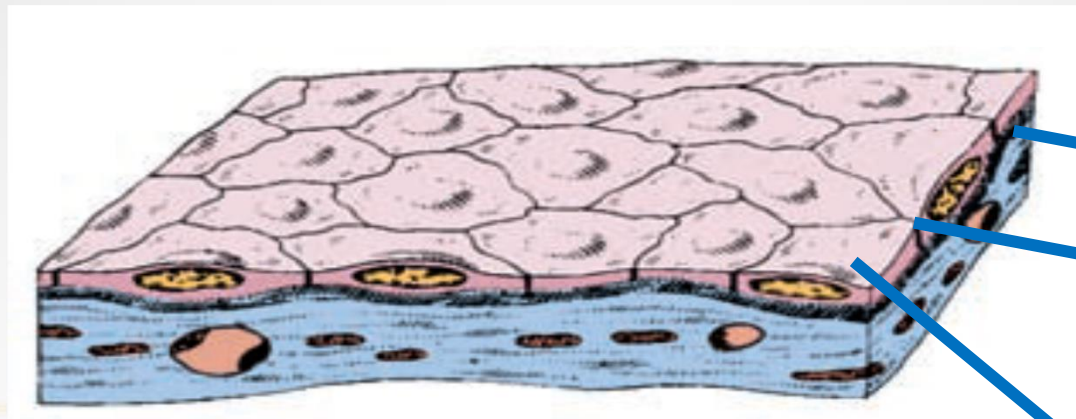
- In section cell profiles appear as squares with central nuclei.
- Found lining tubules in kidney, found in thick segment of Heles loop



**Nucleus of simple
squamous cell**

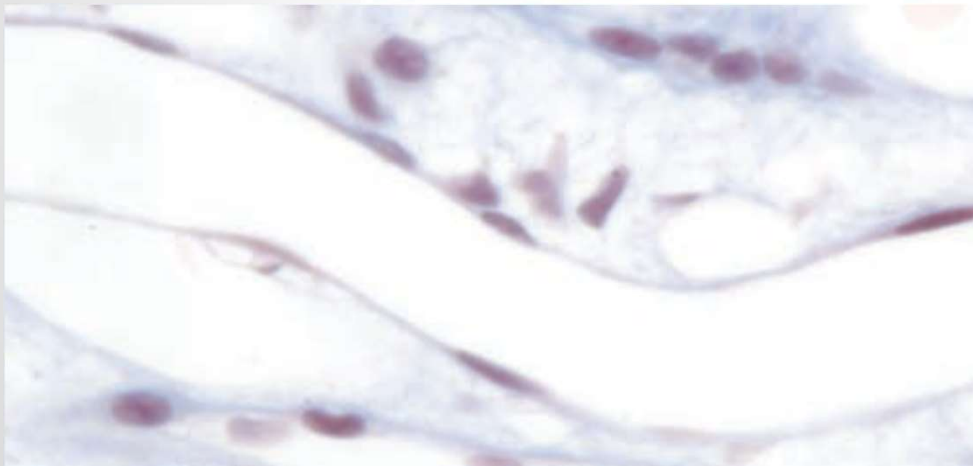
**Nucleus of simple
cuboidal cell**

Simple squamous epithelium

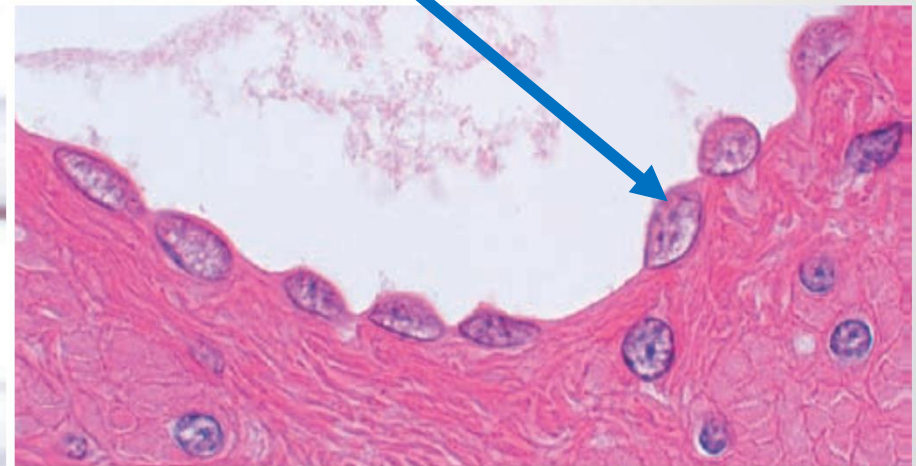


Basement
membrane

Epithelium

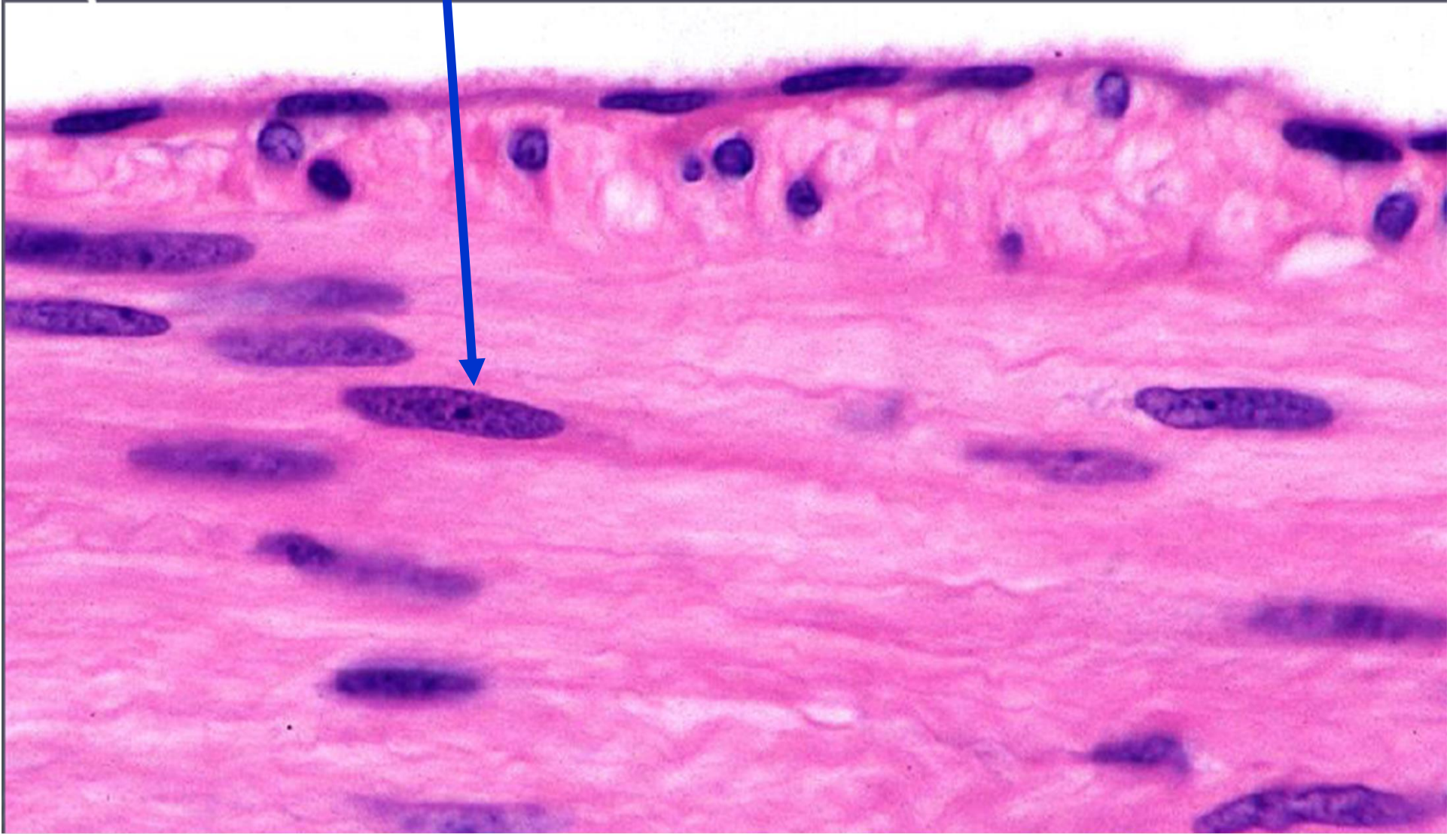


lining the thin renal loops of Henle (facilitates the movement of materials)



