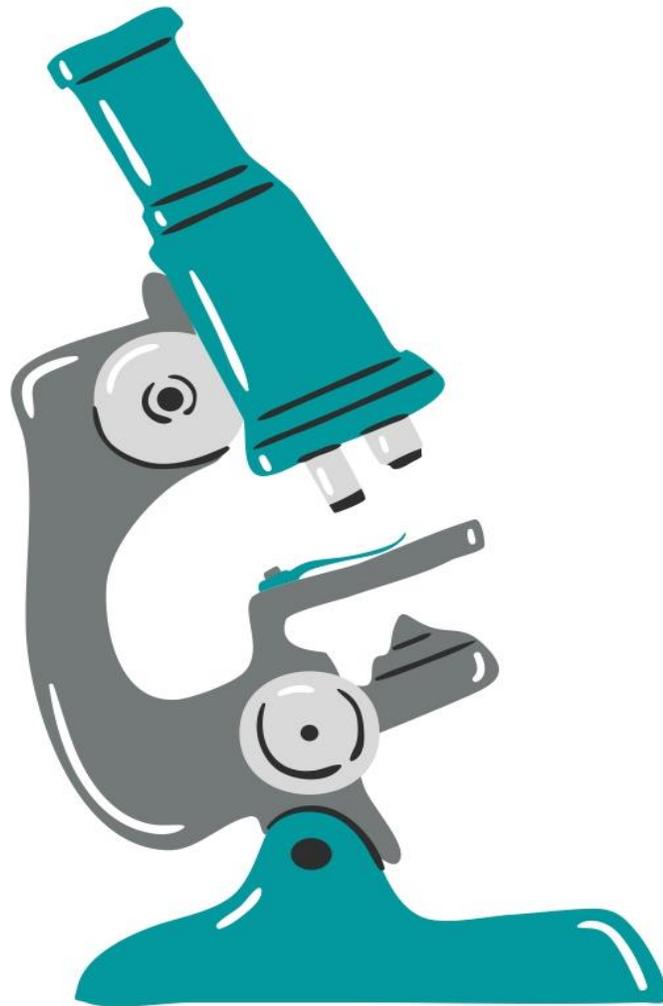


Sheet no. 7



Histology



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Note: The Dr started the lecture by asking a few questions and this is the summary:

Tissue: a group of cells and the ECM surrounding them that work together to perform a particular function.

Types of tissue: nervous, muscular, connective and epithelial tissue.

How to identify the epithelium tissue?

By noticing the lumen, the high packing of the cells and the very little amount of the ECM.

Extracellular=intercellular

Main properties of epithelium tissue:

a) Polarized (the organelles are unevenly distributed; every compartment has different structures to fit its function).

b) Avascular: that's why it is supported by connective tissue.

Epithelia: plural

Epithelium: singular

Epithelial: adjective

Glandular Epithelium

Glands

Glandular epithelia are tissues formed by cells specialized to produce secretion.

Secretion: if substances produced are used elsewhere in the body, they are called secretions (used inside the body).

Excretion: if products are discarded from the body, they are known as excretions (materials that leave the body: sweat and urine).

Both of them are active, intentional processes.

