EPITHELIUM II

DR. Heba Elkaliny

Associate professor of Histology & Cell biology

Intended learning outcomes

by the end of this chapter **(EPITHELIUM)** the students will be able to:

1. Describe the structural characteristics of the epithelial tissue.

2. Differentiate between different types of epithelial tissue.

3. Recognize the structural specializations of the cell surfaces

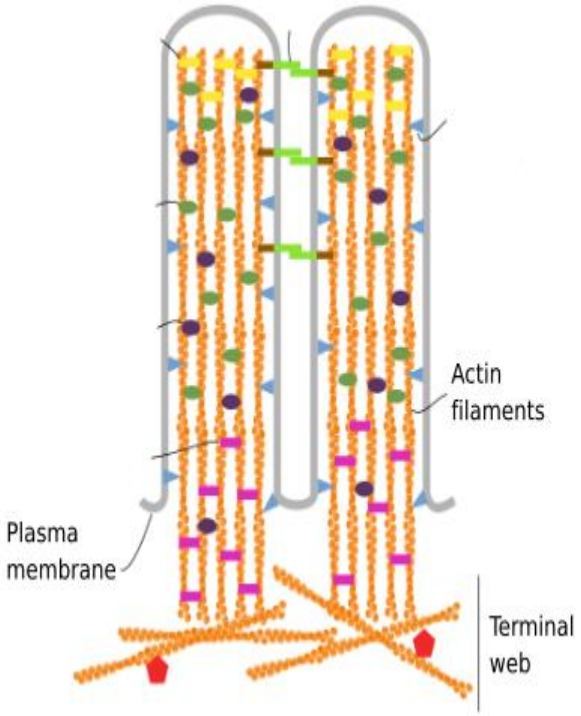
4. Relate the composition of epithelial tissue type to its specific function.

EPITHELIAL POLARITY
SPECIALIZATIONS OF THE CELL SURFACE

The epithelial cell has an apical, basal and lateral surfaces; meaning that cell regions near each surface exhibit special structural modifications to carry out specific functions.

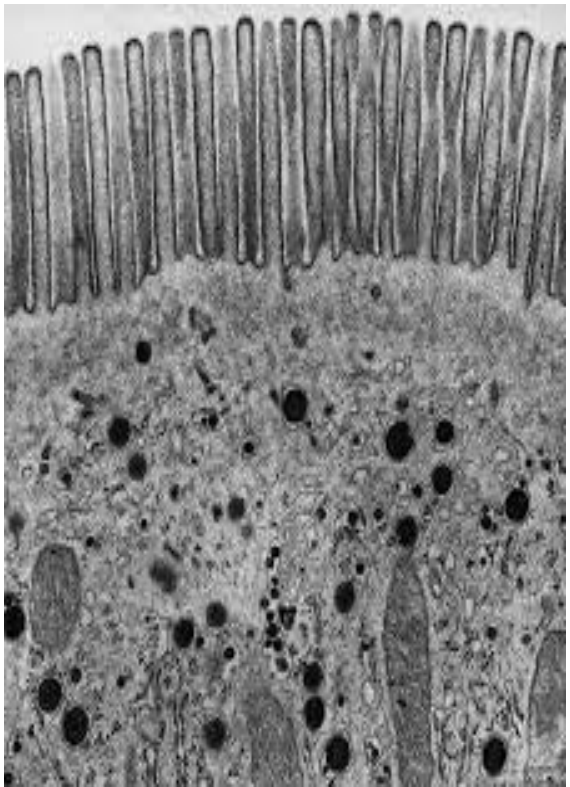
APICAL SPECIALIZATIONS

Microvilli



L/M

E/M



APICAL SPECIALIZATIONS

I- Microvilli

L/M:

Microvilli appear as brush or striated border.

E/M:

1) Few to many, long or short finger-like extensions of the cytoplasm.

2) The microvillus has a core of actin microfilaments.

The basal ends of these microfilaments intermingle with that of the terminal web.