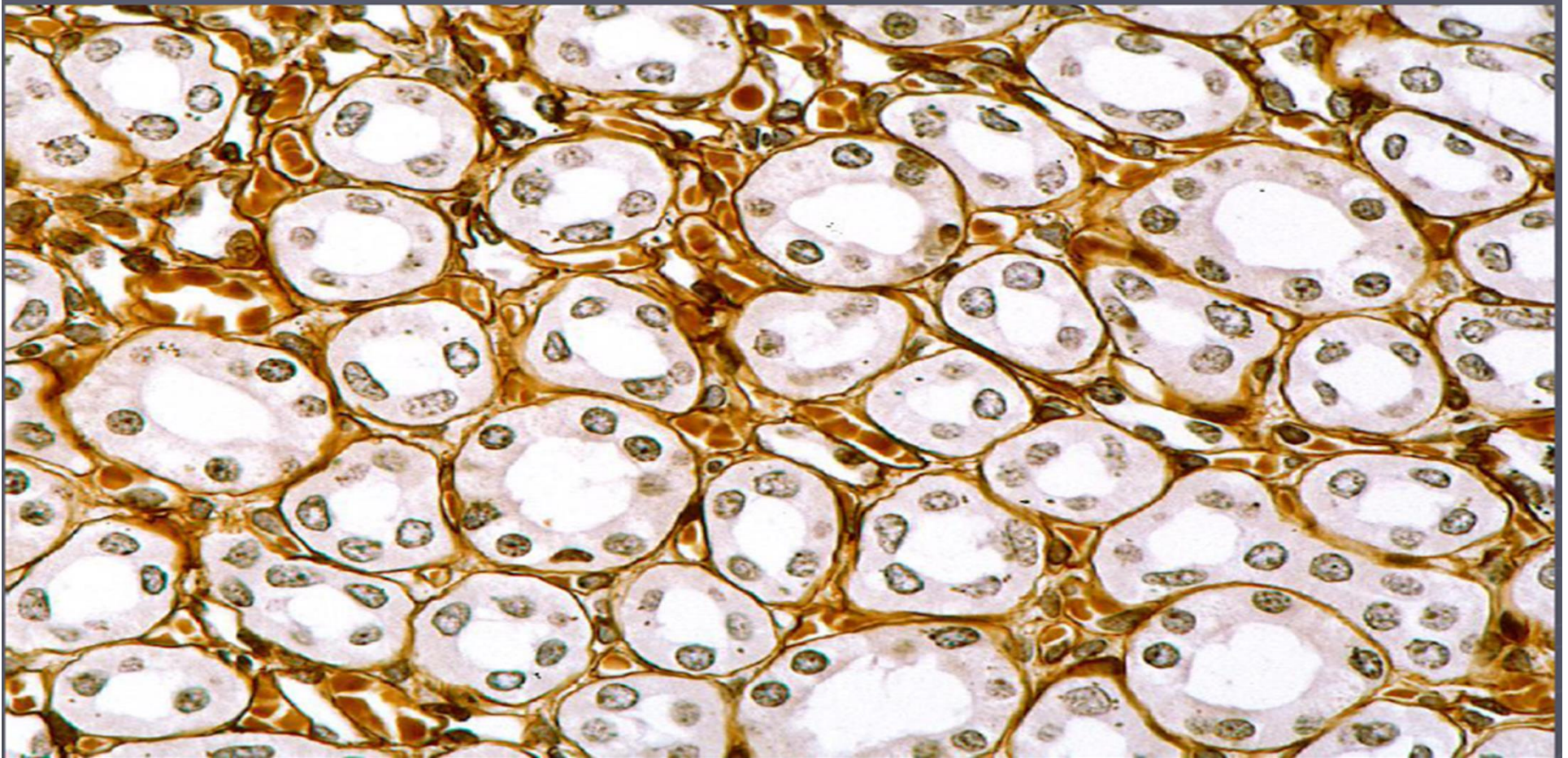
covering the outer wall of the intestine

