Epithelial tissue
Lec . 2

Second year

Histology

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Histology

A cell is the smallest structural and functional unit of an organism.

A tissue is a collection of cells and non cellular structures, which have the similar origin, structure and functions.

Histology: is the study of cell and the extracellular matrix of tissues.

General histology

There are four types of primitive tissues :-

1. **Epithelial tissue.**
2. **Connective tissue.**
3. **Muscular Tissue.**
4. **Nervous Tissue.**

General histology

- Epithelial tissue covers the whole surface of the body. It is made up of cells closely packed and ranged in one or more layers.
- This tissue is specialized to form the covering or lining of all internal and external body surfaces. Epithelial tissue that occurs on surfaces on the interior of the body is known as endothelium.

Epithelial cells characteristics

- 1- Epithelial cells are packed tightly together.
- 2- Almost no intercellular spaces and only a small amount of intercellular substance.
- 3- Epithelial tissue usually separated from the underlying tissue by a thin sheet of connective tissue; basement membrane. The basement membrane provides structural support for the epithelium and also binds it to neighboring structures.

Types of Epithelia

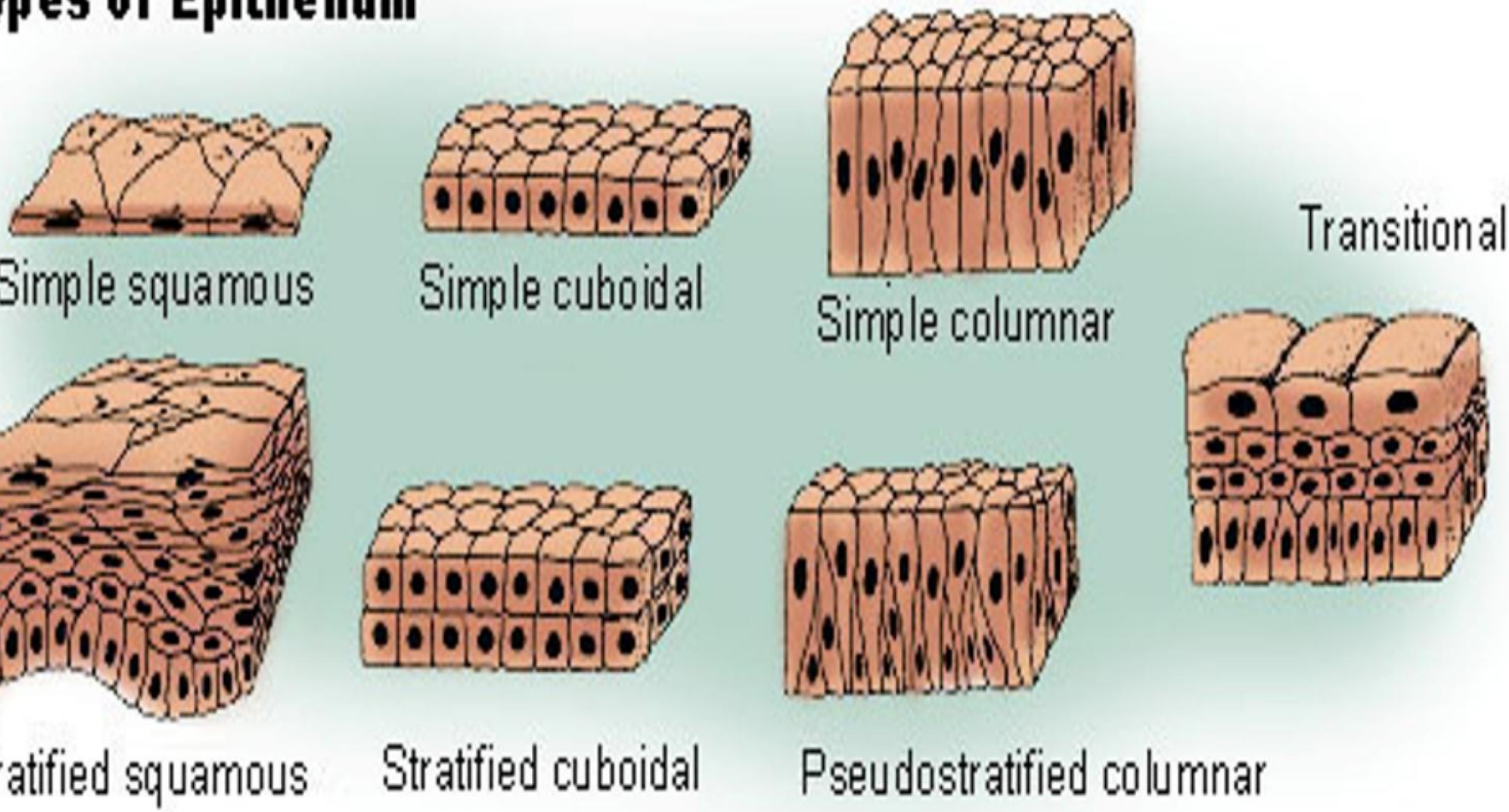
- **Covering Epithelia**

Covering Epithelia are tissues in which the cells are organized in layers that cover the external surfaces or lines cavities of the body. **Epithelia** are generally classified by the morphology of their cells, and the number of layers they are composed of.

Epithelial tissue that is only one cell thick is known as simple epithelium. If it is two or more cells thick, it is known as stratified epithelium.

There are three principal morphologies associated with epithelial cells. **Squamous , cuboidal and columnar**

Types of Epithelium



Functions of epithelial tissues

- **The primary functions of epithelial tissues are:**

  (1) To protect the tissues that lie beneath it from radiation desiccation, toxins, and invasion by pathogens, and physical trauma.

  (2) The regulation and exchange of chemicals between the underlying tissues and a body cavity.

  (3) The secretion of hormones into the blood vascular system, and/or the secretion of sweat, mucus, enzymes, and other products.

  (4) To provide sensation.

