Secretory Epithelia & Glands

* glands are originally from epithelial tissues
* starts early in embryolife

Epithelial cells that function mainly to produce and secrete various macromolecules may occur in epithelia with other major functions or comprise specialized organs called **glands**.

Cells among epithelial cell performs as secretory cells → secretes macromolecules and release them Because tissues need them. → best seen in the Stomach → it synthesizes and release what it needs (HCl - enzymes (pepsengin))

Note : Cells of some glands (eg. Sweat glands) have little synthetic activity and secrete mostly water and electrolytes (ions) transferred from blood

Secretory Epithelia & Glands

- Synthesize and release of substances; proteins, lipids, carbs, and proteins. → every gland could make one of each.
  - In special locations such as mammary glands they could combine All 3
  - Pancrease
  - Subaceous + adrenal
  - Salivary
- Types based on the presence of duct system:
  - A. Exocrine glands (duct)
    - → Exocrine glands have their designated duct system that carry their secretion toward the location that they need to be taken to ("hormones")
    - Salivary glands: make saliva and through the duct system they deliver it to the oral cavity
    - Lacrimal gland: Synthesize and secrete an imp part of the tears → delivers it to the eye.
  - B. Endocrine glands (no duct)
    - → system that carries the secretion or the product that these glands have produced
    - → they rely on the Blood stream
      - Blood vessels that reach them → (capillaries)
      - To pick up the hormones that they produced → to be redistributed to the target tissues.

Types based on number of cells:

- A. Unicellular → goblet cells
- B. Multicellular → most of glands (many cells involved in their structure)

• Epithelium is running on the surface given a specific pathway that signals the cells to have more downward growth. = instead of growing linearly it will go towards the underlying connective tissue

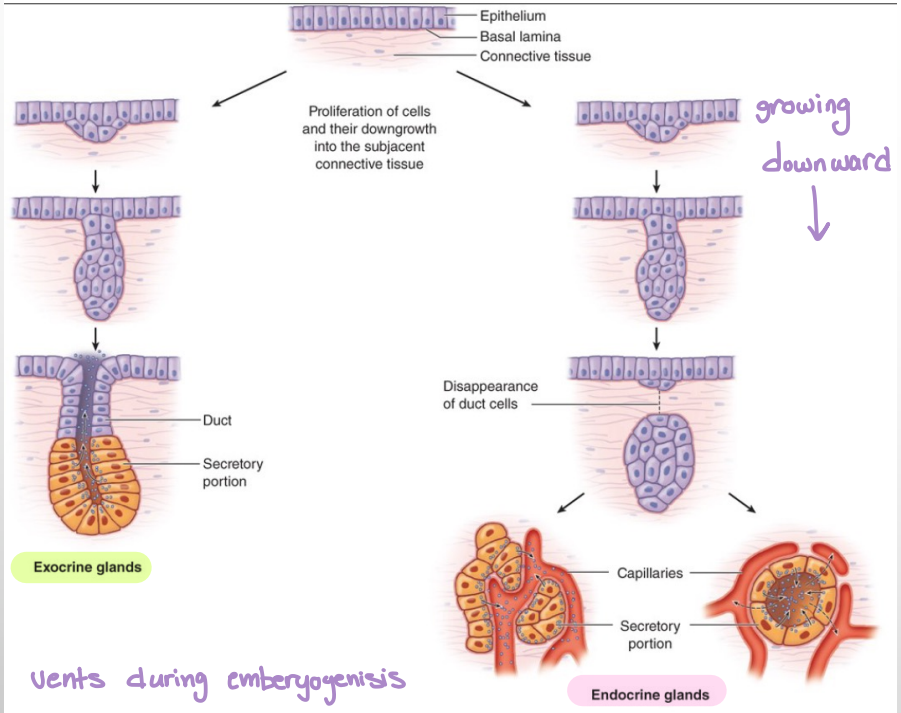
→ So these cells are growing downward + becoming bigger

Cells are proliferating → they are multiplying

+

Cells are differentiating → acquiring different types + features / Becoming sth new diff. from their parents.