SIMPLE SQUAMOUS



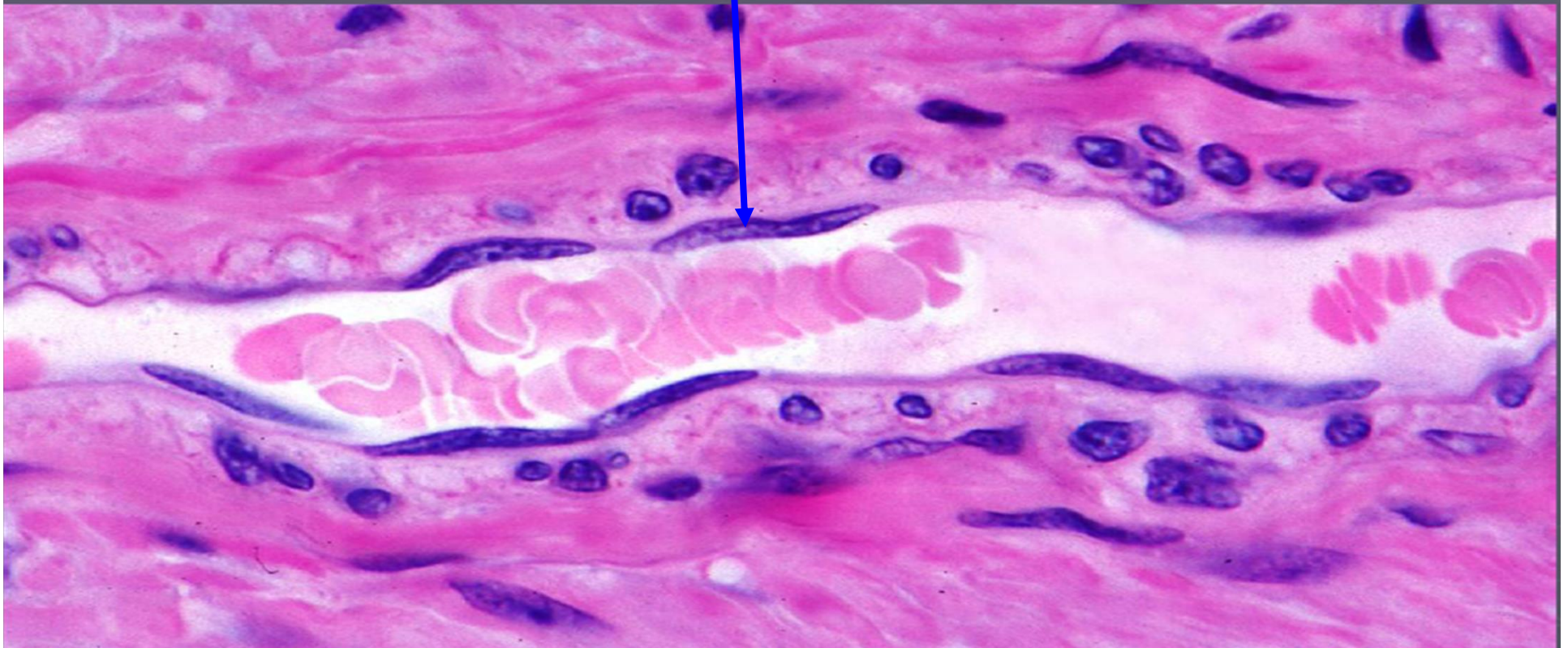


SIMPLE CUBOIDAL



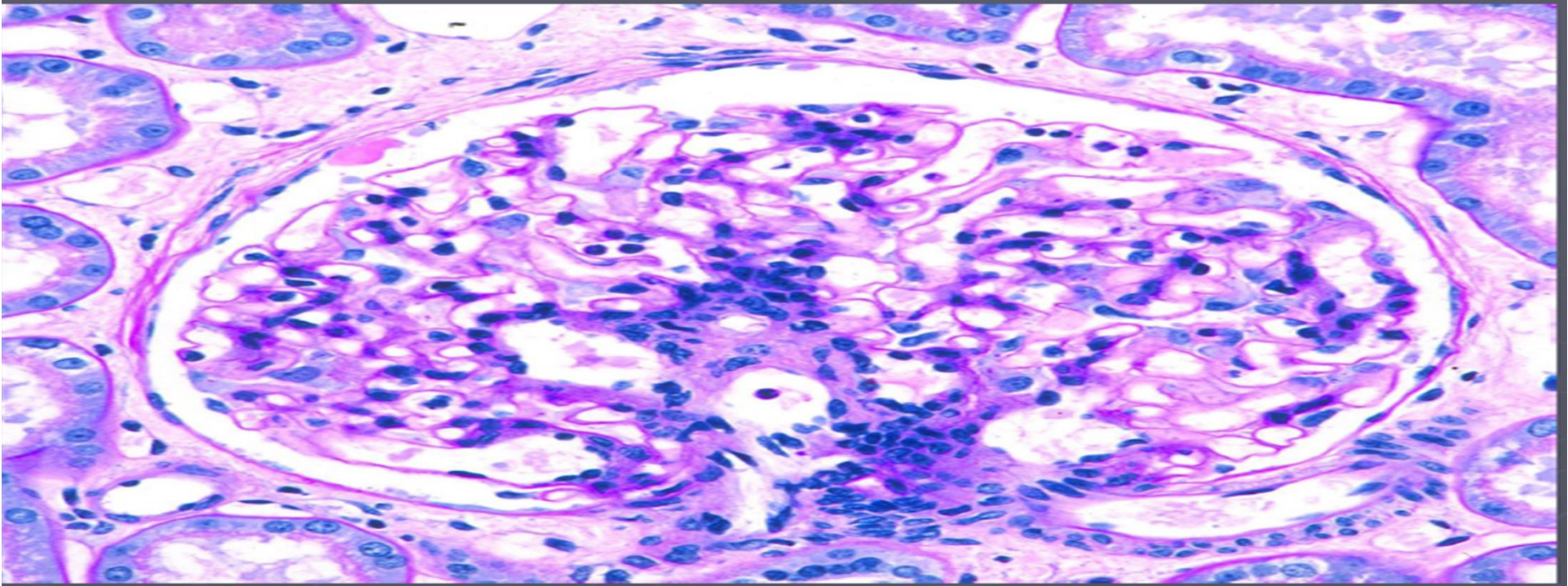


SIMPLE SQUAMOUS



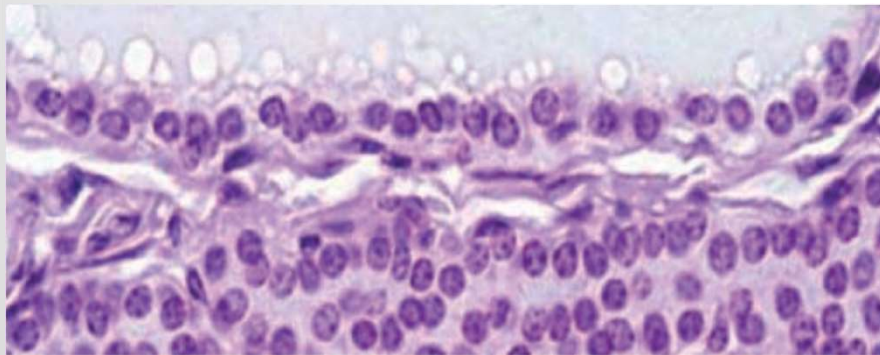
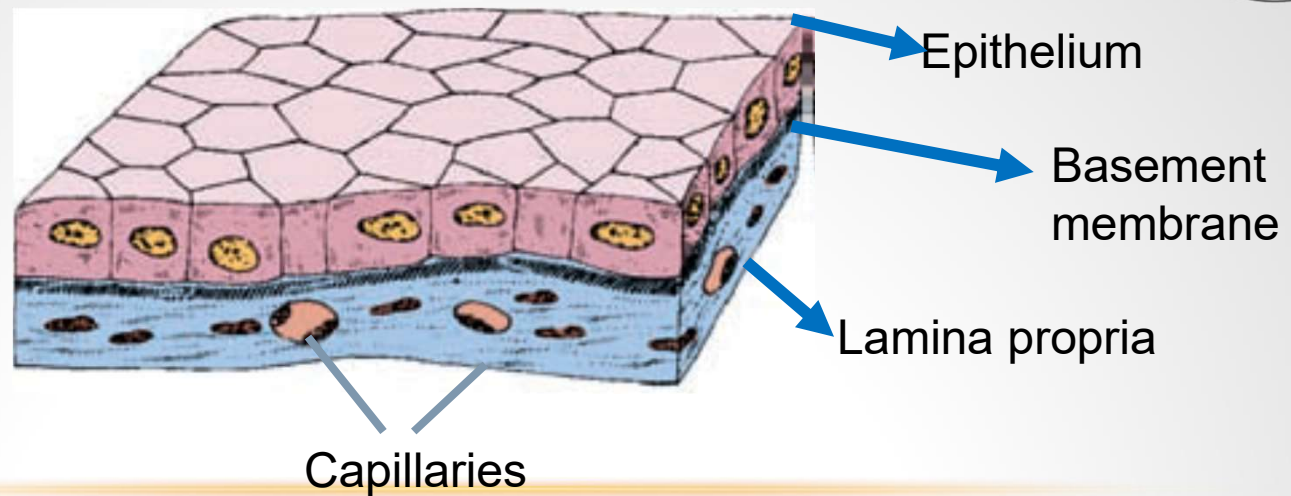


SIMPLE SQUAMOUS

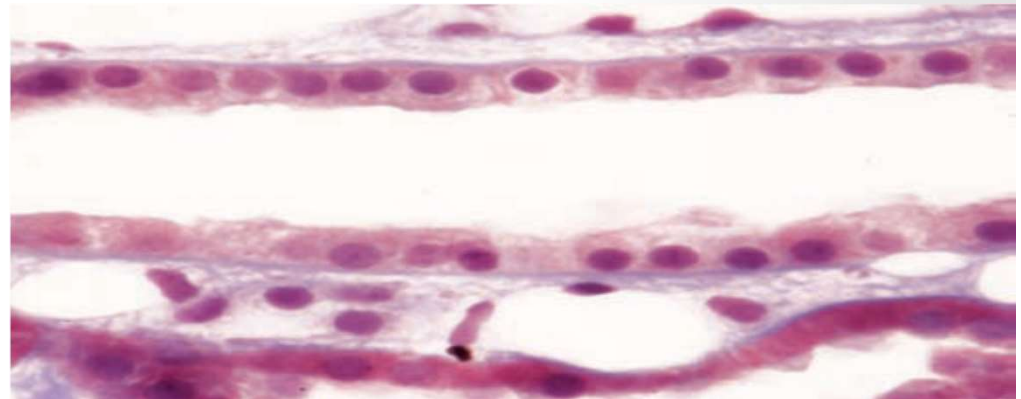


The glomerulus of capillaries is surrounded by the capsular space covered by the simple squamous parietal layer of Bowman capsule.