The basement membrane

- The basement membrane is a thin sheet of fibers that anchors the epithelium to underlying connective tissue.
- The basement membrane is visible with the light microscope.
- **Electron microscopy revealed that the basement membrane is composed of two sub layers:**
- **The basal lamina**
- **The reticular lamina**

1- The basal lamina

- The basal lamina is a layer of extracellular matrix secreted by the epithelial cells, on which the epithelium sits. The main components of basal lamina are type IV collagen, the glycoproteins laminin and proteoglycan The basal lamina layer can further be divided into two layers:
- **lamina lucida The clear layer closer to the epithelium .**
- **lamina densa the dense layer closer to the connective tissue**

The lamina densa and the lamina Lucida together make up **the basal lamina.**

2- The reticular lamina

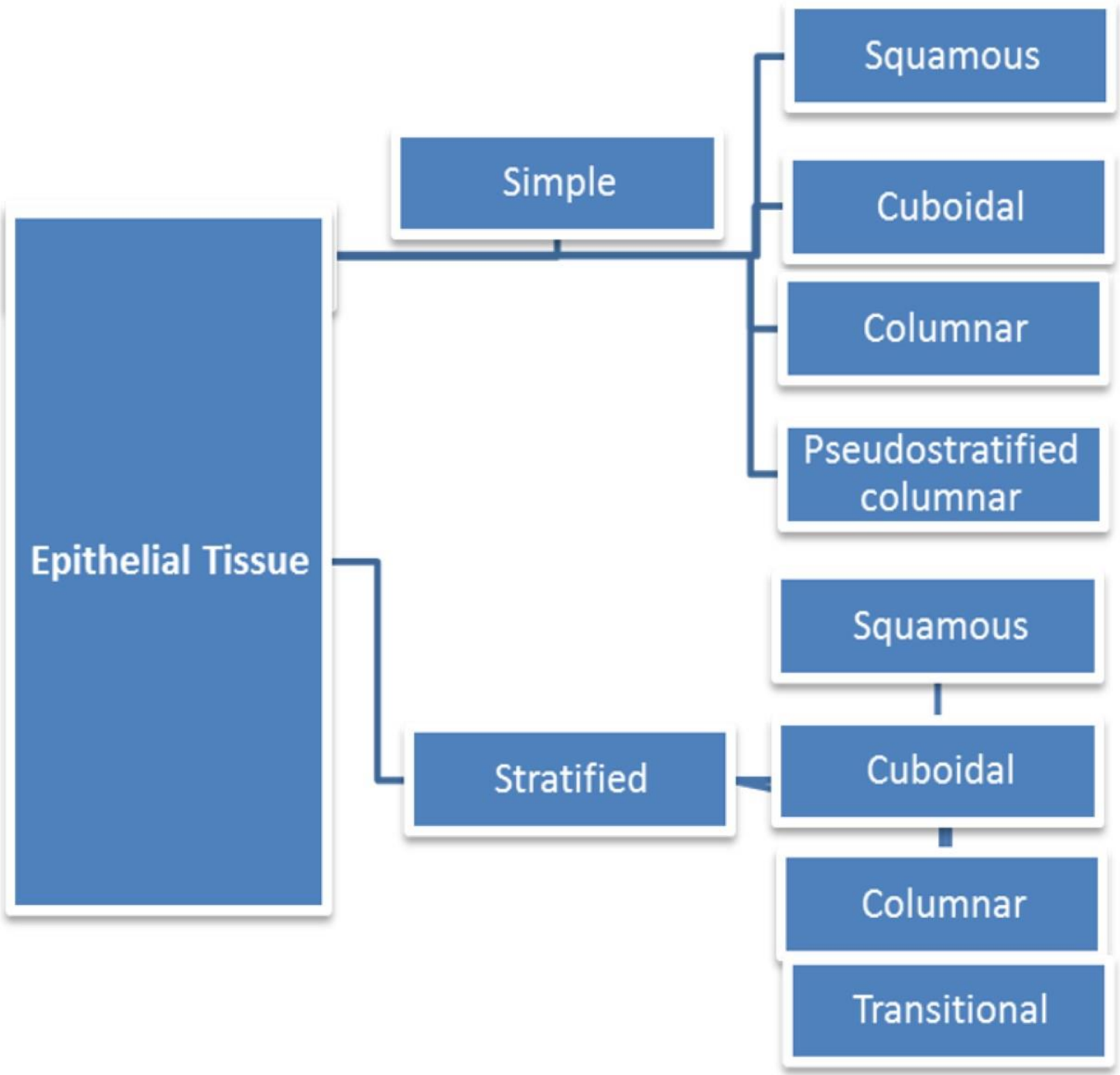
- The reticular lamina located under the basal lamina of most basement membranes.
- The reticular lamina consists of reticular fibers embedded in ground substance.
- **The components of the reticular lamina** are synthesized by cells of the connective tissue underlying the epithelium. The two layers (the basal lamina and the reticular lamina) are collectively known as the **basement membrane**.

Functions of The Basement membrane

- Structural support via cell-matrix adhesions.
- Allow nutrients and waste to diffuse.
- Filter for macromolecules (kidneys).
- Zone for differentiation and polarization of cells.
- Plays a role in regeneration