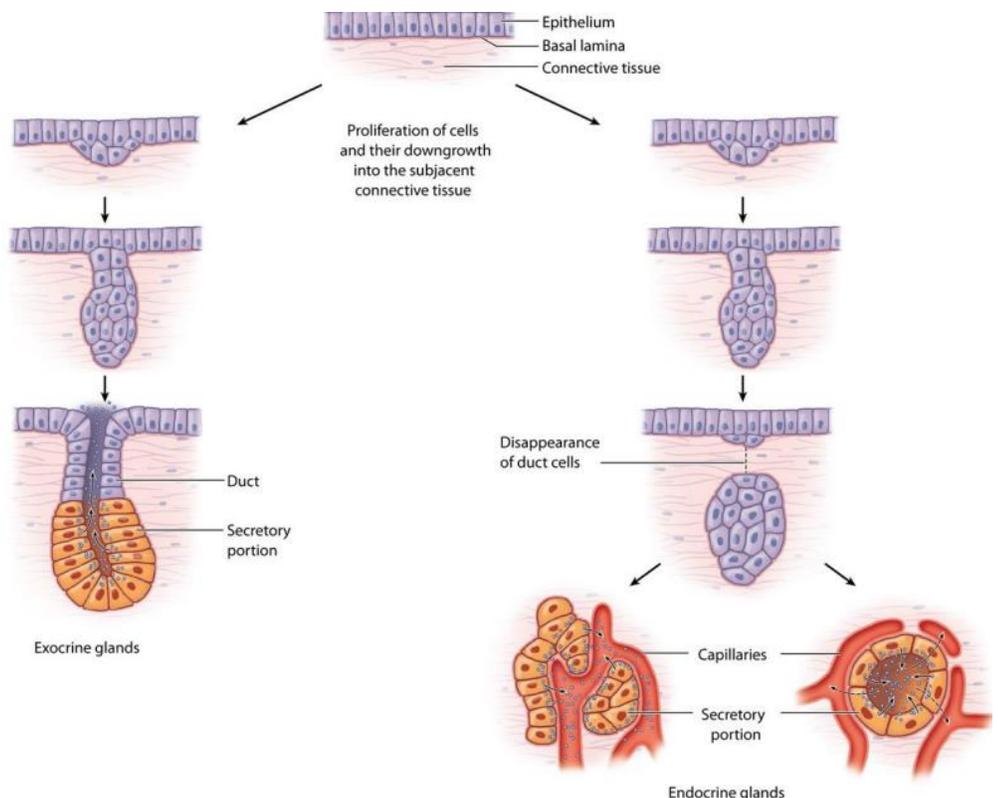
Glandular epithelial cells may synthesize, store, and secrete proteins (e.g. pancreas), lipids (e.g. sebaceous glands-غدد دهنية), or complexes of carbohydrates and proteins (e.g. salivary glands).

The **mammary glands** secrete all 3 substances (vital for the baby's health).

Some glands have low synthesizing activity (e.g. sweat glands). They secrete mostly substances transferred from the blood to the lumen of the gland.

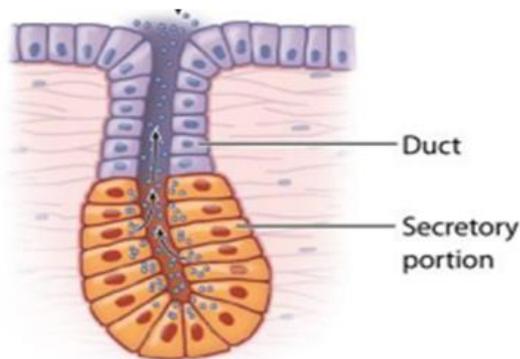
Development of glands:

Glands develop as invaginations of covering epithelia. Epithelial cells proliferate and penetrate connective tissue. They may—or may not—maintain contact with the surface. When contact is maintained, **exocrine glands** are formed; without contact, **endocrine glands** are formed.

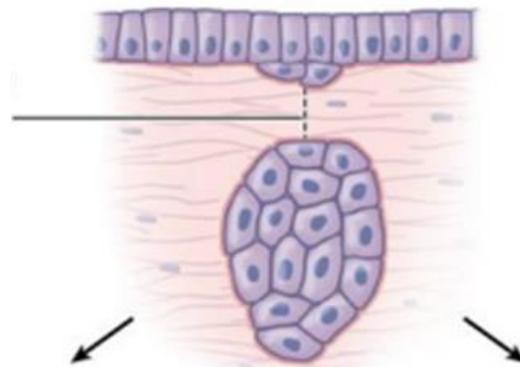


The cells grow and mitosis occurs. An **order** is sent for a specific group of cells to start dividing. They start from the **surface**; they become larger in number and eventually invaginate the underlying connective tissue.

Now let's compare these two images.



The glandular tissue **maintains its connection** to the overlying epithelium by means of a duct. **Enzymes** are produced by exocrine glands



The glandular **tissue loses its contact with the overlying epithelium**. It has no duct and the product goes directly to the bloodstream. **Hormones** are secreted by this gland.

If you notice, this is the regular organization of levels.



However, goblet cell is an exception here. It is a cell performing the function of an organ.

Exocrine glands are classified according to number of cells into:

Unicellular glands

- e.g. Goblet cells which are present in the lining epithelia of intestine and the respiratory tract.