Simple cuboidal epithelium



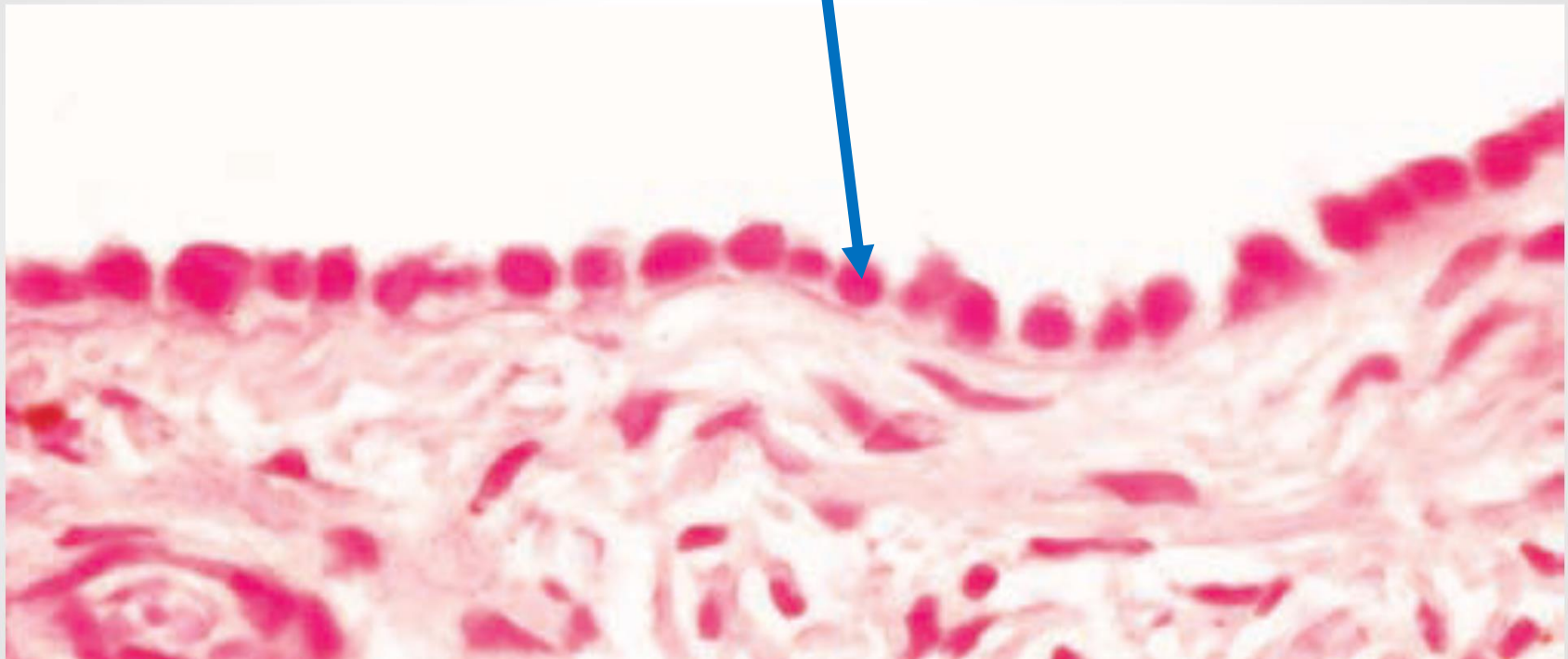
Large thyroid follicle(secretion function)



Examples shown here are from a renal collecting tubule(protection)



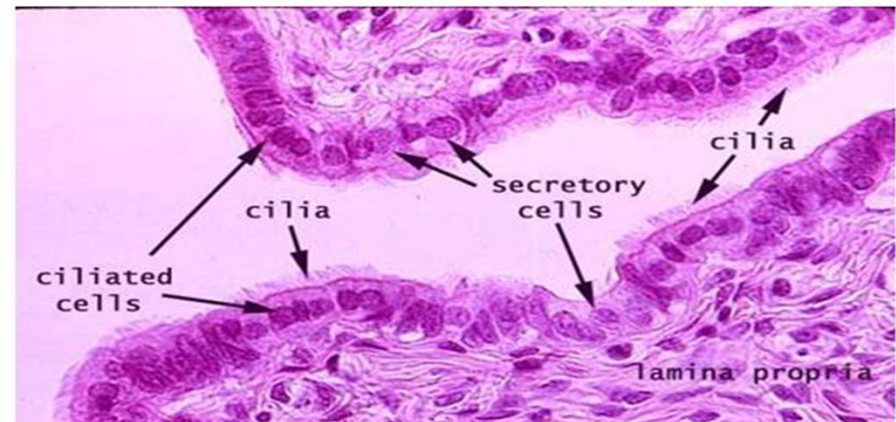
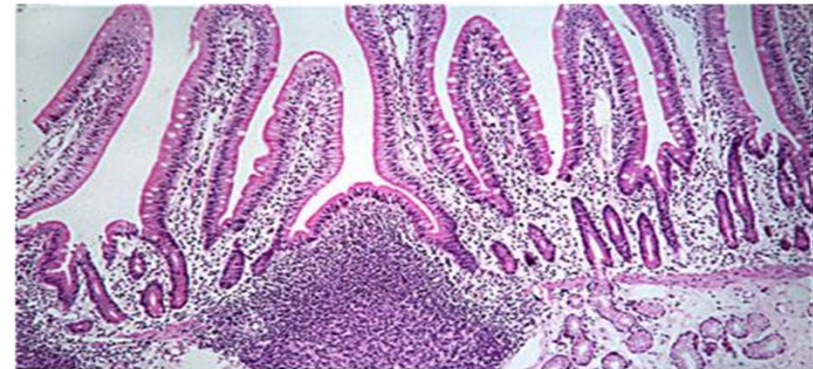
Simple cuboidal epithelium



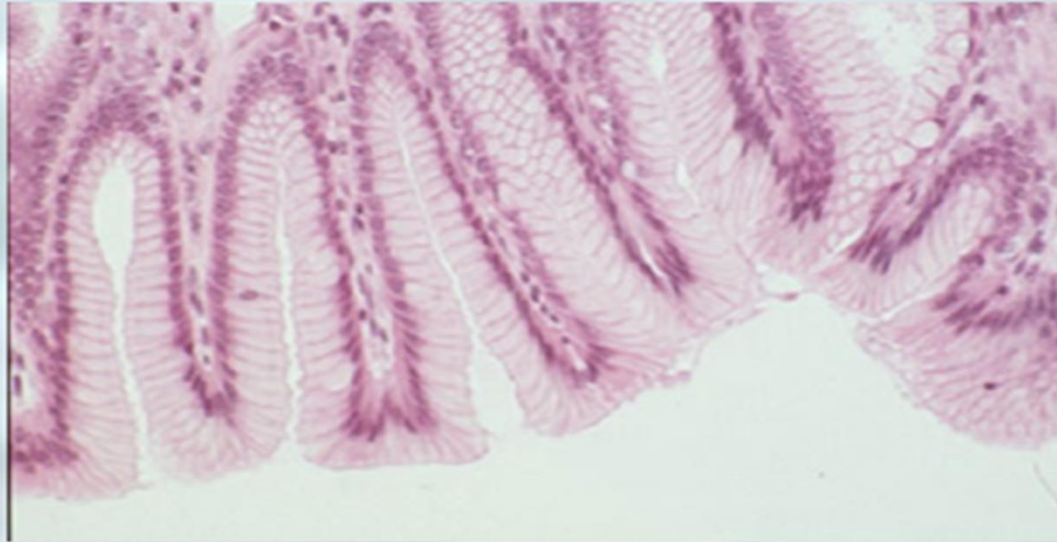
thick mesothelium covering an
ovary(protection function)

Simple Columnar Epithelium

- Location
 - Non-ciliated form
 - Lines digestive tract, gallbladder, ducts of some glands
 - Ciliated form
 - Lines small bronchi, uterine tubes, uterus