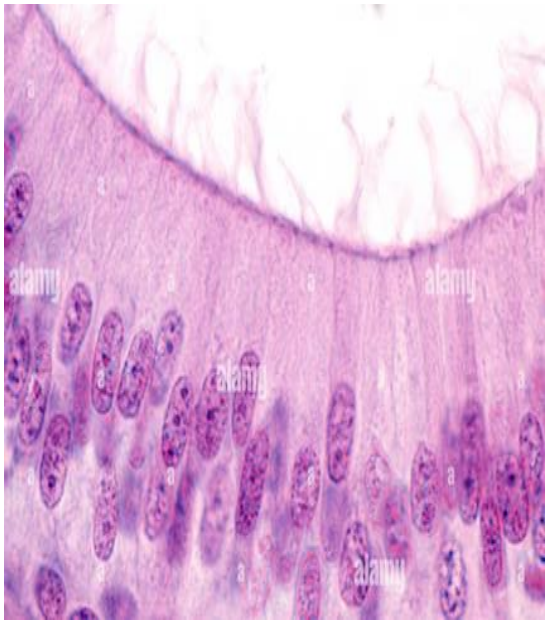
- **Terminal web** is a dense layer of horizontal filaments in the apical cytoplasm beneath the microvillus.

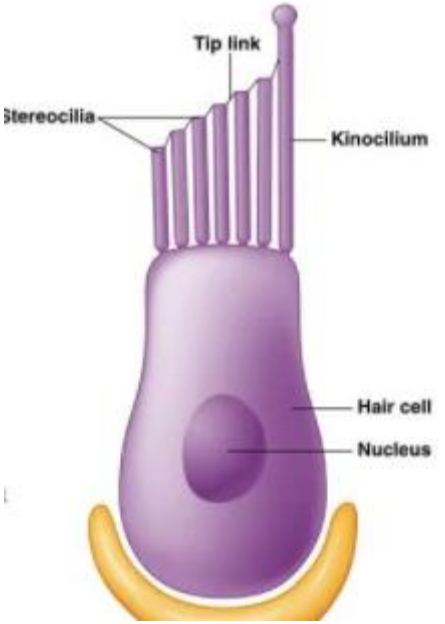
3) The microvillus is covered with a filamentous coat called glycocalyx.

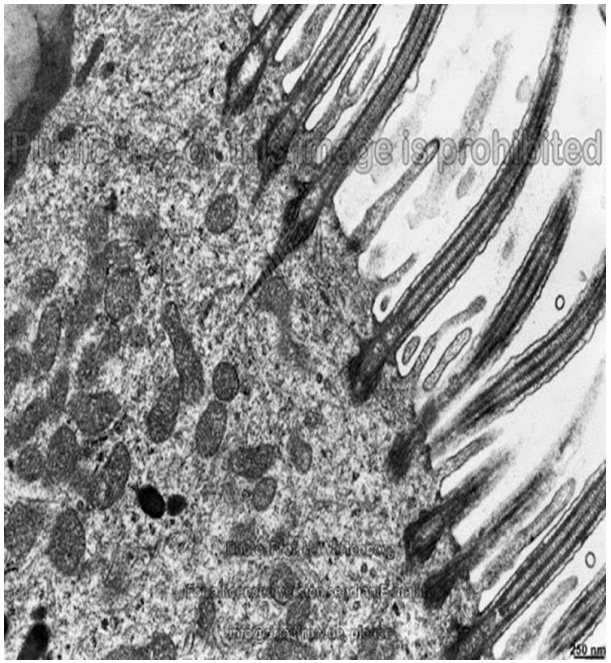
Sites: They are found on the surfaces of certain cells e.g. Absorptive epithelial cells lining the small intestine - Cells of proximal renal tubule.

Function: they increase the absorptive surface area of the cell.

II- Stereocilia are long, branching microvilli found mainly in the non-ciliated pseudostratified columnar epithelium of the male genital ducts e.g. the epididymis. They increase the surface area for fluid absorption.







III- Cilia: are motile hair-like projections arising from the free surface of certain epithelial cells

Medical application:

Abnormal proteins of cilia or flagella resulting from mutation are responsible for the **immotile cilia syndrome.**

symptoms:

- Male infertility due to immotile spermatozoa.
- Chronic respiratory infection caused by lack of cleaning action of cilia in the ciliated pseudostratified columnar epithelium of respiratory tract.