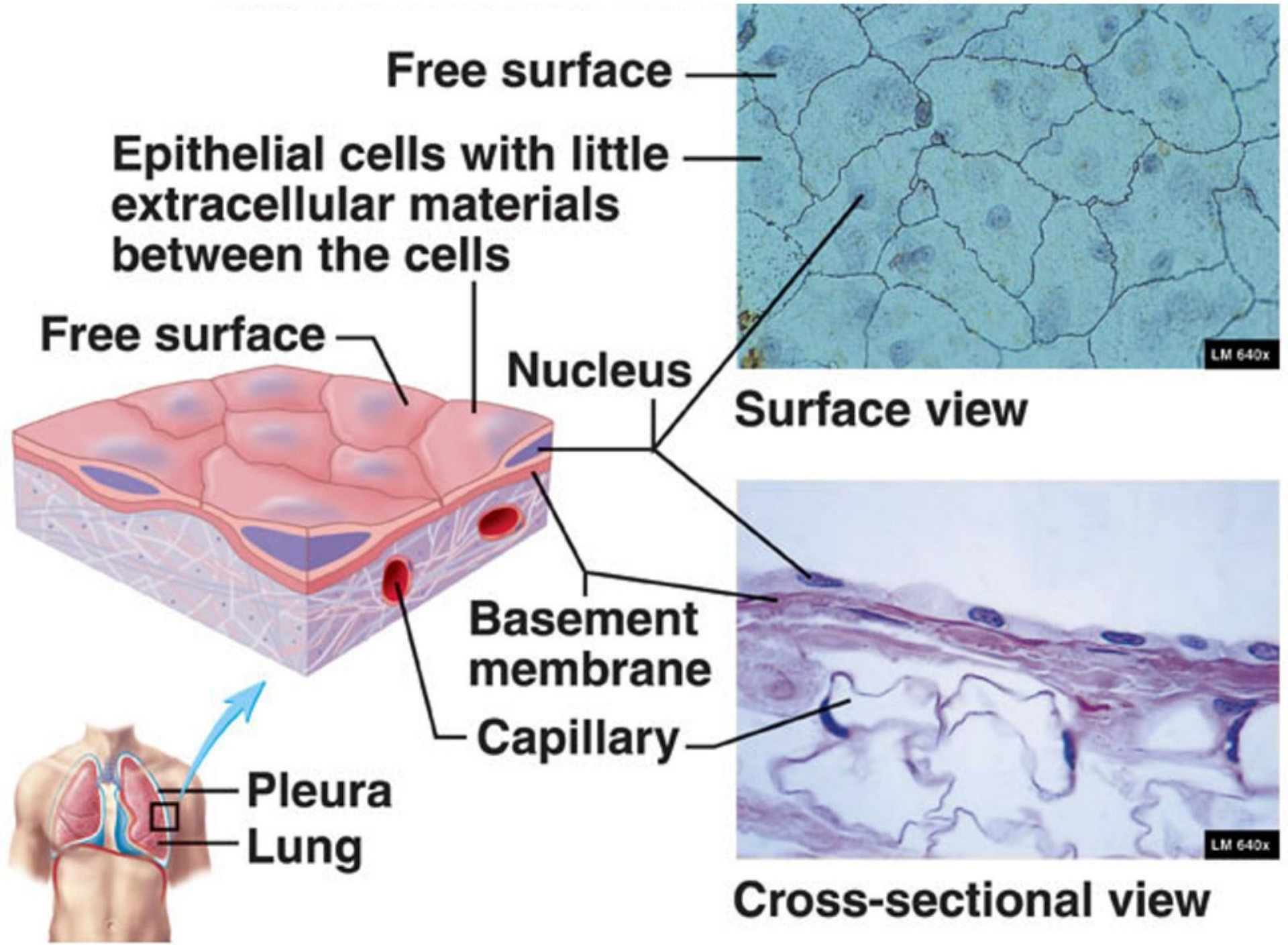
Types of Epithelial Tissue

- Epithelial tissue can be divided into two groups depending on the number of layers of which it is composes. Epithelial tissue which is only one cell thick is known as simple epithelium. If it is two or more cells thick such as the skin, it is known as stratified epithelium.


Epithelial Tissue
Simple
Squamous
Cuboidal
Columnar
Pseudostratified columnar
Stratified
Squamous
Cuboidal
Columnar
Transitional

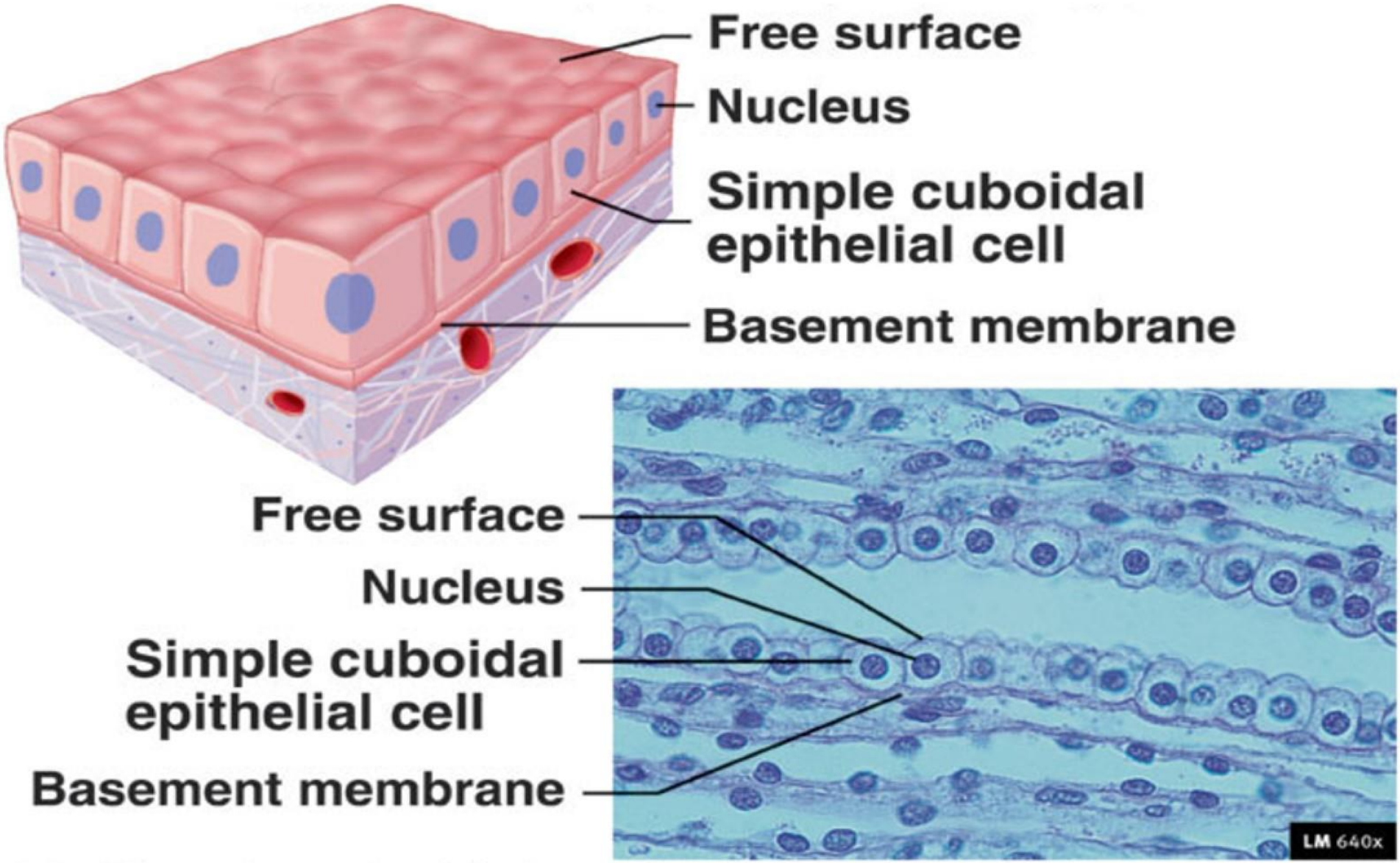
Simple epithelium

- Simple epithelium can be subdivided according to the shape and function of its cells.
- **Squamous (pavement) epithelium.**
- Squamous cells have the appearance of thin, flat plates. The shape of the nucleus usually corresponds to the cell form and help to identify the type of epithelium. Squamous cells, for example, tend to have horizontal flattened, elliptical nuclei because of the thin flattened form of the cell. They form the lining of cavities such as blood vessels, heart and lungs.


Free surface
Epithelial cells with little extracellular materials between the cells
Free surface
Nucleus
LM 640x
Surface view
Basement membrane
Capillary
Pleura
Lung
LM 640x
Cross-sectional view

Simple Cuboidal Epithelium.

- cuboidal cells are roughly square or cuboidal in shape. Each cell has a spherical nucleus in the center.
- Cuboidal epithelium is found in glands and in the lining of the kidney tubules as well as in the ducts of the glands. They also constitute the germinal epithelium which produces the egg cells in the female ovary and the sperm cells in the male testes.