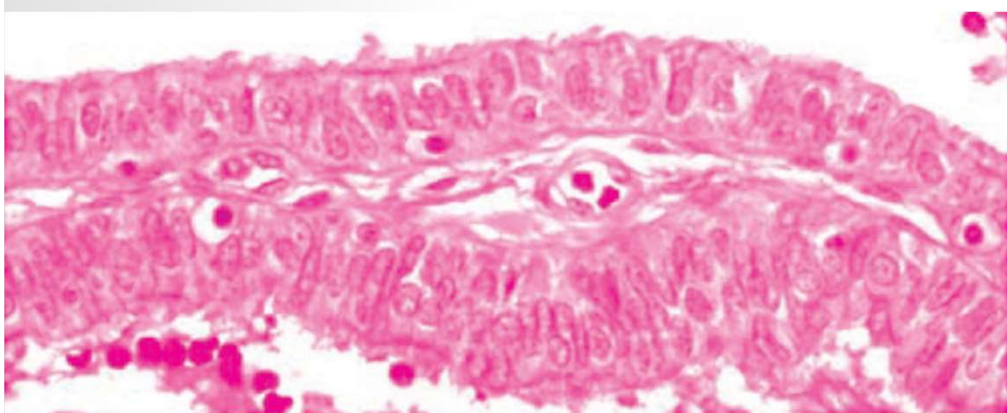
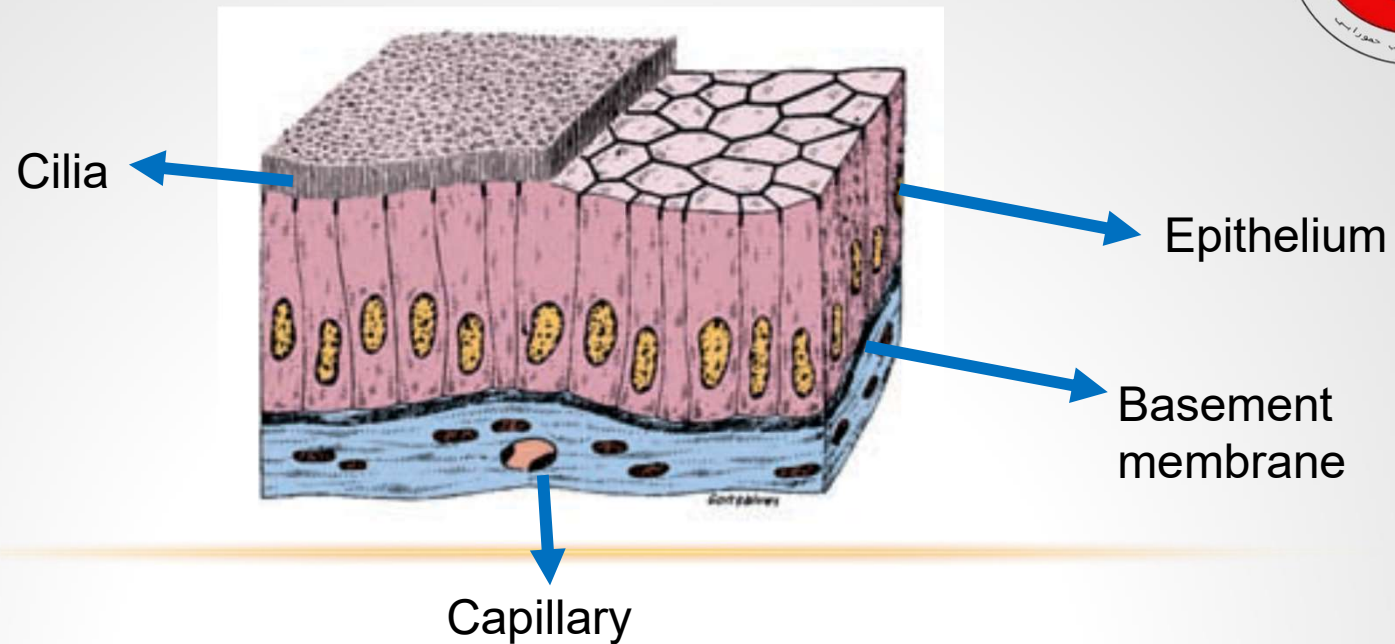


Simple Columnar Epithelium



- Found extensively in the gut, glands and ducts of glands.
- Cells taller than they are wide although height variable.
- Ovoid nucleii basally located.
- Example here from the stomach.
- Cells often involved in secretion (as in the stomach) and also in absorption as in the small intestine