LATERAL SPECIALIZATIONS

(Intercellular junctions)

They are three types

1- Occluding junctions: (Tight or zonula occludens)

2- Anchoring junctions: (Adhering)

- **Zonula adherens:**
- **Macula adherens = desmosomes:**

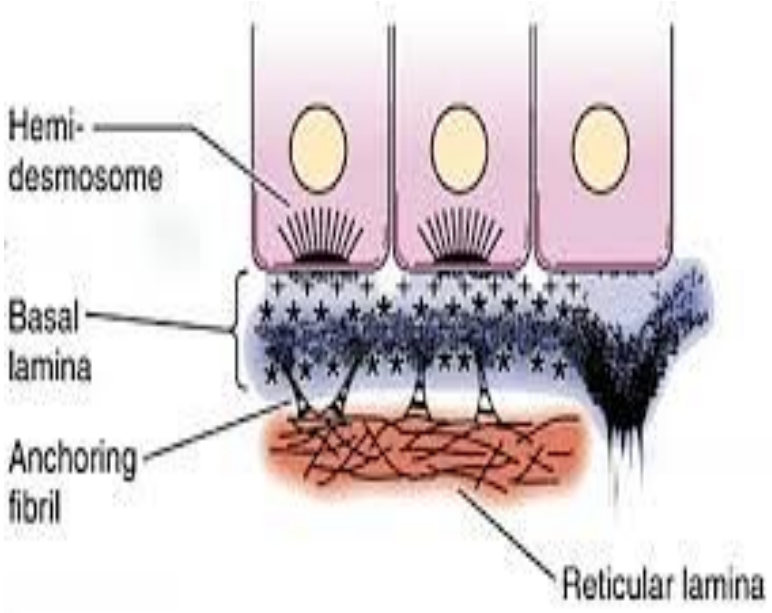
3- Communicating junctions: (Gap or nexus)

BASAL SPECIALIZATIONS

The structural modifications in the basal domain include

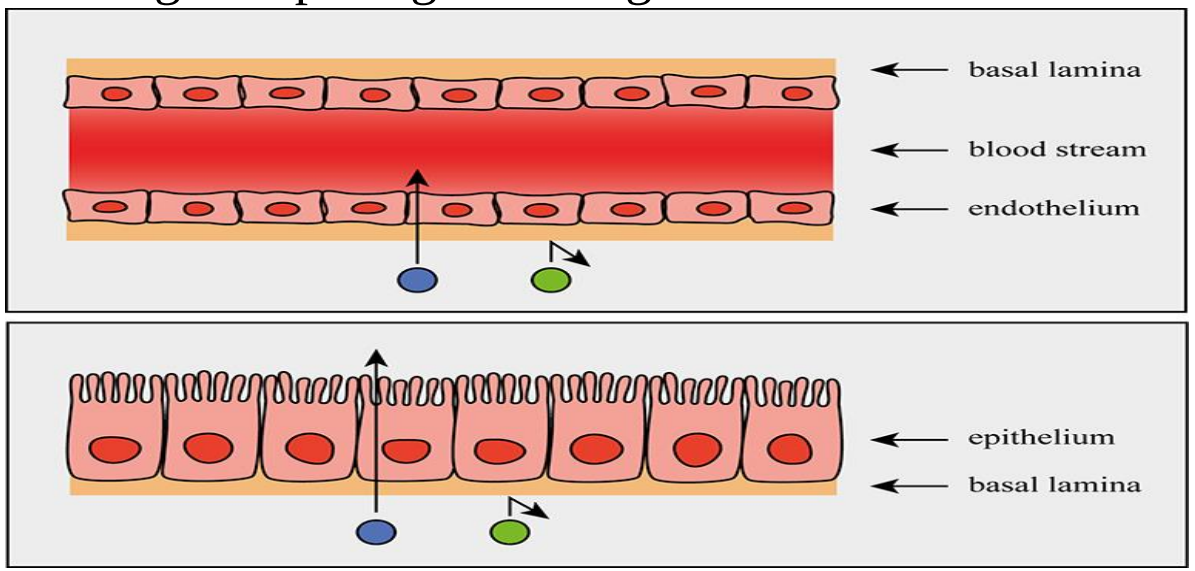
- **flagella:** Flagella resemble cilia in structure but they are much longer and single e.g. flagellum of the spermatozoon.
- basal infoldings (discussed later)
- cell-to-matrix junction (hemidesmosome).
- the basement membrane

- **Basement membrane** all epithelial cells have at their basal surfaces a specialized extracellular material, in the interface between epithelium and connective tissue. It has 2 constituents:
- **basal lamina** formed of adhesive glycoprotein
- outer **reticular lamina** formed of fine network of collagen fibrils.