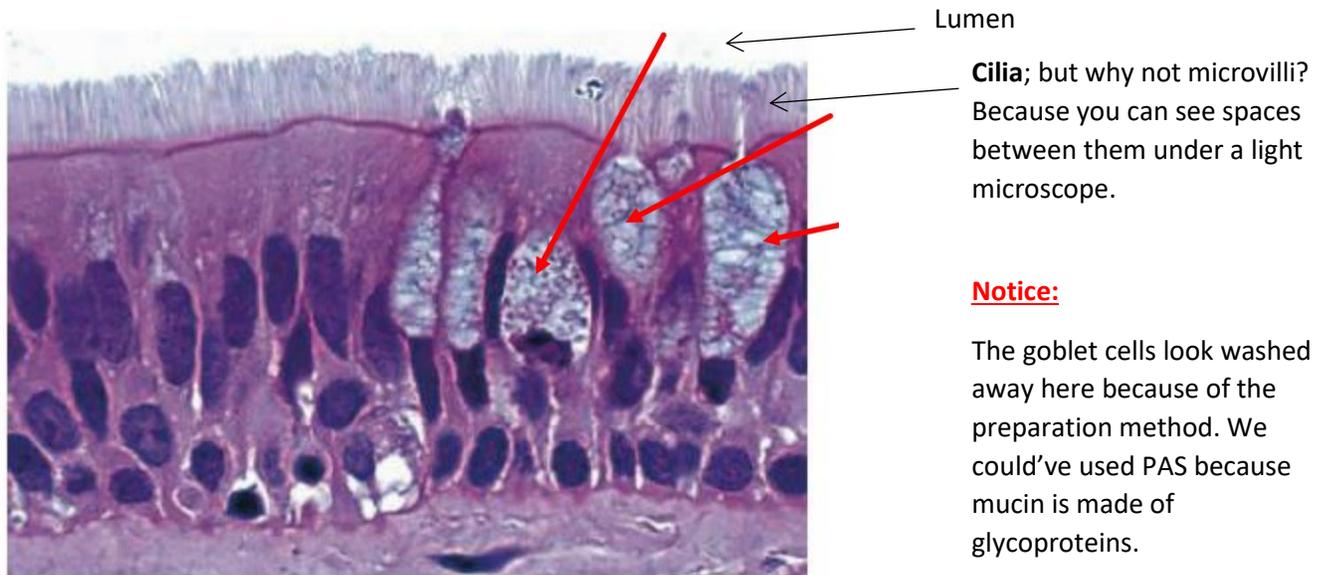
Multicellular glands

- they form most of the glands of the body
- e.g. salivary gland

Goblet cells

- They are scattered secretory cells, sometimes called unicellular glands.
- They are common in simple cuboidal, simple columnar and pseudostratified epithelia.
- Goblet cells are abundant in the lining of the small intestine and respiratory tract.
- They secrete lubricating mucus that aids the function of these organs.

This is a light micrograph of a section of epithelium found in the **respiratory tract**:



The red arrows point to **goblet cells**.

The nuclei may appear to be on more than one level; however, if you look closely, you will notice that all the cells reach the basement membrane → **pseudostratified**.

The nuclei are elongated → **columnar**.

This is ciliated pseudostratified columnar epithelium with goblet cells.