Simple columnar epithelium

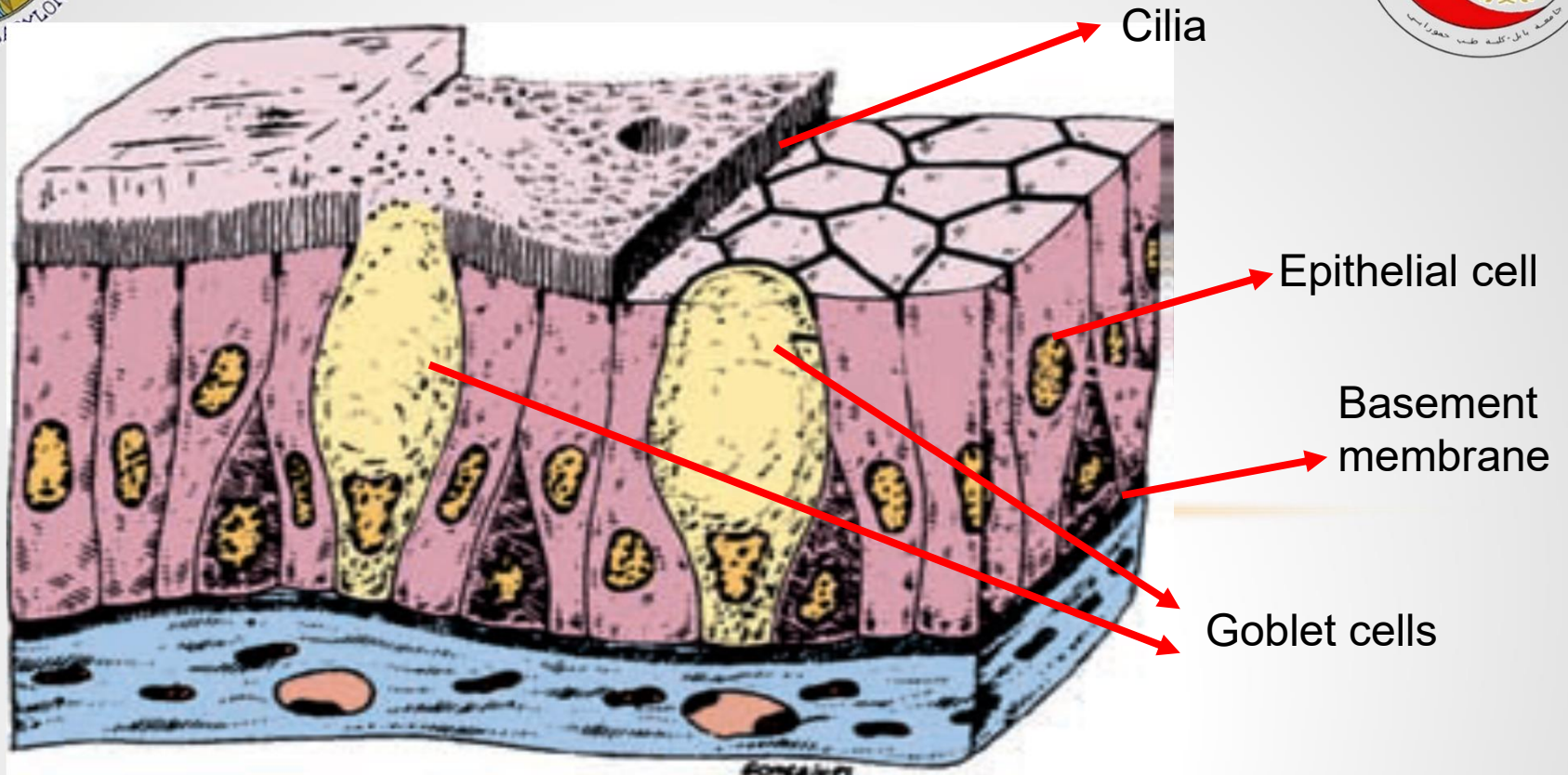


the oviduct lining, with both secretory and ciliated cells



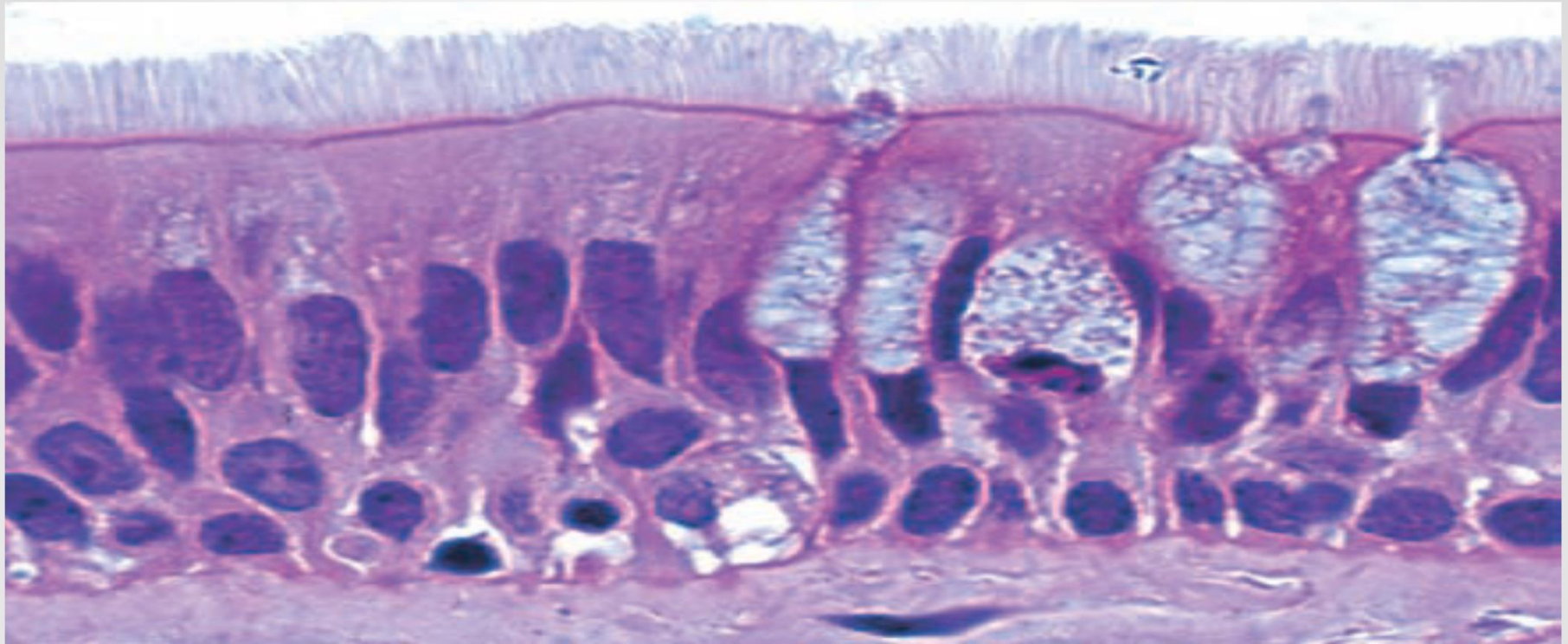
The examples shown here are from a renal collecting duct

Pseudostratified epithelium





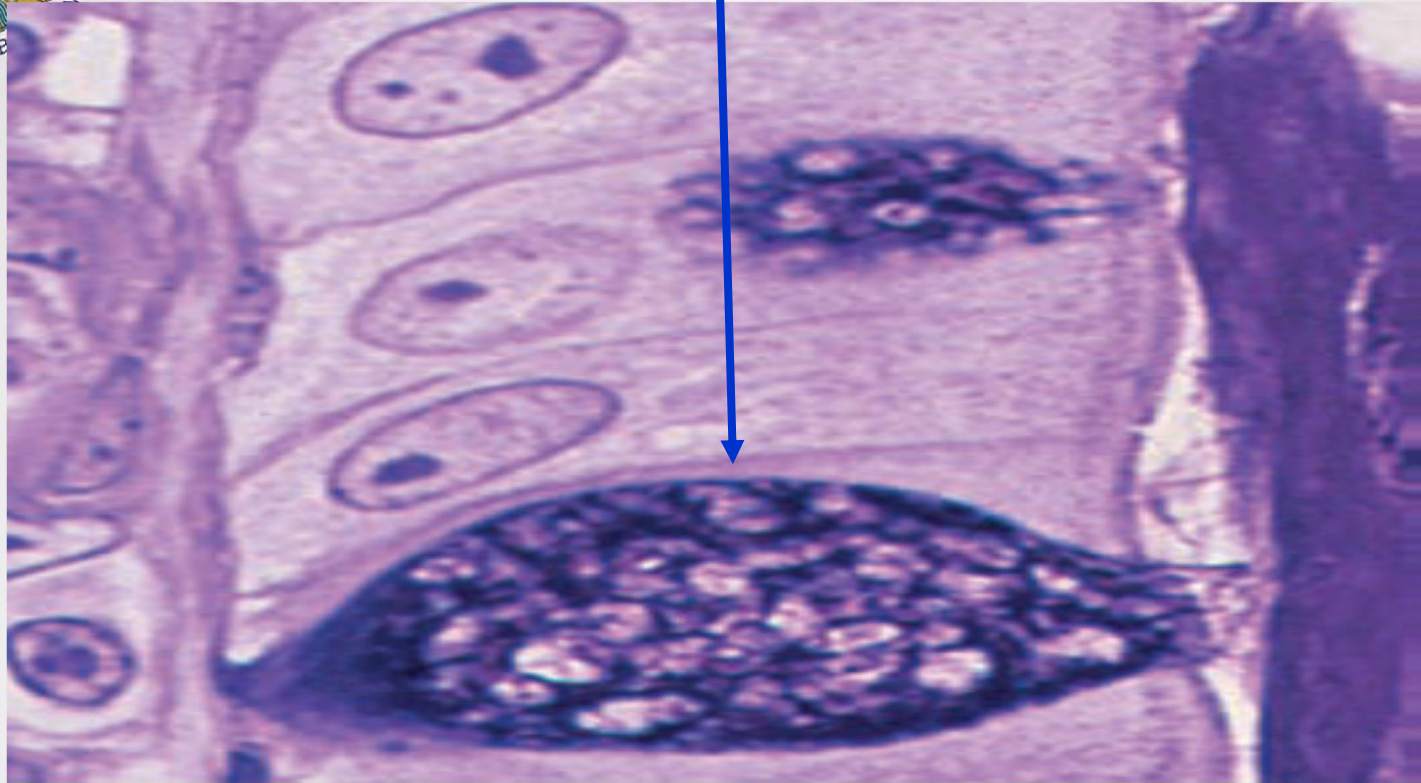
Pseudostratified epithelium



Cells of pseudostratified epithelia appear to be in several layers, but their basal ends all rest on the basement membrane. The pseudostratified columnar epithelium of the upper respiratory tract shown here contains many ciliated cells, as well as other cells with their nuclei at different levels



