Department of biology

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((Theoretical Histology))

Stage (-3-)

LEC- ((4))

Epithelial tissue

By

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Tissues: are aggregates or groups of cells organized to perform one or more specific functions.

Cells → **Tissues** → **Organs** → **Organ systems**

Organism Cells: are not found by themselves; they're with others. These are called tissues. Tissues: A group of cells, usually similar, which share a particular function. Organs: A group of tissues which share a particular function. Organ systems :A group of organs which share a particular function (digestive system, nervous system, urinary system).

The human body is composed of only four basic types of tissue:-

1. **Epithelial Tissue EP**
2. **Connective Tissue CNT**
3. **Muscle Tissue MT**
4. **Nervous Tissue NT**

} **Basic tissues**

- **Epithelium (epithelial tissue)** covering, lining body cavities, and forms glands.
- **Connective tissue** supports the other three basic tissues,
- **Muscle tissue** responsible for movement.
- **Nerve tissue** control the activities of the body.

Epithelial tissue

- The epithelia (singular: epithelium) are one of the four basic tissues, with a wide distribution and many functions.
- It consists of continuous sheets of cells that cover exposed body surfaces.
- It also lines internal cavities, such as those of the digestive, respiratory, cardiovascular, and genitourinary systems.
- During embryonic development, epithelium invaginates into underlying tissues to form glands.
- Epithelium is a basic tissue of body that consists of tightly adhered cells called epithelial cells.

Function of epithelium tissue

(1) Protection of the body from abrasion and injury (e.g., skin and esophagus).

(2)Absorption of material from a lumen (e.g., tubules in kidney, small and large intestines).

(3)Transportation of material along a surface (e.g., cilia-in the trachea).

(4)Secretion of mucus, hormones, and proteins (e.g., glands).

(5) Gas exchange (e.g., alveoli in the lung).

Special Characteristics of epithelial tissue:

1. Cellularity :- Epithelium is made of contiguous and adhesive cells bound together by intercellular junctions.

2. Polarity:- Epithelium has an apical (or free) surface, lateral surfaces between adjacent cells, and a basal surface in contact with basement membrane.

3. Avascular:- Epithelium lacks a direct blood vessels and are fed via diffusion from underlying tissues (supported by connective tissue).

4. Innervated:- (supply with nerves)

5. Regeneration:- Epithelium has a high mitotic index with constant cell renewal, an advantage because cells undergo mechanical stress and trauma.

Specialized Structures of the Epithelial Cell:

■ **Apical surface :** Exposed to a luminal or external environment; site of primary function (absorption, protection, etc.).

1. Microvilli :- Microvilli increase apical surface area to aid in absorption.

2. Cilia :- Cilia aid in the transport of material across the surface of the epithelium.

■ **Lateral surface :** Contains junctional complexes that connect cells to neighboring cells.

1. Tight junctions:- specialized membrane proteins between the apical and the lateral surfaces of the cell. Surround the apical borders and serve as impermeable barriers.

2. Adhering junctions: beneath the tight junctions, form bandlike junctions, and link the cytoskeleton of one cell to

neighboring cells. They provide mechanical stability of the cells.

3. Desmosomes junction: spotlike junctions, which assist in cell-to-cell attachment.

4. **Gap junctions:** communicating junctions that permit passage of ions and small molecules between neighboring cells.

■ Basal surface: Contains junctional complexes and basement membrane. Basolateral folds may also be present.

Basement membrane: consists of basal lamina and reticular lamina, which provide an underlying sheet for epithelial cells.

Classification of epithelial tissue:

According to the structure and function, Epithelia can be divided into two main groups:

1. Covering (or lining) epithelia

2. Glandular epithelia

Covering (or lining) epithelia classed histologically according to:

A. Number of cells layers into two main groups:

1. Simple epithelia contain one cell layer.

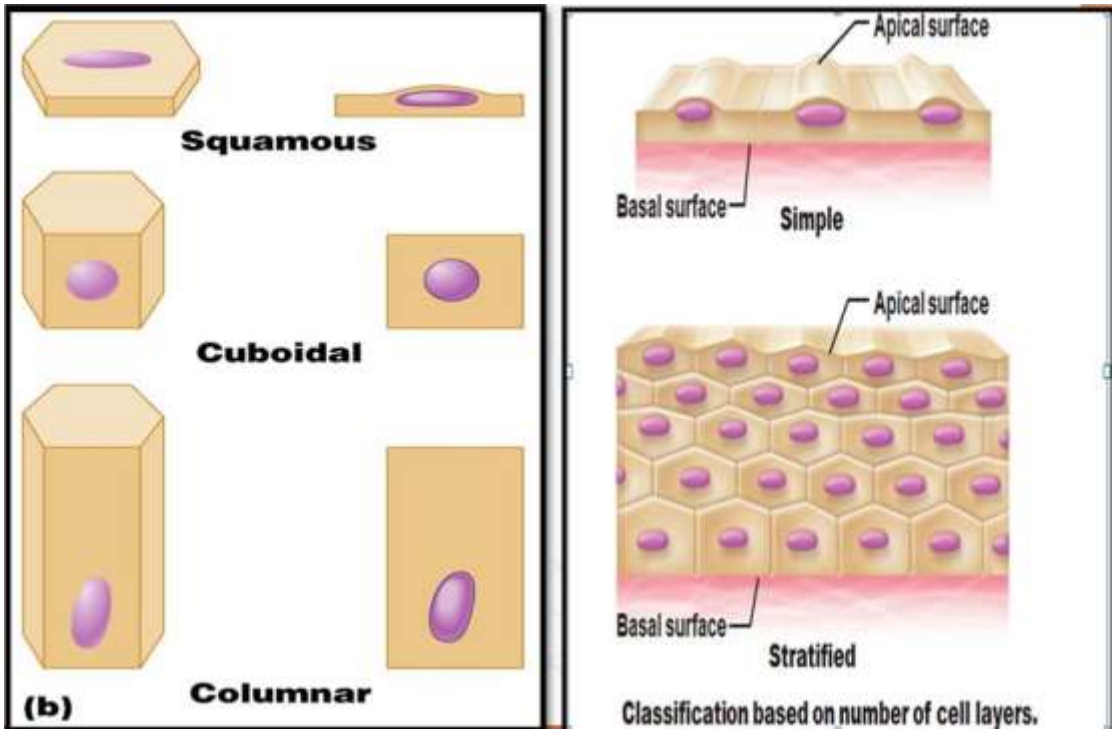
2. Stratified epithelia contain two or more layers.

B. Shape of the surface cells into:

1.Squamous cells

2.Cuboidal cells

3.Columnar cells



Shape of simple epithelial tissues

Naming the epithelia includes both number of layers (first) and the shape of the cells (second)

i.e. stratified cuboidal epithelium / Simple squamous epithelium

The name may also include any accessory structures

- **Goblet cells**
- **Cilia**
- **Keratin**

C- Special classification of epithelium tissue:

1.Pseudostratified epithelia

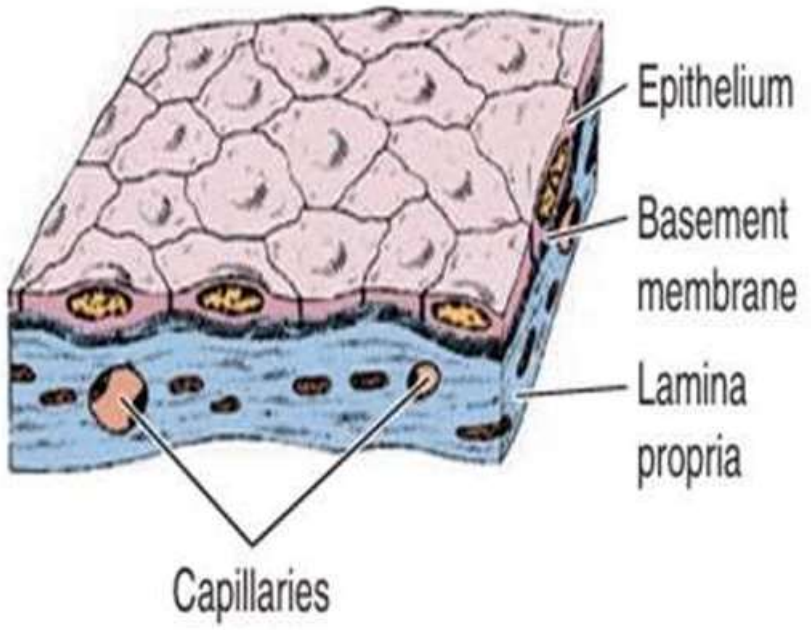
2.Transitional epithelia

A) Simple epithelium:

1- Simple squamous epithelium tissue:

Structure and Function of Simple Squamous Epithelium

- ❖ Consists of a single layer of flattened cells resting on a basement membrane.
- ❖ The cells, shaped like scales (Latin squama).
- ❖ One nucleus for each cell.
- ❖ Thinness of the epithelium permits diffusion and bidirectional movement of gases, fluids, and nutrients from the free surface to underlying tissues.
- ❖ Names of this epithelium depend on location:-
- ❖ Endothelium; lining of the **heart**, **blood vessels**, and **lymphatic channels**.
- ❖ Mesothelium; lining internal body cavities example heart.



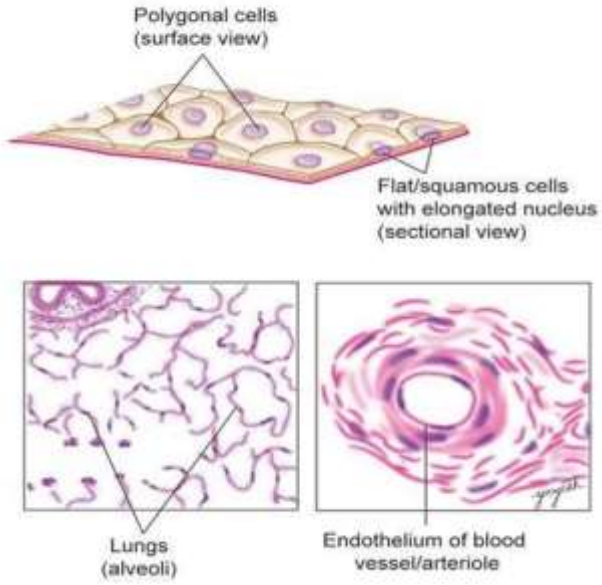
Simple squamous epithelium cells

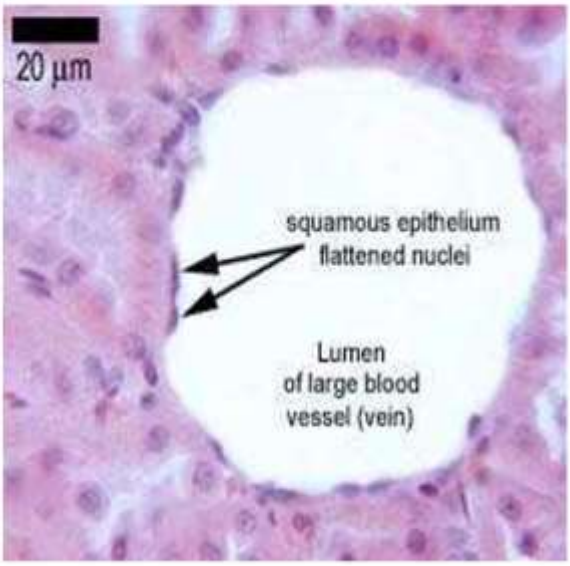
Functions of Simple Squamous Epithelium