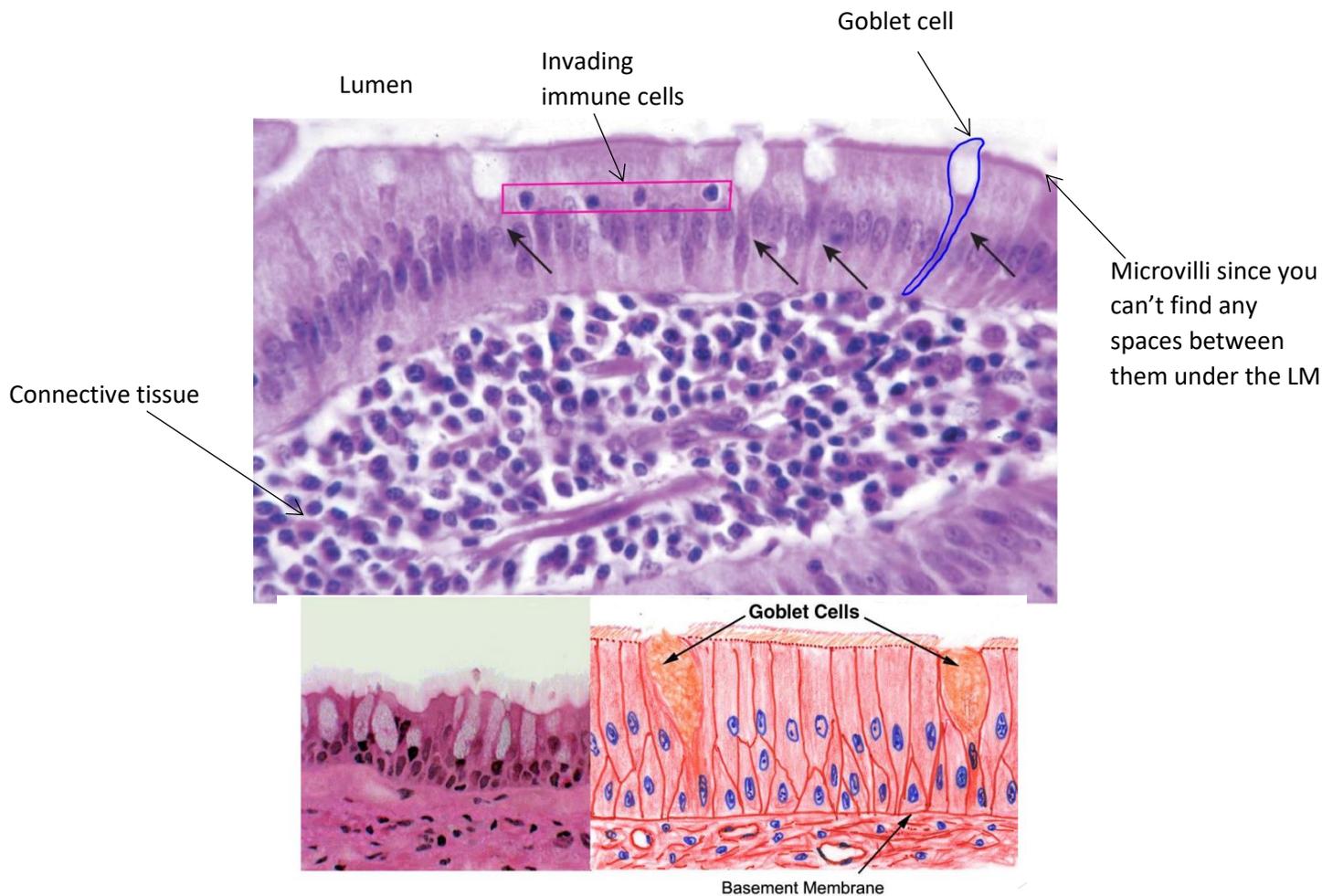
Empty magnification: occurs when the image continues to be enlarged, but no additional detail is resolved.

Does the basement membrane actually exist?

No! It is simply a line that was observed under the LM that misled scientists to thinking that it was a structure. What's actually present is the basal lamina.

The nuclei are on the same level.

You can find this type of epithelium in the **GI tract** because it performs absorption and secretion. This is **simple columnar**.



The goblet cell is **highly polarized** with the nucleus and other organelles concentrated at the base of the cell. The remainder of the cell's cytoplasm is occupied by membrane-bound secretory granules containing mucin.

A **secretory cell that is actively secreting proteins** will have the following

- 1- A basally located nucleus
- 2- A prominent nucleolus
- 3- Chromatin(euchromatin since it's an active cell).
- 4- RER and golgi apparatus

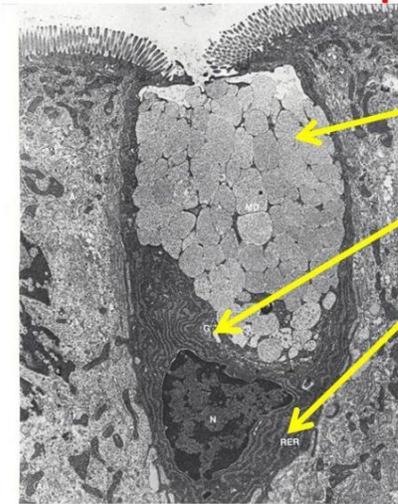
The **apical** surface will appear **acidophilic** because it is where proteins are accumulated.

The **basal** surface will appear **basophilic** because it is where the nucleus, **RER** and ribosomes are located.

Heterochromatin: condensed chromatin in less active cells.

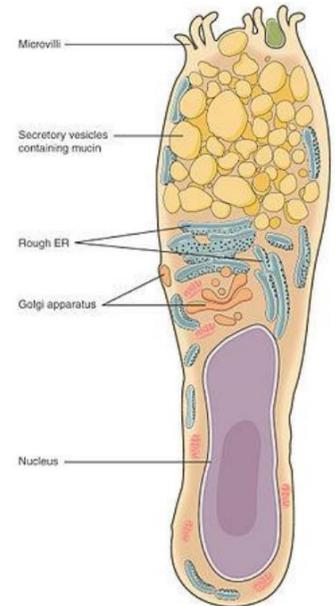
Euchromatin: diffuse chromatin found in active cells.