Function of basement membrane:

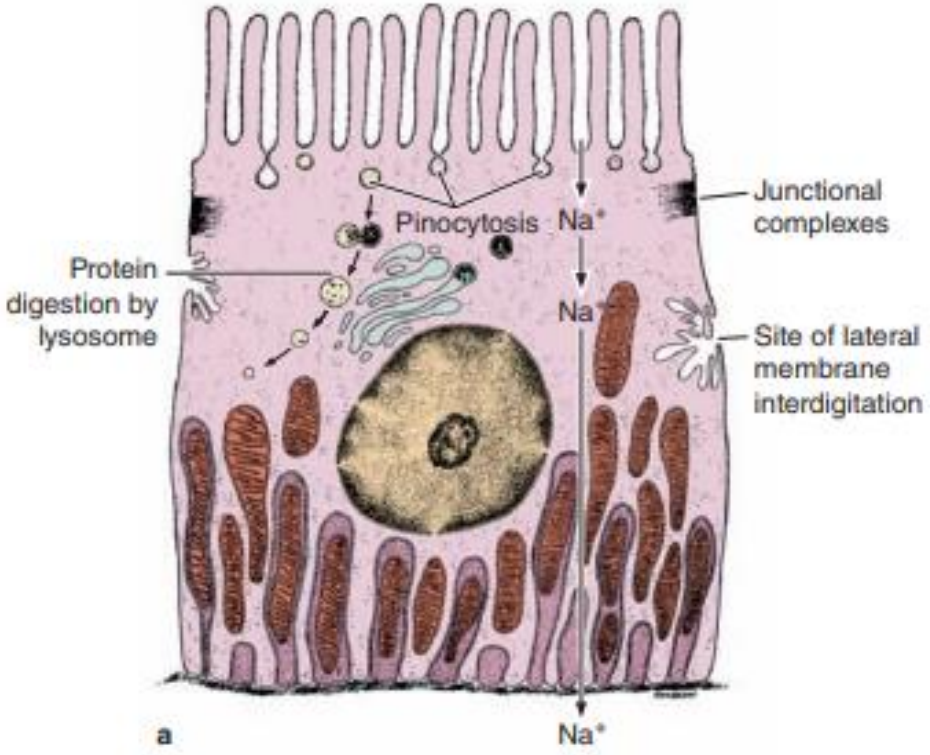
- **Structural attachment** as it serves in the attachment of the epithelial cells to the underlying connective tissue.
- **Filtration** as it regulates exchanges of macromolecules between the epithelium and the surrounding tissues.
- **Tissue scaffold** as it directs the migration of epithelial cells (re-epithelization) during wound repair.
- It acts as barrier against passage of malignant cells.

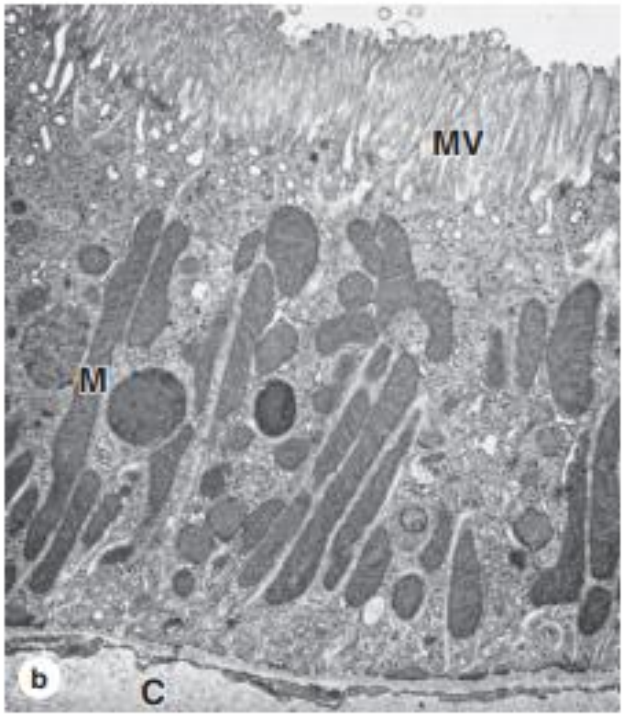


BIOLOGY OF EPITHELIAL CELLS

As cells differentiate, they acquire morphologic and physiologic characteristics related to their functions. These are the basic epithelial cell types:

I. Ion- transporting cells





I. Ion- transporting cells

- All cells which are able to transport certain ions against a concentration gradient using ATP as an energy source. This is called active transport .