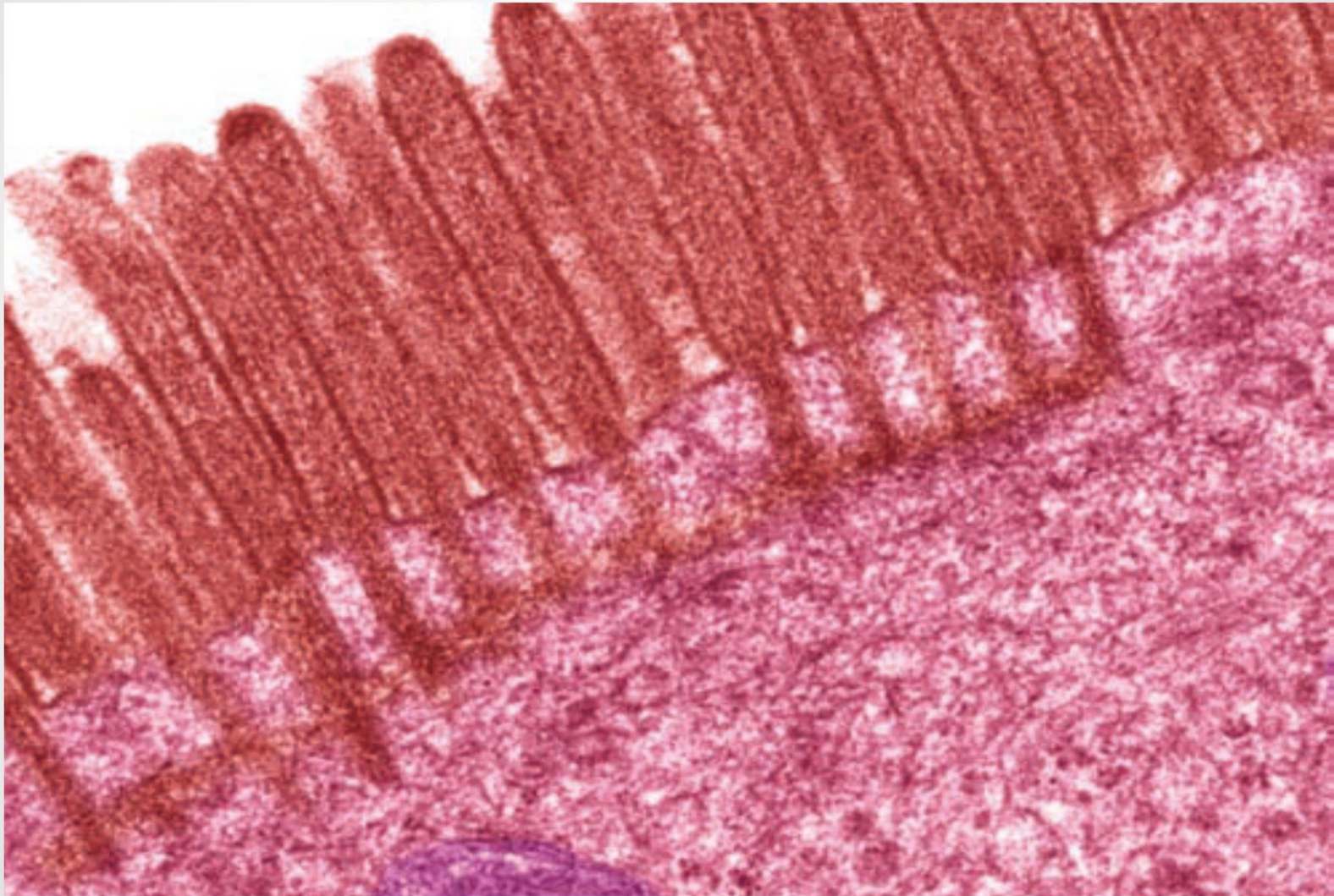
Goblet cell



The simple columnar epithelium lining the large intestine shows many isolated goblet cells secreting mucus into the Lumen. Scattered secretory cells, sometimes called unicellular glands, these goblet cell abundant in the lining of the small intestine and respiratory tract, which secretes lubricating mucus that aids the function of these organs.



Microvilli



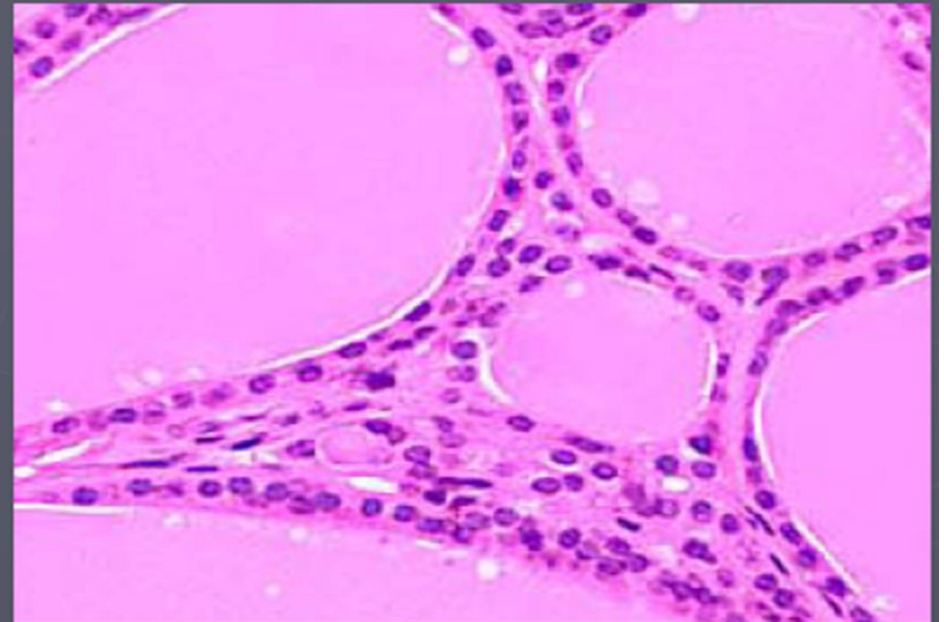
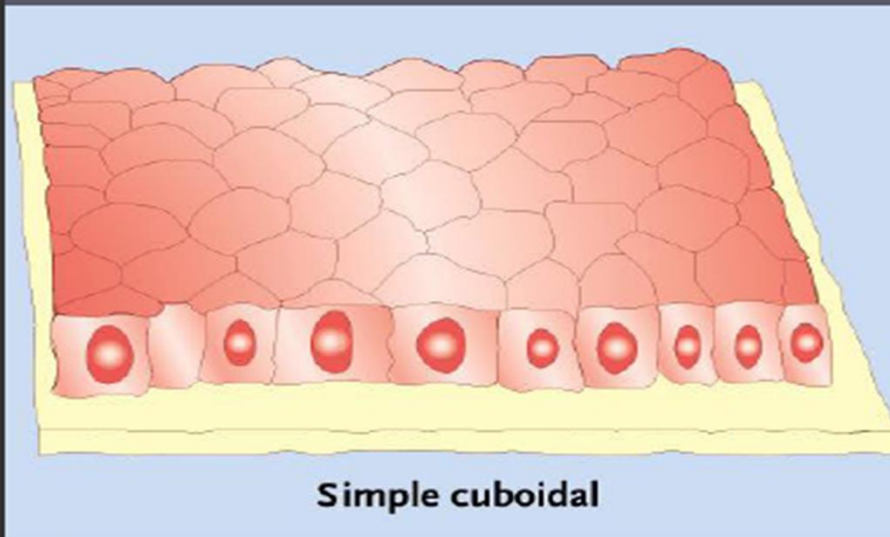


Microvilli



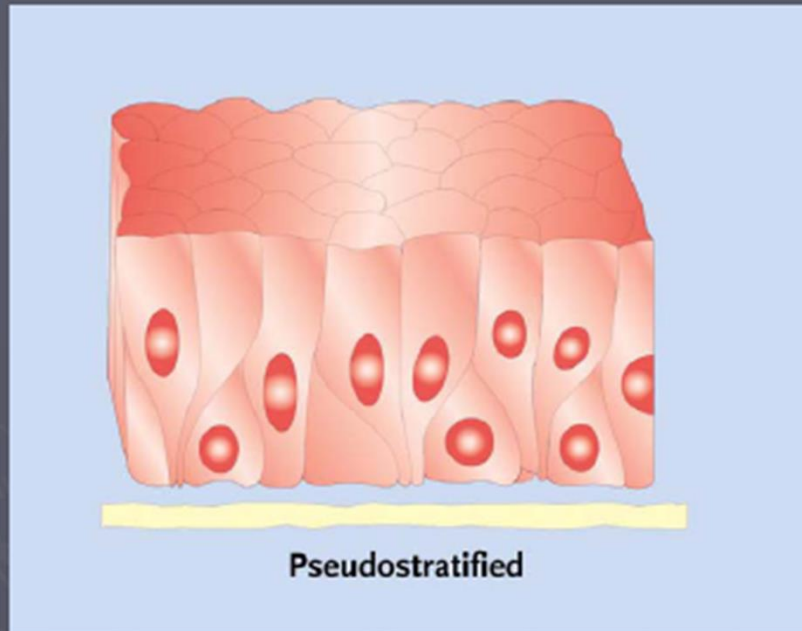
Cytoplasmic projection contain many bundle of actin filament capped and cross-linked to each other and to the surrounding plasma membrane by many different actin binding proteins .The presence of microvilli on the apical surface of this epithelium increase surface area and contain membrane –bound enzymes that complete the final stages of digestion . Their location on the membrane ,close to the transmembrane transport proteins allows the end products of digestion to be quickly and immediately absorbed into the body