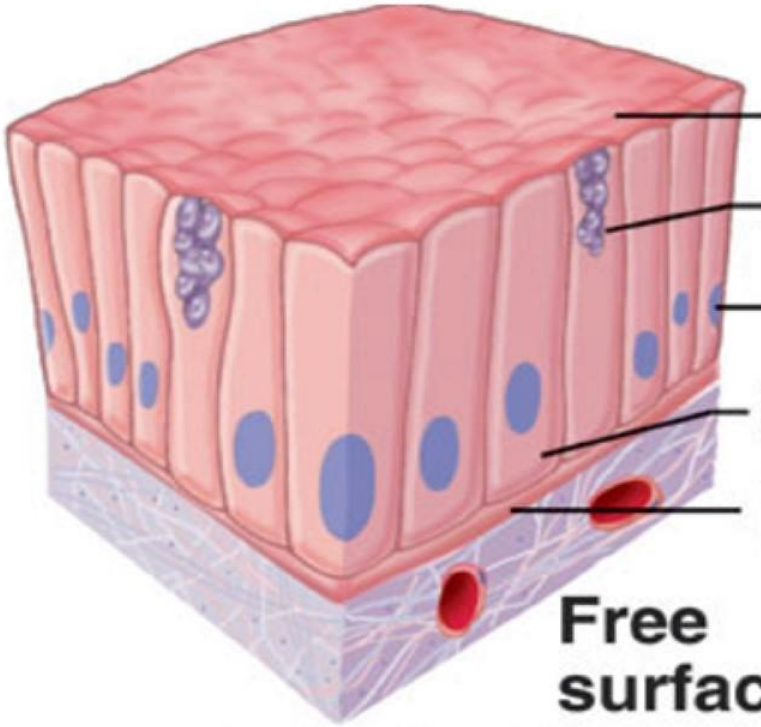


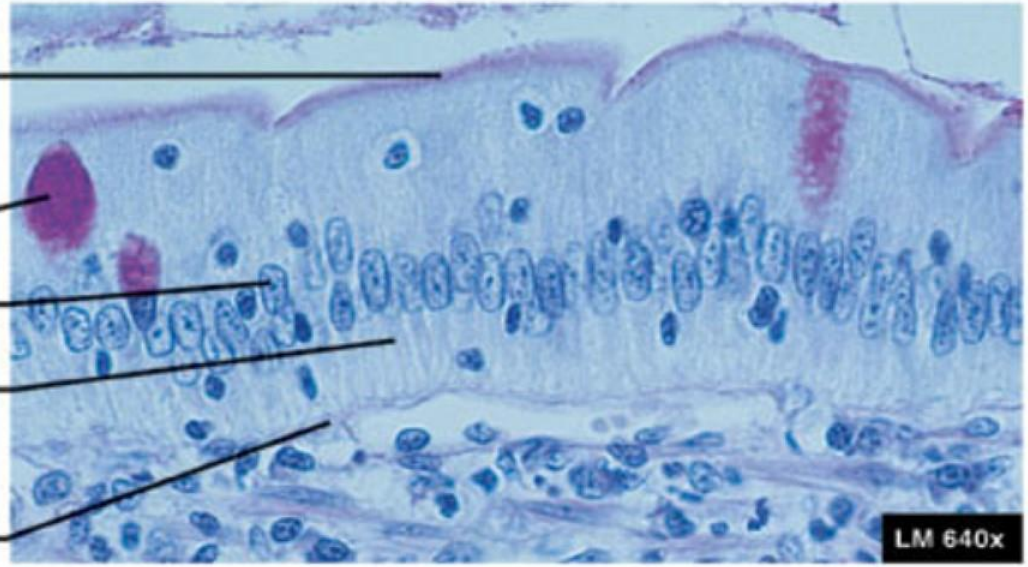
(b) Simple cuboidal epithelium

Kidney tubules, glands, lining of terminal bronchioles, etc.

Simple Columnar Epithelium

- The cells are elongated and column-shaped.
- The nuclei are elongated and are usually located near the base of the cells.
- Columnar epithelium forms the lining of the stomach and intestines. Some columnar cells are specialized for sensory reception such as in the nose, ears and the taste buds of the tongue. Goblet cells (unicellular glands) are found between the columnar epithelial cells of the duodenum. They secrete mucus or slime, a lubricating substance which keeps the surface smooth.



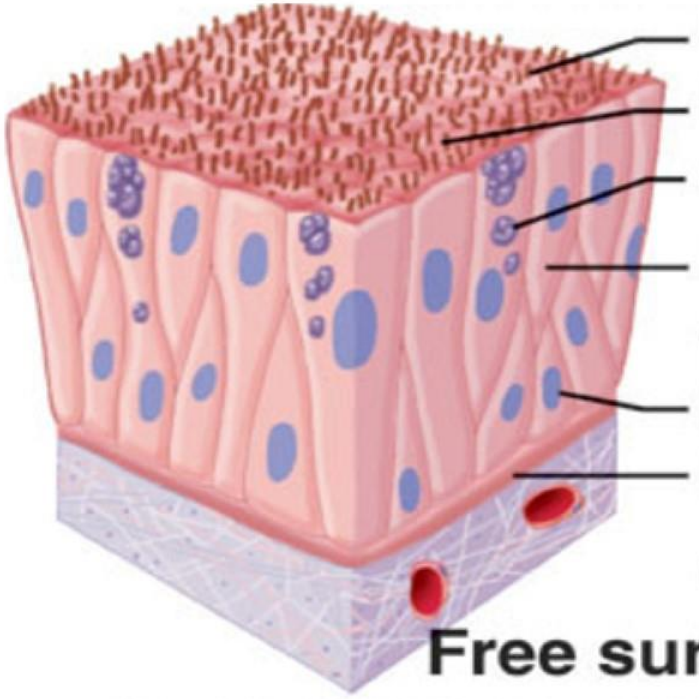


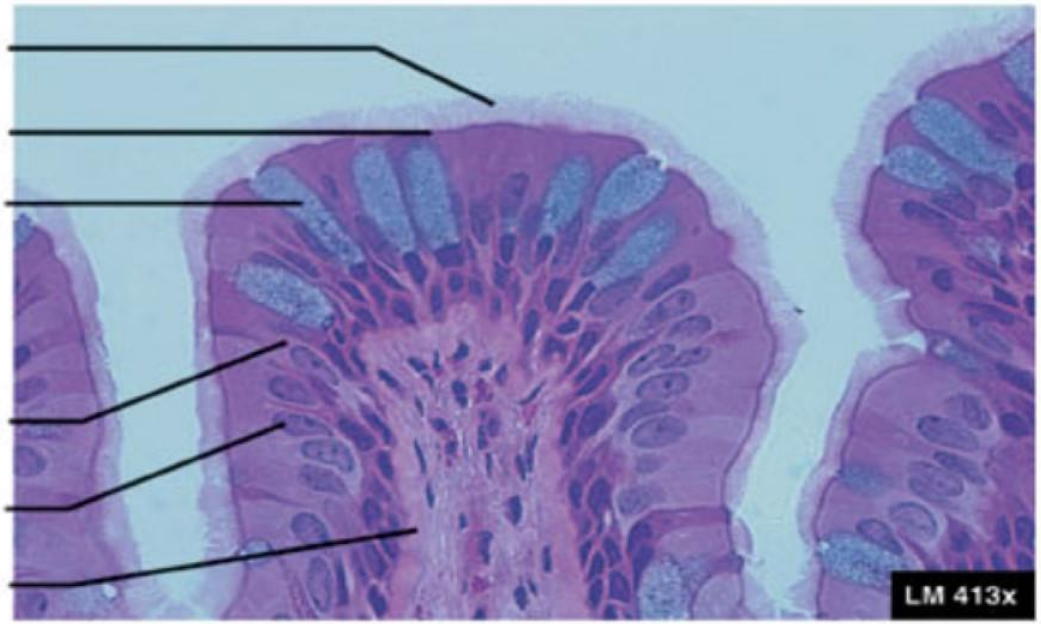
(c) Simple columnar epithelium

Glands, bronchioles, stomach, intestines, bile ducts, etc.