- E/M:

1-The basal surfaces of these cells have many long invaginations of the basal membrane with vertically oriented mitochondria (supply energy (ATP) for the active transport) in-between these invaginations.

2- In the lateral membranes, there are interdigitations between the adjacent cells.

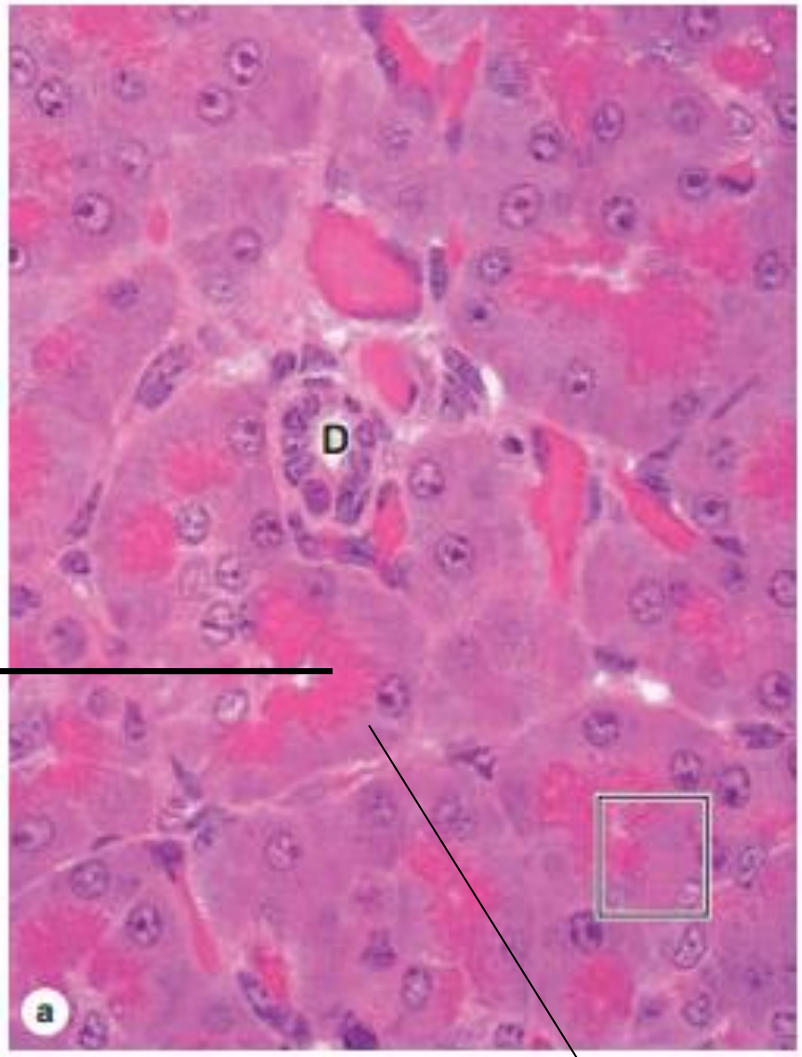
I. Ion- transporting cells

3- Apical microvilli: The apical surfaces of these cells have many microvilli to increase surface area exposed for the process of ions transport.

4- Apical tight junctions: They are impermeable to ions, water and larger molecules, to prevent back diffusion of materials already transported across the epithelium.