1. Filtration
2. Gaseous exchange
3. Aiding movement of viscera.

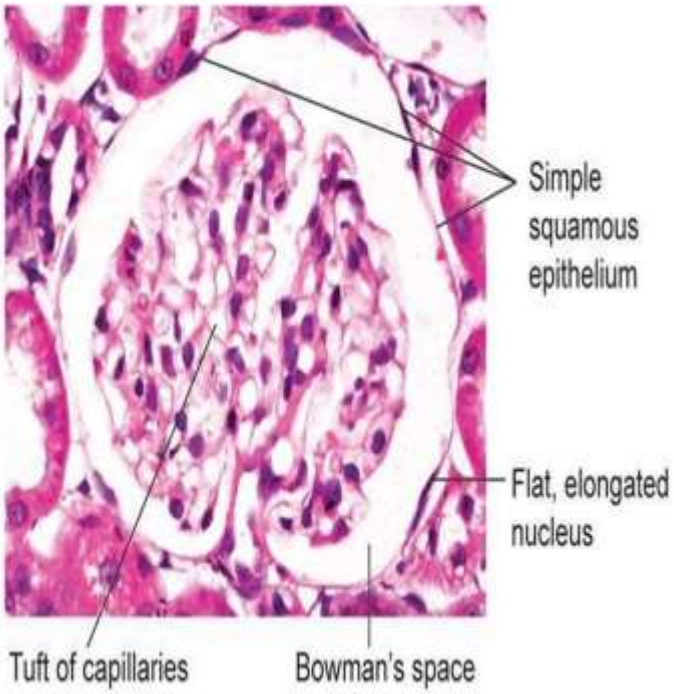
Location of Simple Squamous Epithelium

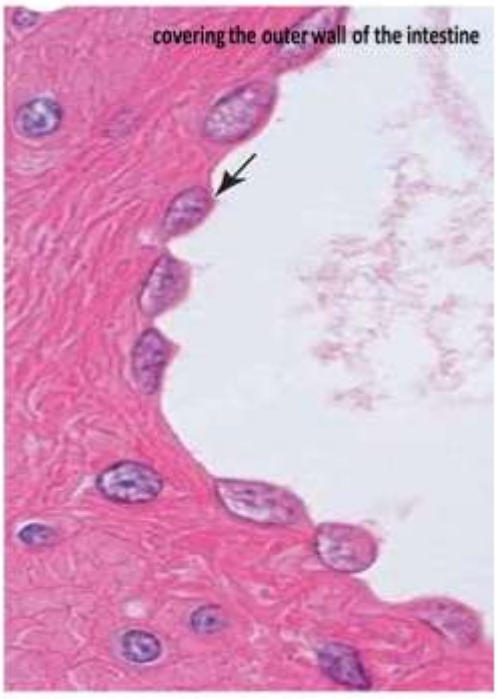
1. Lining of alveoli of lungs.
2. Bowman's capsule and loops of Henle
3. Lining of heart, blood and lymphatic vessels.
4. Lining of ventral body cavity.
5. Covers visceral organs of these cavities
6. Mesothelium ,serosae (lining epithelium of serous cavities of body [pericardium, peritoneum, pleura), and covers visceral organs of those cavities.





Simple Squamous Epithelium in vascular organs





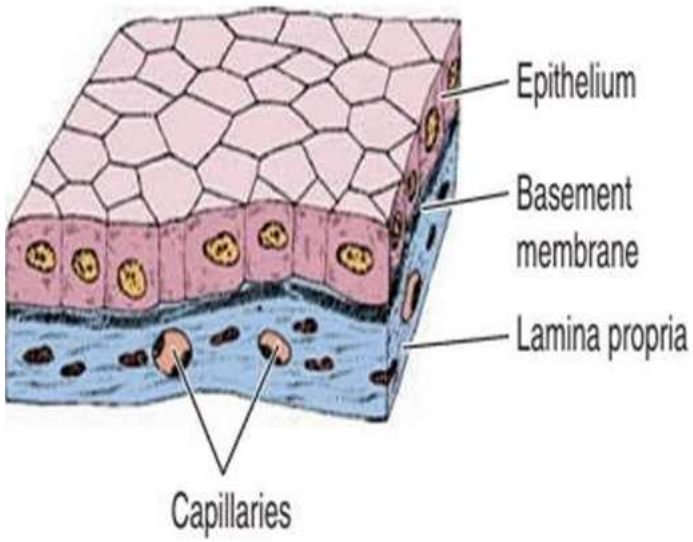
Simple Squamous Epithelium in vascular organs Bowman vascular

2- Simple Cuboidal Epithelium:

Structure and Function:

Structure

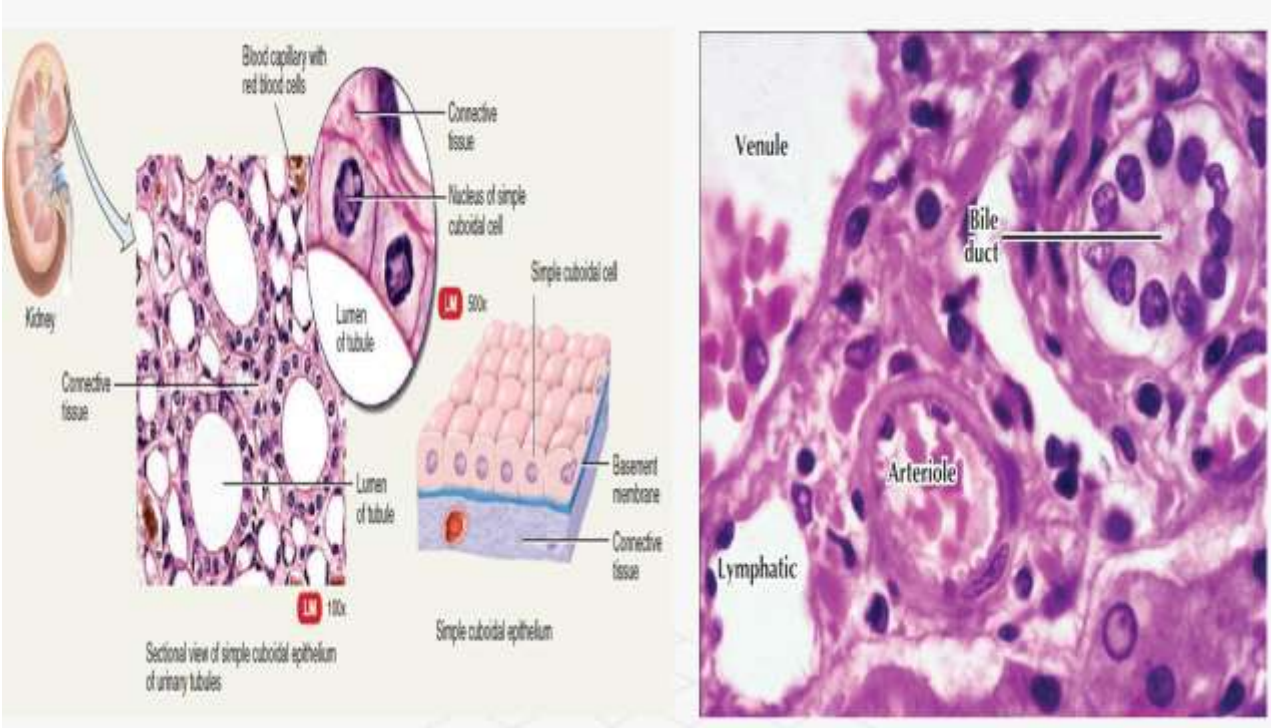
- Consists of one layer of cells whose height roughly equals their width.
- As in other epithelia, cells rest on a basement membrane.
- Each cell has one spherical, centrally placed nucleus.



Simple Cuboidal Epithelial cells

Function:-

- Protection, forms conduits for gland ducts, and may be specialized
- for active secretion.
- Location:- Lines **kidney tubules**, **thyroid Follicles**, **surface of ovary.**



simple cuboidal epithelium of renal tables

3- Simple Columnar Epithelium:

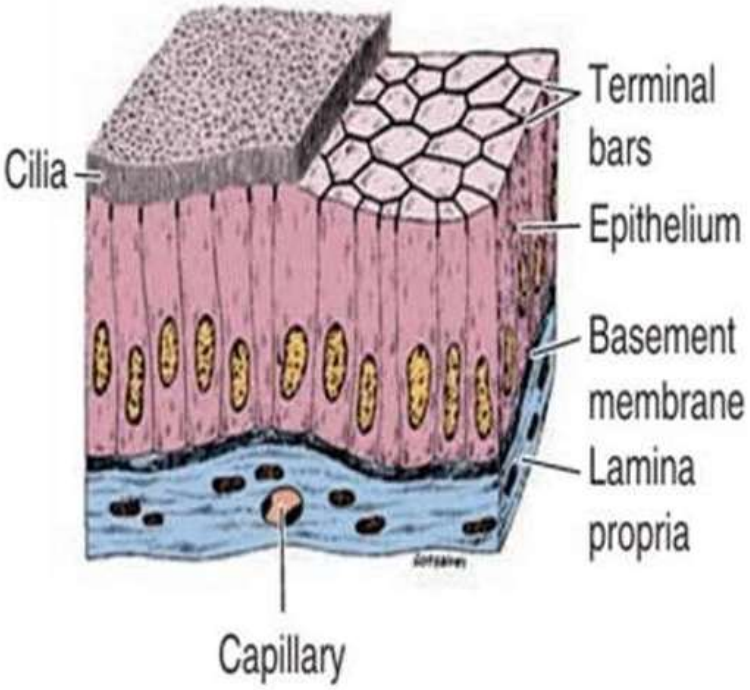
Structure and Function:

Structure:

- ❖ Consists of one layer of column cells.
- ❖ Cells rest on a basement membrane.
- ❖ The ovoid nucleus is centrally or basally placed.