Pseudostratified Columnar Epithelium

- Pseudostratified columnar epithelium of the trachea, formed by long and short cells.
- As some cells do not reach the surface of the epithelium .
- Pseudostratified epithelia appears to be layered (stratified) because the cell nucleus are present in different heights of the epithelial layer.



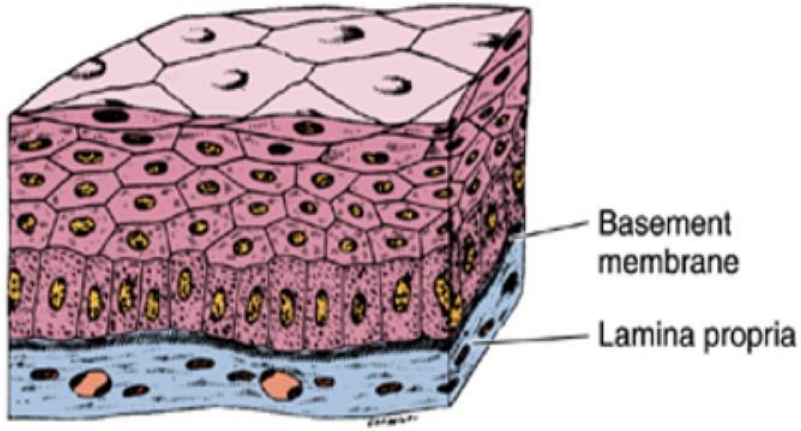


(g) Pseudostratified columnar epithelium

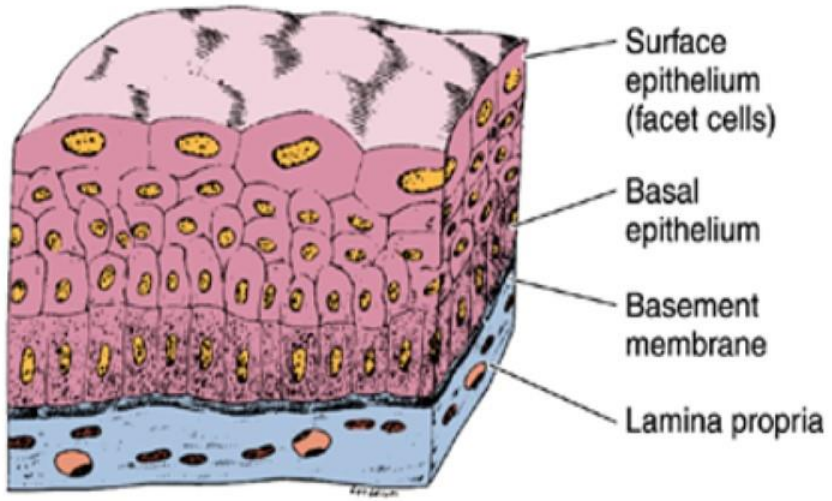
Lines nasal cavity & sinuses, auditory tubes, trachea, bronchi