Goblet cell (by transmission electron microscope "TEM")

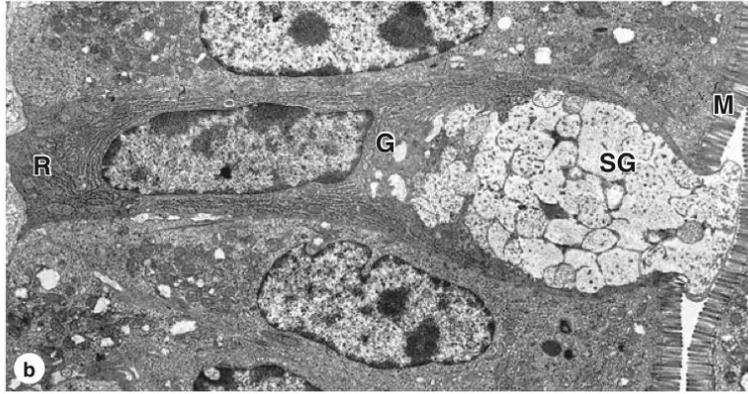


- ~~mucous~~
- Golgi
- rER

Mucous is wrong; it's supposed to be mucin.



- Apical granules
- Basally located nucleus
- Euchromatin (light) and heterochromatin(dark)
- More euchromatin than heterochromatin
- Prominent golgi apparatus apical to the nucleus



The simple columnar epithelium lining the small intestine shows many isolated goblet cells secreting mucus into the lumen.

(a) With a stain for the oligosaccharide components of mucin glycoproteins, the cytoplasmic secretory granules of two goblet cells and secreted mucus are stained purple. (X600; PAS-PT)

(b) As shown ultrastructurally, goblet cells always have basal nuclei surrounded by RER (R), a large Golgi complex (G), and abundant apical cytoplasm filled with large secretory granules (SG). After exocytosis mucin components are hydrated and become mucus. A brush border of microvilli (M) is seen on neighboring columnar cells. (X17,000)

(a) goblet cell doesn't appear washed away. Staining method was correct.

(b) Microvilli appear interconnected.

The difference between mucin and mucus:

Mucin: carbohydrates + protein (glycoprotein)

Mucus: the hydrated mucin

Classification of glands

Exocrine glands release their products onto an epithelial surface, either directly or through a duct e.g. the salivary glands.

Endocrine glands release their products into the blood stream (ductless), e.g. thyroid gland. The products of endocrine glands are called hormones.

Pastpaper questions:

All of the following are correct about glands except

- A) They are epithelial cells
- B) They may synthesize, store, and secrete proteins, lipids, or complexes of carbohydrates and proteins
- C) Some glands have high synthesizing activity, other have low synthesizing activity
- D) All of the above are correct

Answer is: D

The substance that is produced by the gland to be used in the body, This process is

- A) Excretion
- B) Secretion
- C) Hydration
- D) Histogenesis

Answer is: B

The mammary glands secrete

- A) Proteins
- B) Lipids
- C) Complexes of Carbohydrates and Proteins
- D) All of the above are correct

Answer is: D

Most of our glands are MULTICELLULAR GLANDS such as

- A) Salivary glands
- B) Goblet glands
- C) Thyroid glands
- D) A and C are correct

Answer: D

The products of endocrine glands are called

- A)Enzymes
- B)Hormones
- C)Antibodies
- D)None of the above

Answer:B

Mucous cells can be stained by

- A)PAS method
- B)H&E stain
- C)DAPI stain
- D)Sudan black
- E)All of the above are correct except D

Answer: A

The goblet cells have in their apical region

- A)Secretory granules
- B)Nucleus
- C)RER
- D)Mucin
- E)A and D are correct

Answer: E

All of the following are correct regarding exocrine glands except:

- A. Goblet cells are unicellular and are present in the lining epithelia of intestine and respiratory tract
- B. Salivary glands are multicellular glands
- C. They disappear after invagination
- D. They maintain contact with the surface
- E. Multicellular glands form most of the body glands

Answer: c

Which of the following is incorrect regarding to goblet cells?

- A. They are unicellular(scattered)
- B. Secretory granules containing mucin are concentrated at the base of the cell
- C. They secrete lubricating mucin
- D. Highly polarized
- E. They are classified as endocrine glands

Answer : B+E

Good Luck!