Location of simple columnar epithelium:-

- ❖ Location:- Found in **ducts of glands**, **inner lining of the stomach**, **small and large intestines**, **gallbladder**, **small bronchi of the lungs**, and **oviducts** and **uterus of female reproductive tract**.



Functions Simple Columnar Epithelium

1. Secretion of enzymes, mucus and so on.

2. Absorption of nutrients in intestine.

3. Ciliary beats: Propulsion of mucus in respiratory tract and ova in fallopian tube.

4. Microvilli: increase absorptive surface area of cells in gall bladder and intestine.

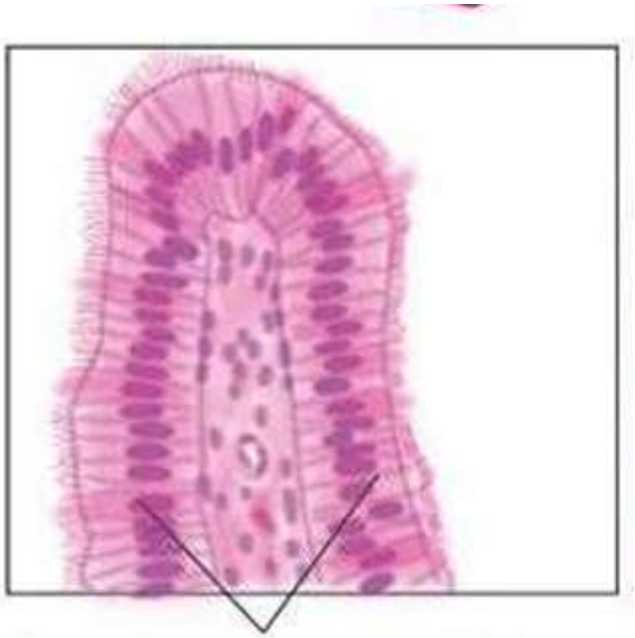
Simple Columnar Epithelium: can exist in two forms:-

A. Ciliated simple columnar epithelium: has cilia at their apical surface.

Location: Lines some **bronchioles** (small tubes) of respiratory tract, **uterine (fallopian) tubes**.

Function: Cilia beat in harmony, moving mucus and foreign particles toward throat, where they can be coughed up and swallowed or spit out (Respiratory system). Cilia also help move

oocytes expelled from ovaries through uterine (fallopian) tubes into uterus (Female Reproductive system).



Simple columnar epithelium in fallopian tube

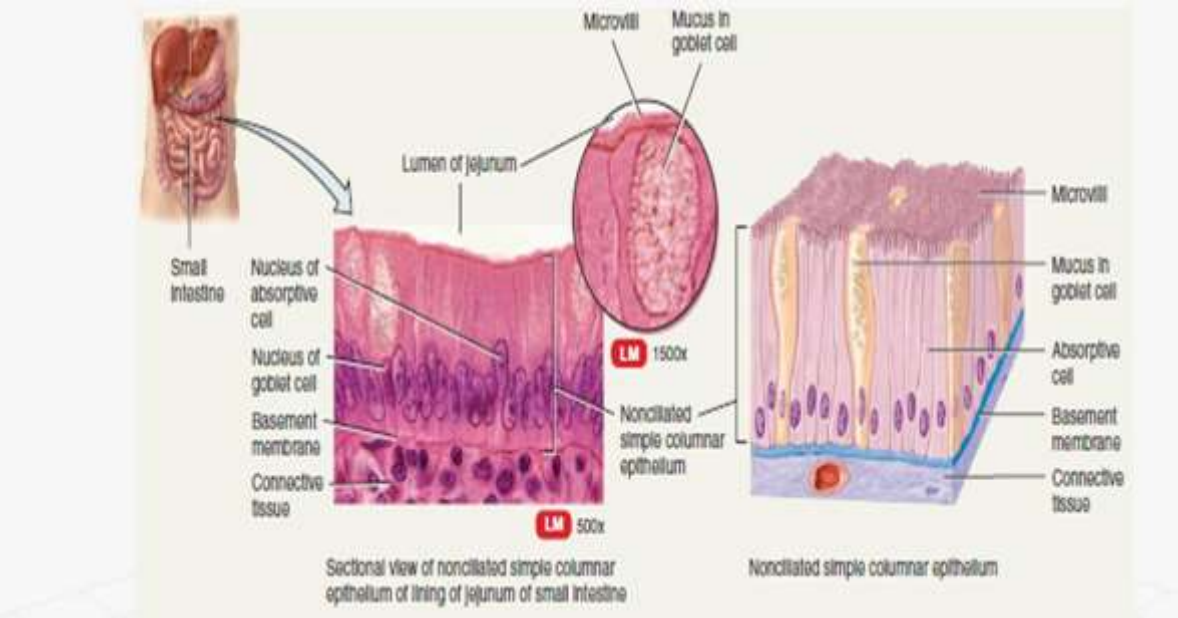
B. Non-ciliated simple columnar epithelium, which contains microvilli at their apical surface.