Stratified epithelium

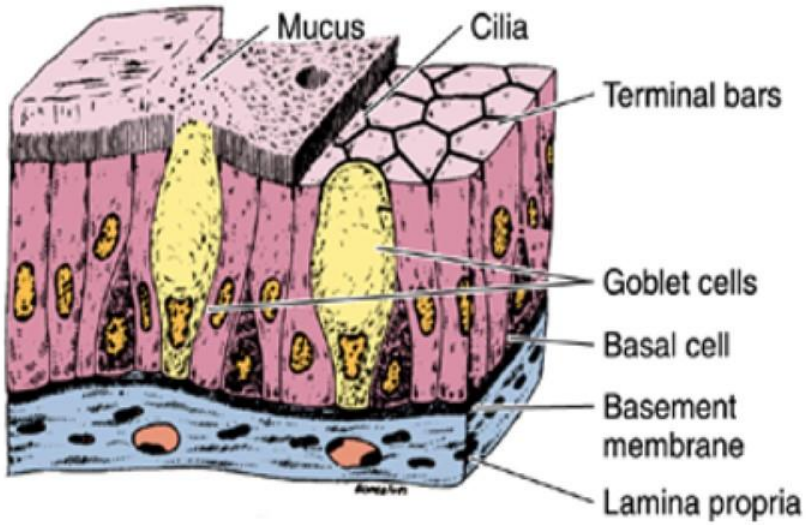
A Stratified squamous epithelium



B Transitional epithelium



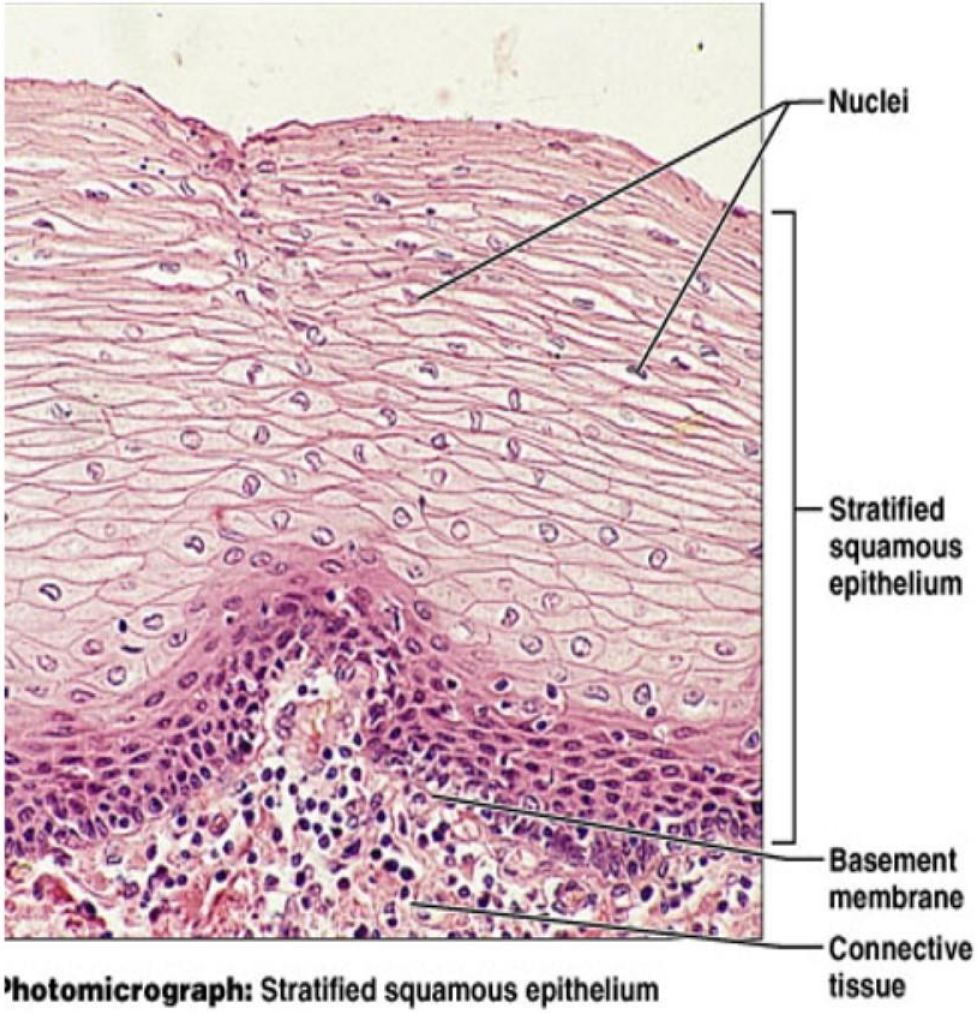
C Ciliated pseudostratified epithelium



Squamous (Nonkeratinized).

Stratified squamous nonkeratinized (moist) epithelium of the esophagus.

The most superficial cells (arrow) have the form of very thin scales.



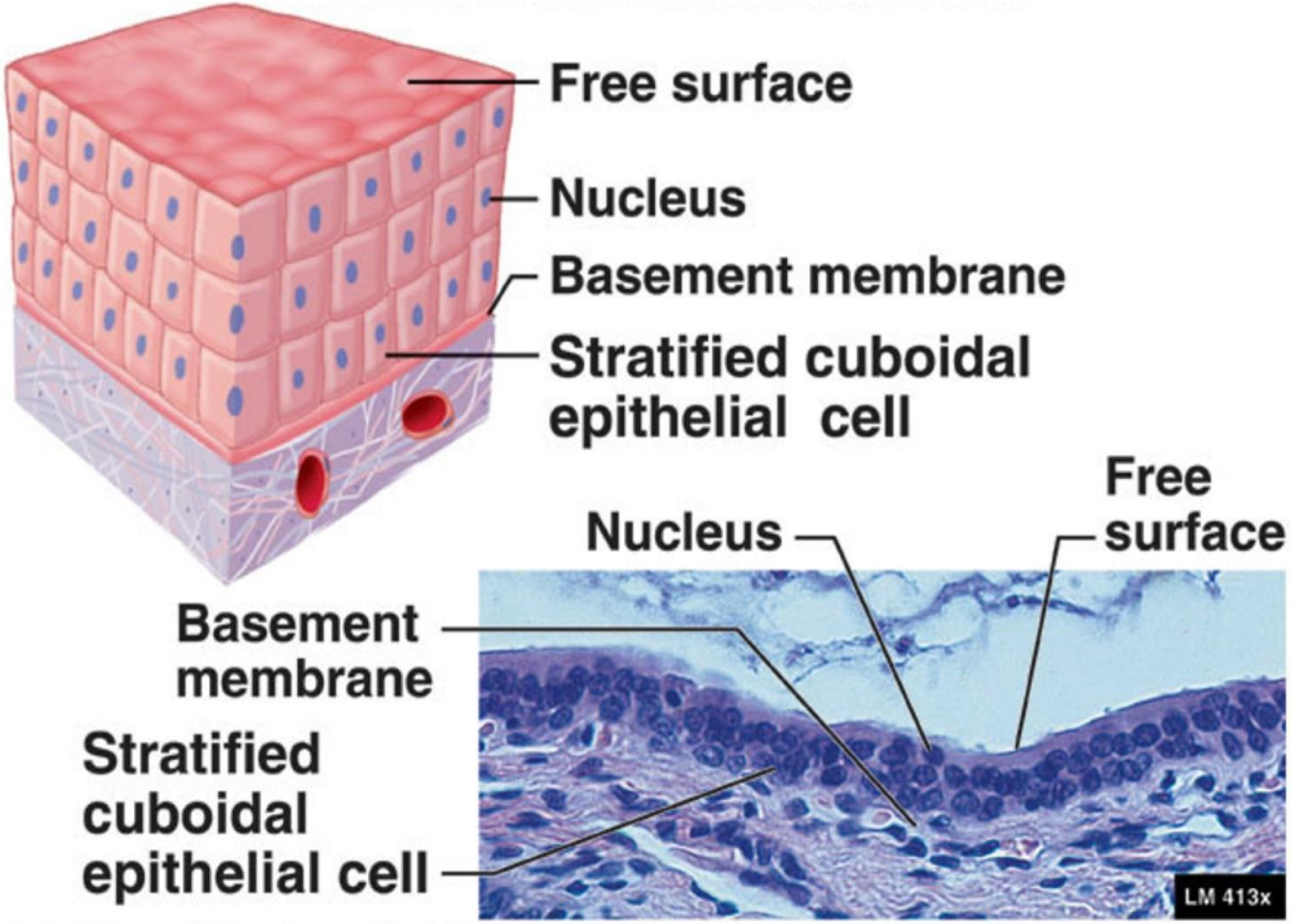
Photomicrograph: Stratified squamous epithelium

(keratinized)