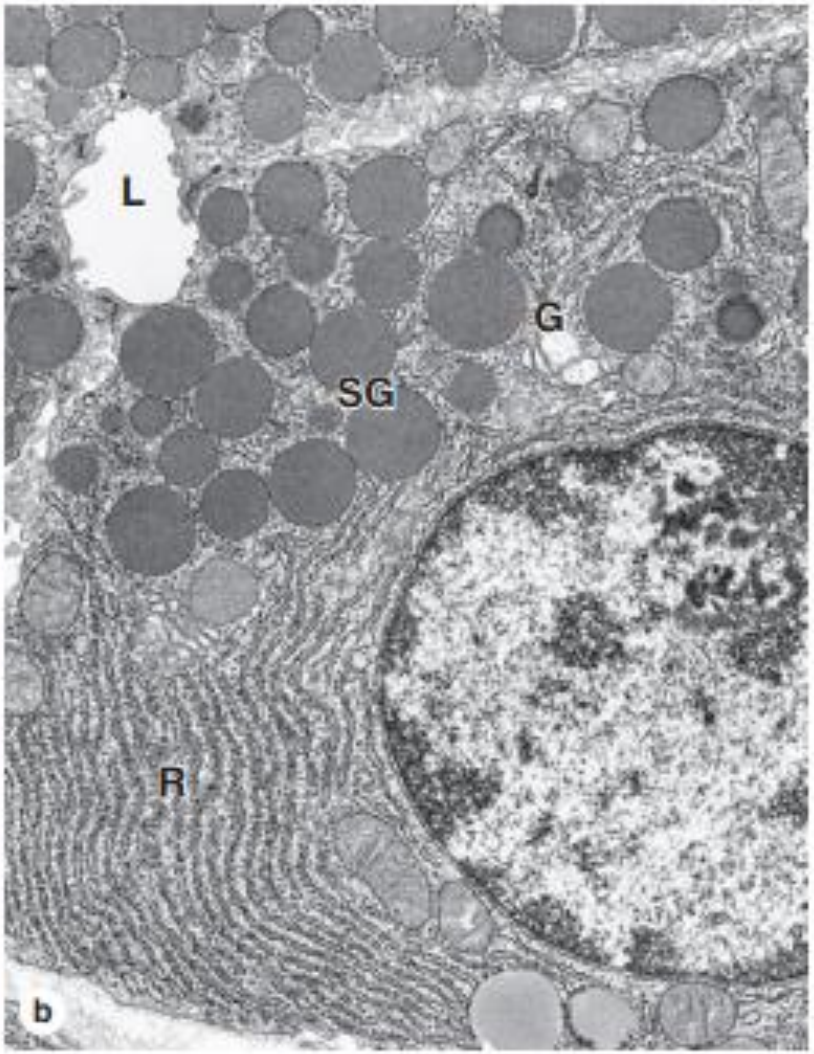
- Sites: In proximal and distal renal tubules, striated ducts of salivary glands, intestine and gall bladder.

II. Protein synthesizing cells



AA

BB



II. Protein synthesizing cells

- L/M

- Cells are polyhedral or pyramidal
- Nucleus is central and rounded
- Well defined polarity: apical acidophilia & basal basophilia

- E/M

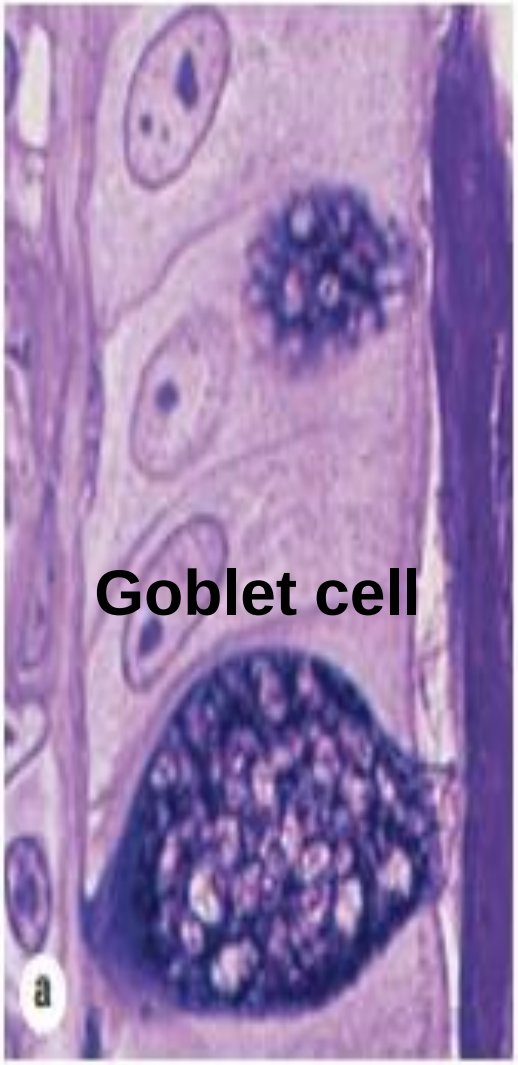
A- In the basal region:

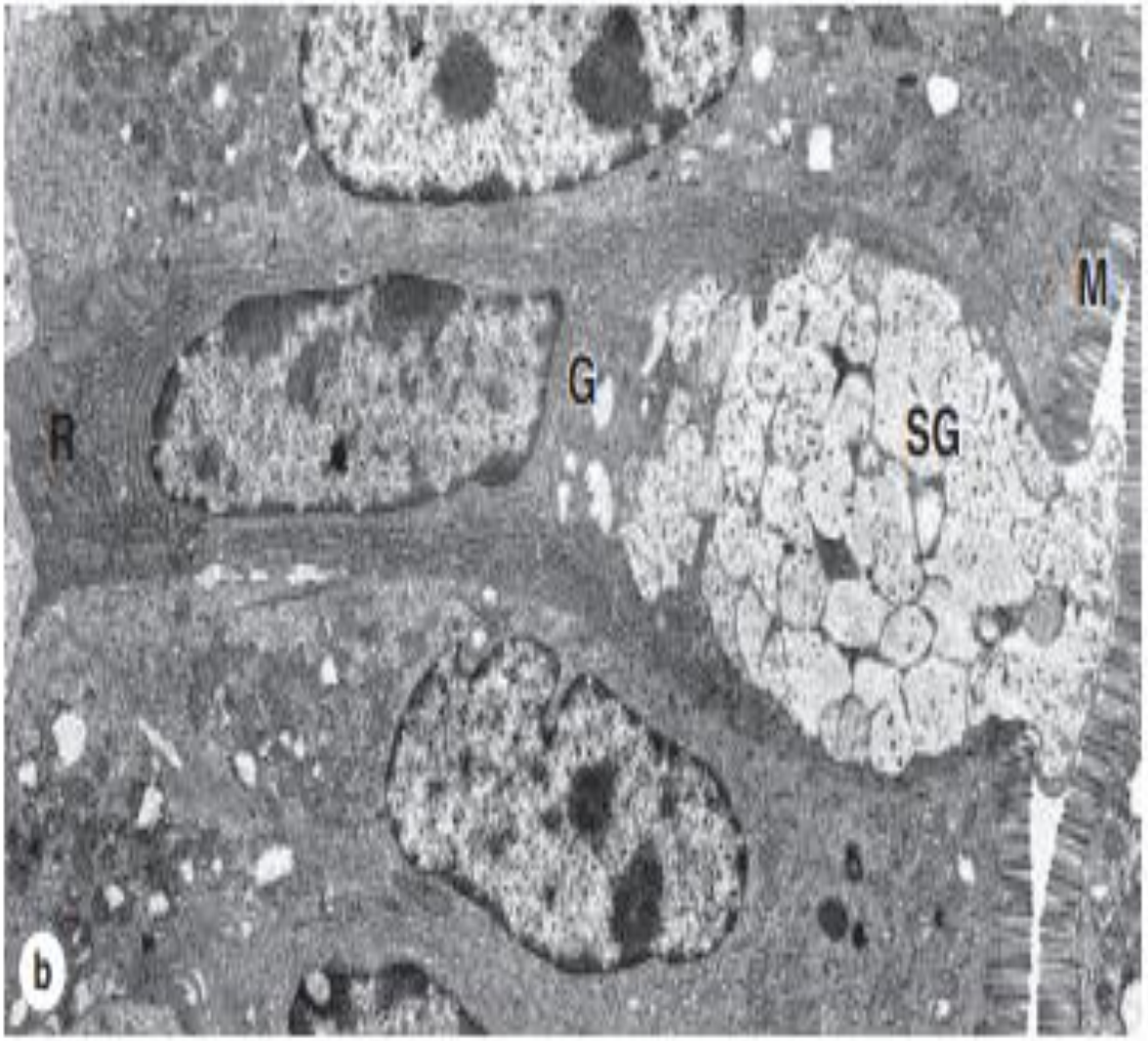
- Infranuclear accumulation of rER.
- Mitochondria - Abundant ribosomes.

B- In the apical region:

- Golgi complex just above the nucleus.
- Secretory granules

Mucus-secreting cells





Mucus-secreting cells

Goblet cell is one of the several types of cells that synthesize glycoproteins (mucin). It is the typical example of mucous cells.

L/M:

- Numerous, large and lightly stained secretory granules fill the wide apical pole.