BASAL LAMINA



In a simple epithelium all of the cells are attached to a common basal lamina (basement membrane). Commonly in simple epithelia the nuclei in the epithelial layer all appear at the same level

PSEUDOSTRATIFIED EPITHELIA

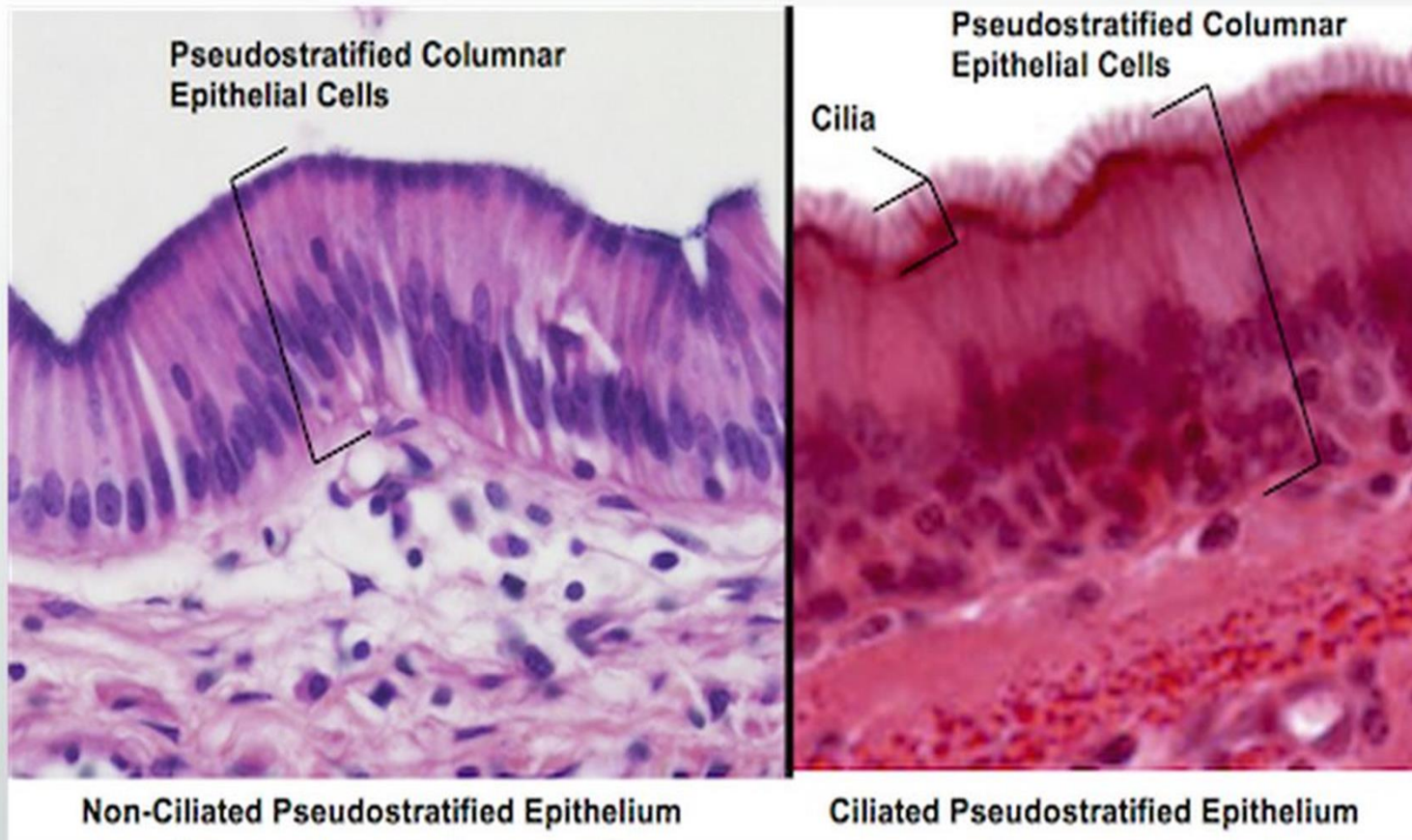


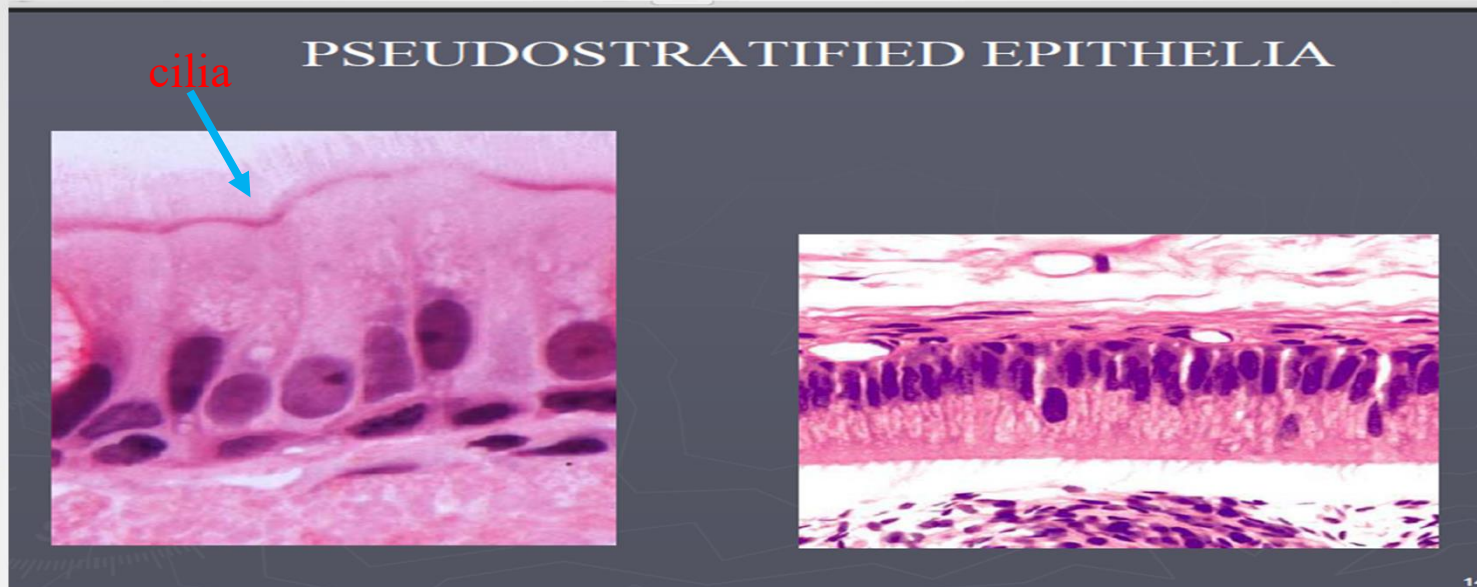
The epithelium shown opposite has nuclei at different levels giving the appearance of several layers. In fact all of the cells attach to a common basal lamina but not all reach the surface.

The epithelium is therefore a simple epithelium

The epithelium is referred to as pseudostratified

As the cells are columnar in form this is a pseudostratified columnar epithelium. It is found in the trachea and some of the airways where it is sometimes known as respiratory epithelium and parts of the male reproductive tract





Cilia mediated transport of particles trapped in mucus out of the air passage



Some Clinical Considerations

Regeneration: Epithelial cells have a capacity for regeneration (e.g. in skin wound healing, in the replacement of surface cells of the skin and cells lining the gastrointestinal tract and the renewal of uterine lining cells following menstruation).

Metaplasia: Some epithelia have the capacity to change from one type of epithelium to another (e.g. in heavy smokers, the pseudostratified columnar epithelium of the respiratory tract may become stratified squamous in type).



Neoplasia :In disease (e.g. in cancer) changes may occur in epithelia giving rise to a tumour (neoplasm) which is termed a **carcinoma**. The cells in benign tumours resemble those of their tissue of origin but those in malignant tumours have altered or abnormal cell structure and also invade adjacent tissues