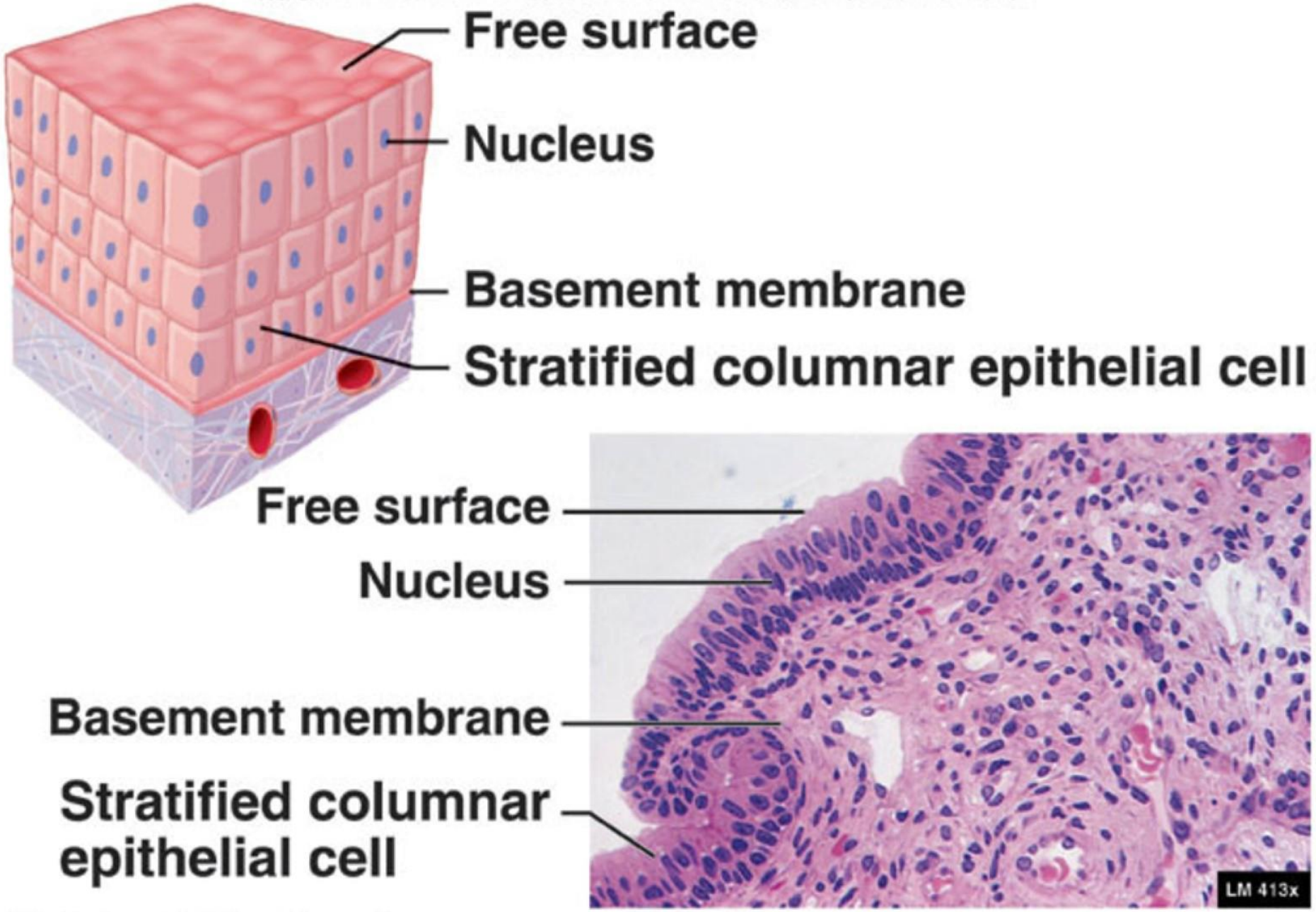
Forming the epithelium of the epidermis of the skin.

- **Stratified cuboidal and columnar epithelia**

- They are not common.
- A two-layered cuboidal epithelium is, for example, seen in the ducts of the sweat glands.
- **Stratified columnar epithelia:** are found in the excretory ducts of the mammary gland and the main excretory duct of the large salivary glands.