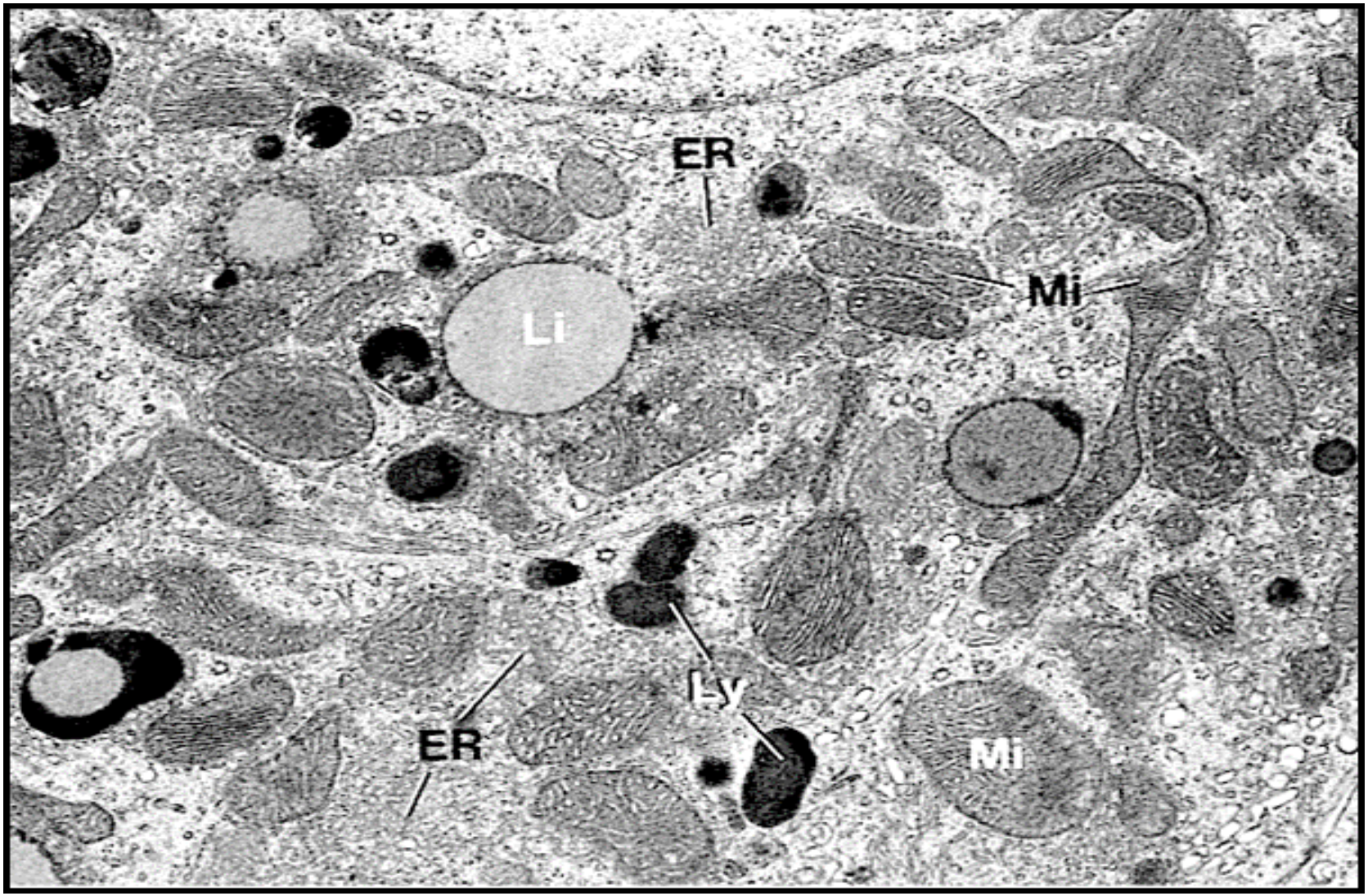
- Nucleus is located in the narrow base of the cell.

E/M:

-Well developed Golgi complex located just above the nucleus.

- Basal region is rich in RER and mitochondria.

Steroid secreting cells



Steroid secreting cells

Sites: They are found in various organs (testes, ovaries and adrenal glands).

L/M:

1- They are polyhedral or rounded

2- Acidophilic cytoplasm

3- Central nucleus

4- The cytoplasm is rich in lipid droplets

E/M:

1- Microvilli on the surfaces facing blood capillaries

2- Rich in SER in the form of anastomosing tubules.

4-Spherical or elongated mitochondria containing tubular cristae.

5- Rich in lipid droplets, Golgi apparatus, lysosomes, and few RER


Thank
you