Location: Lines gastrointestinal tract.

Function: Secretion and absorption.

Non-ciliated simple columnar epithelium:

which contains microvilli at their apical surface. Location: Lines gastrointestinal tract. Function: Secretion and absorption.



Non-ciliated simple columnar epithelium in small intestine lining of jejunum

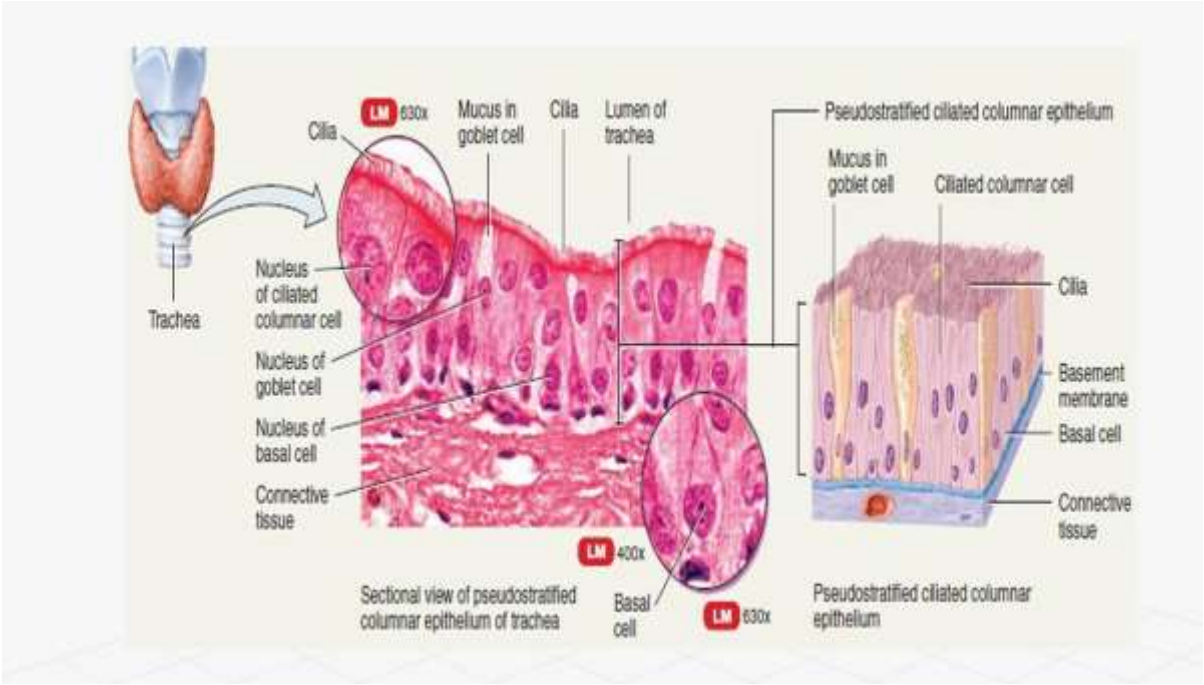
4- Pseudostratified Epithelium tissue:

Structure

- ❖ Consists of more than one type of epithelial cells, of varied size and shape.
- ❖ The nuclei usually appear at different levels, so two or three layers of crowded nuclei are seen.
- ❖ All cells contact an underlying basement membrane, but only some reach the free surface.
- ❖ These features give the epithelium a false impression of stratification.
- ❖ Many of these cells may have cilia on their free surfaces.

Function

- ❖ It lines many parts of the **upper respiratory tract** (nasal cavities, **auditory tube**, **nasopharynx**, **larynx**, **trachea**, and **large bronchi**).
- ❖ Mucous goblet cells usually occur in this epithelium.



Pseudostratified ciliated columnar epithelium tissue in trachea