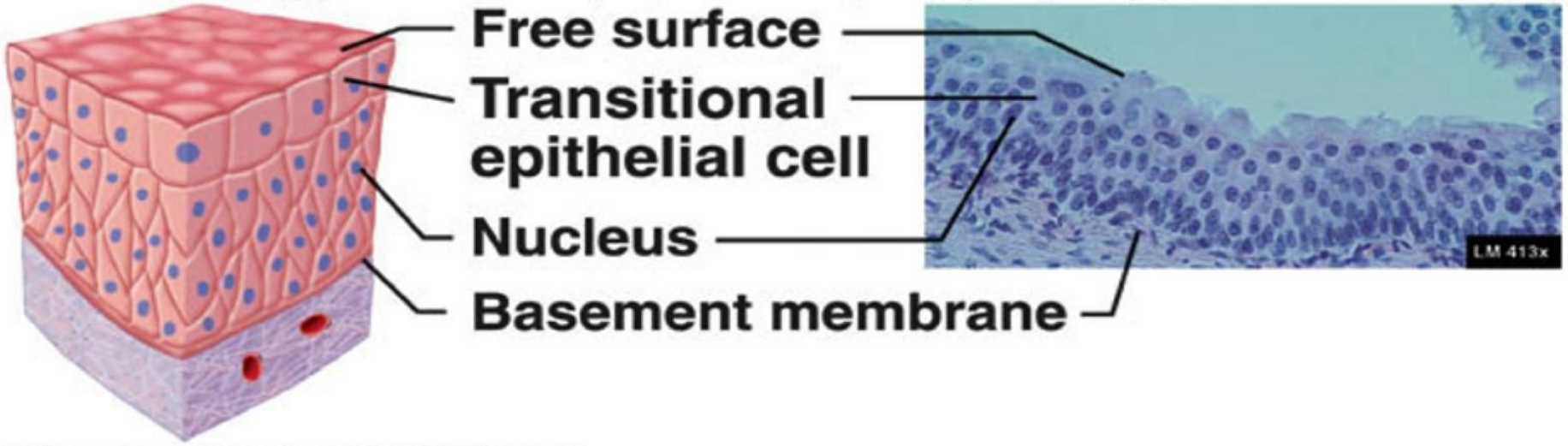
(e) Stratified cuboidal epithelium



(f) Stratified columnar epithelium

Transitional Epithelium

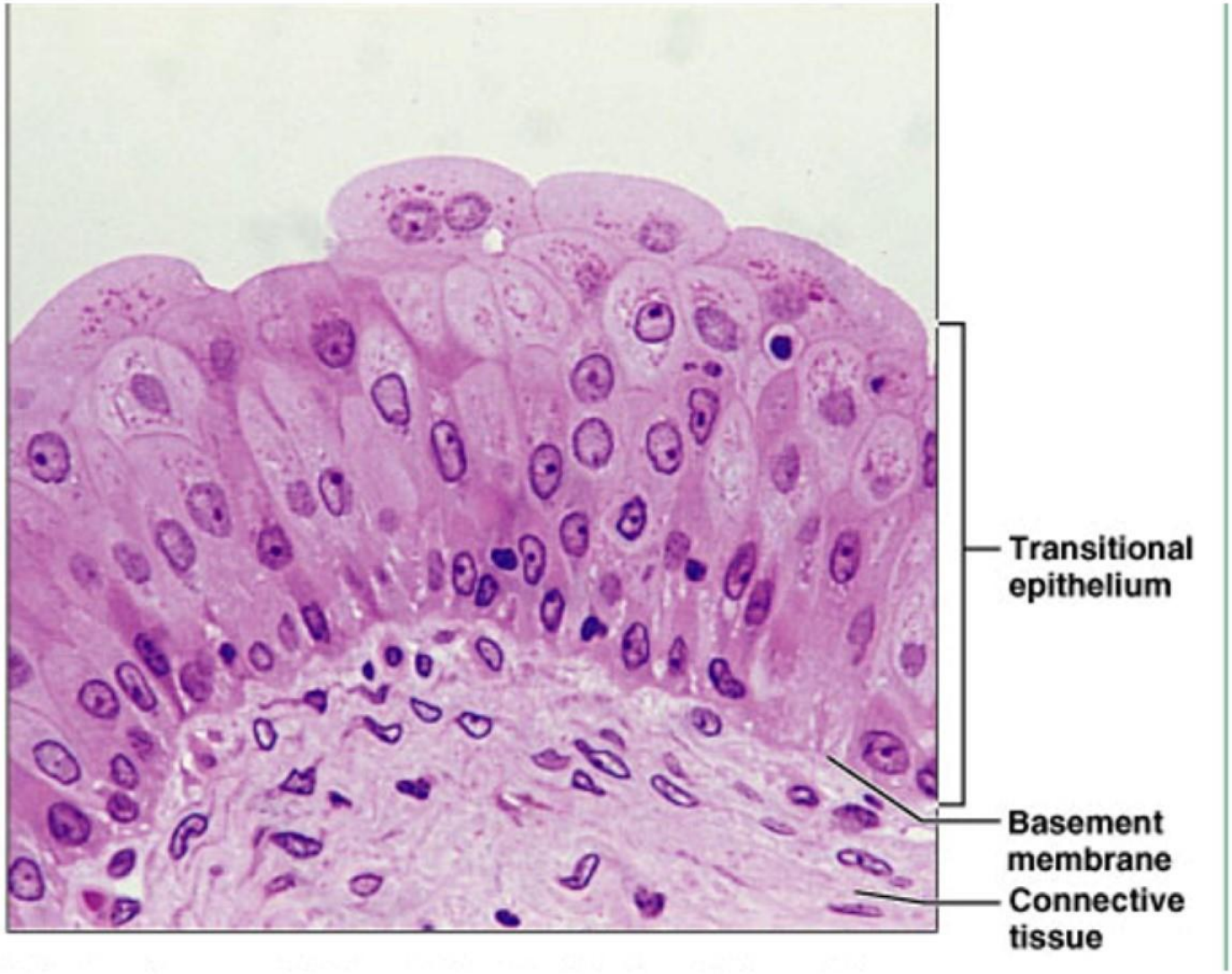
- Structure
  - Many layers
  - Very specialized – cells at base are cuboidal or columnar; at surface are umbrella shaped.
  - Change between stratified & simple as tissue is stretched out.
- Function
  - Allows stretching (change size)
- Location
  - Urinary bladder, ureters & urethra

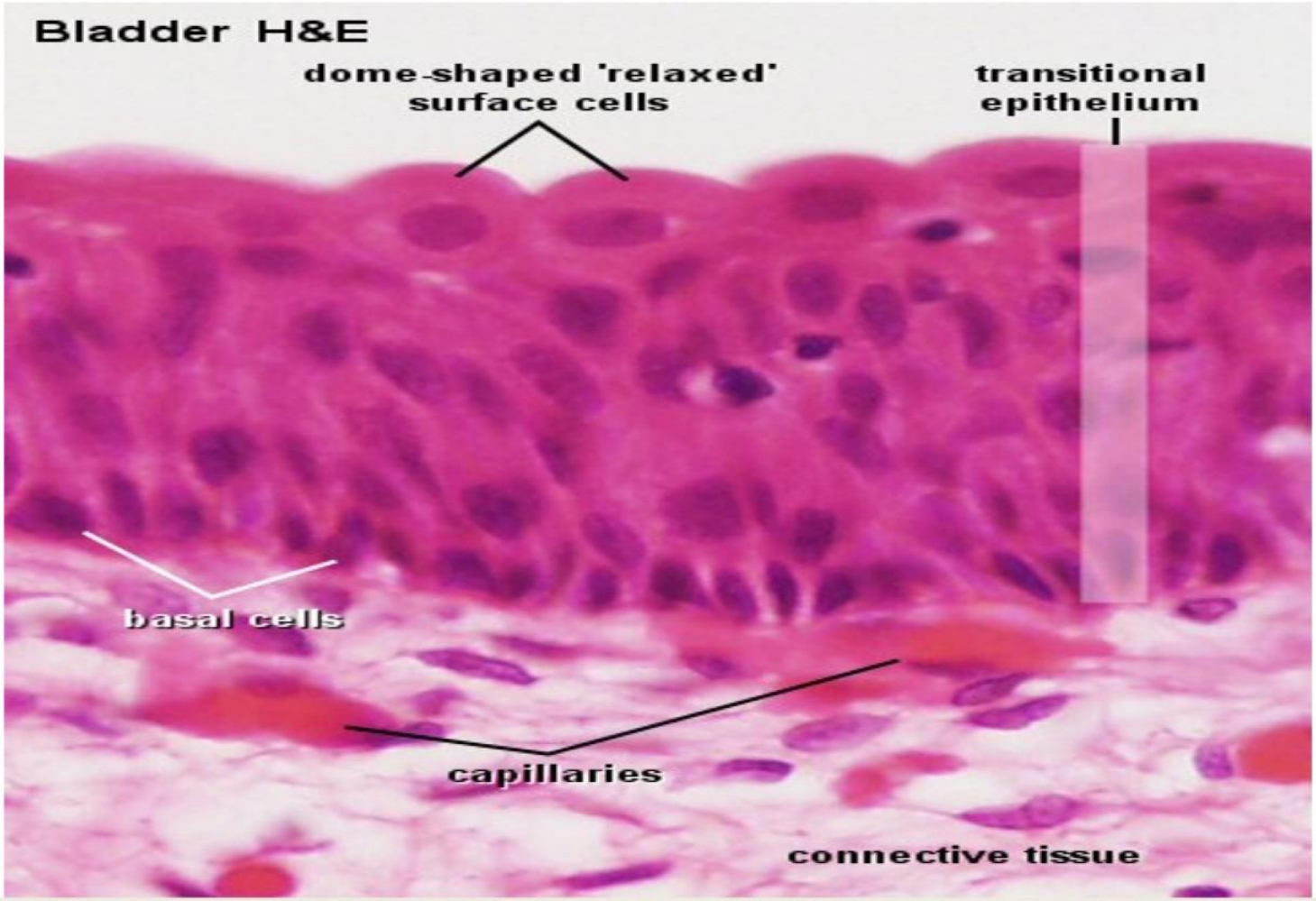


(h) Transitional epithelium

Bladder lining, ureters, and superior urethra

Urinary Bladder, Transitional Epithelium





Transitional epithelium: sections of ureter or bladder - H&E