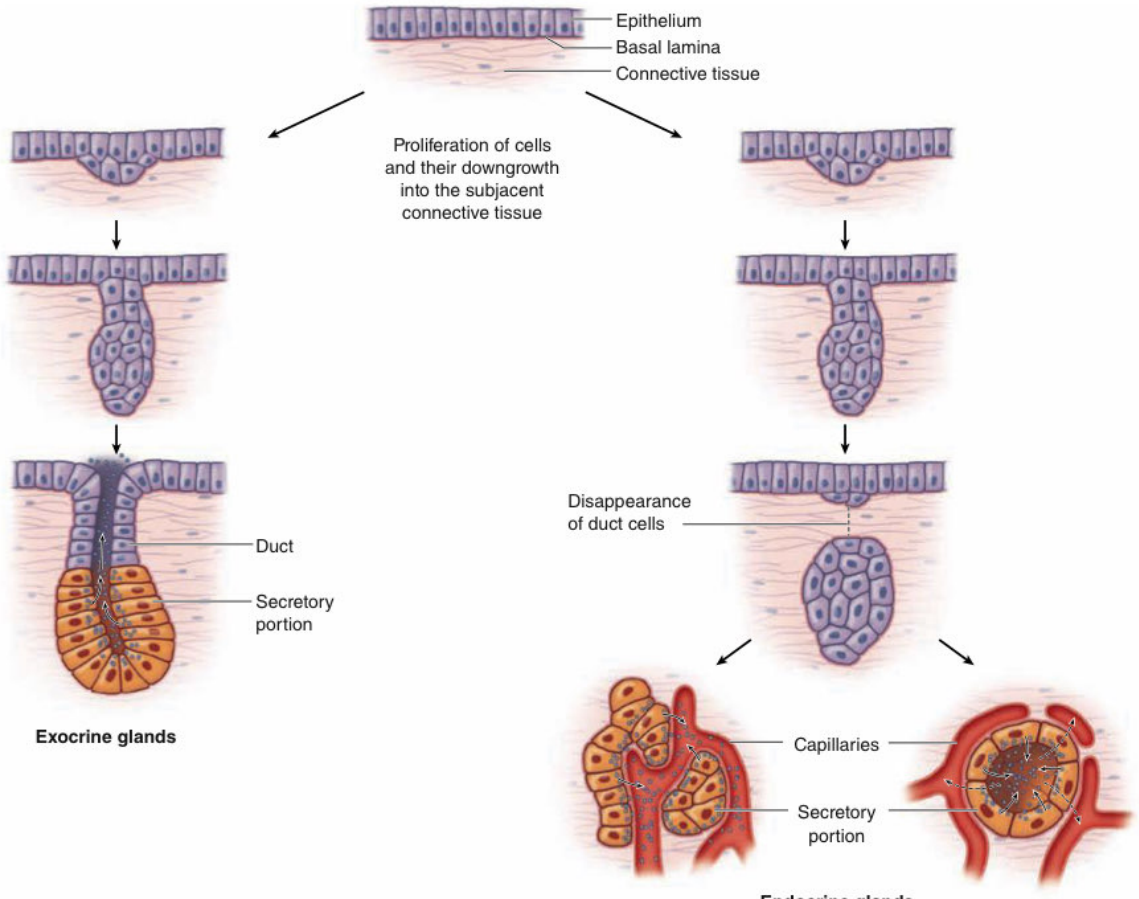
Glands' Formation



vents during emberyogenisis

- Develop from covering epithelia in the fetus by cell proliferation and growth into the underlying connective tissue, followed by further differentiation.
- Retains its connection with the surface=exocrine.
- Loses its connection with the surface=endocrine; capillaries surround them to deliver their product (hormones).
- glands came from epithelium.

FIGURE **4–19** **Formation of glands from covering epithelia.**

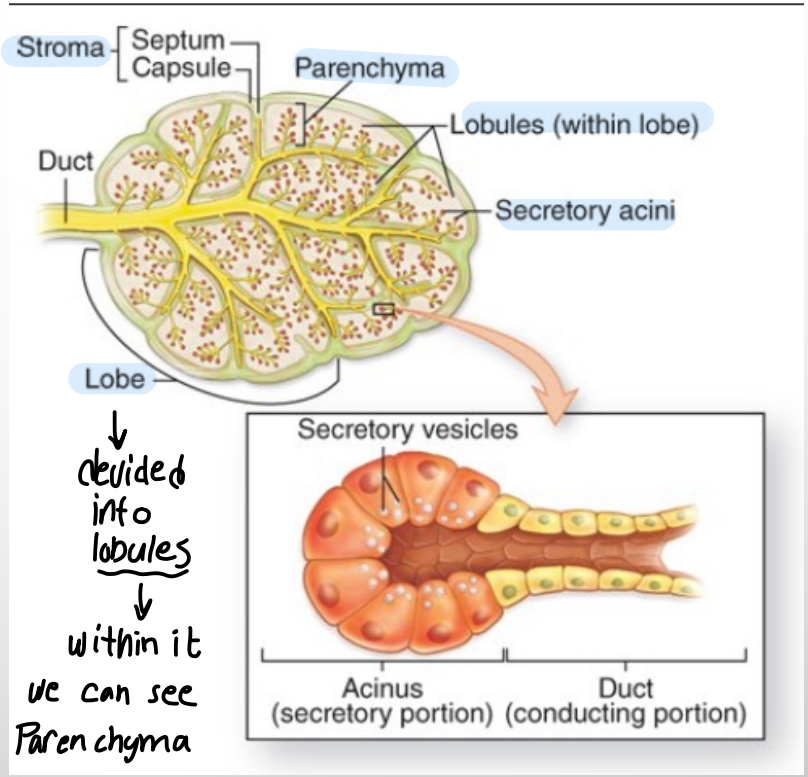


During fetal development epithelial cells proliferate and penetrate the underlying connective tissue. These cells may—or may not—maintain a connection with the surface epithelium. The connection is maintained to form a duct in exocrine glands; it is lost as endocrine glands develop. Exocrine glands secrete substances to specific organs via duct systems. Endocrine glands produce hormones and are always rich in capillaries. Hormones are released outside the cells and picked up by these blood vessels for distribution throughout the body, where specific target cells are identified by receptors for the hormones. Endocrine glands can have secretory cells arranged as irregular cords (left) or as rounded follicles (right) with lumens for temporary storage of the secretory product.

Gland Structure

makes the product that these glands are releasing

- Glands are organized into secretory part and ducts.
  - ↳ starts with smaller duct that becomes bigger till we reach main excitatory duct opens to final destination
- Parenchyma: secretory part.
- Stroma connective tissue element that surround and support parenchyma.
- Glands are usually surrounded by capsules.
- Capsules sends septa to divided the gland into smaller compartments; lobes and lobules within it.



devided into lobules ↓ within it we can see Parenchyma + secretory + Duct cells.

exocrine gland

→ Salivary = opens to Oral cavity.

Simple — one duct only that opens to the surface. it takes secretion to the designated location, Partiallar sites in the human body

Compound — ducts system → we have a smaller ducts when unite they become bigger ducts when they are combined they form bigger ducts till we reach the final bigger duct called "excretory duct" that carrics final form of secretion to it's location.

Classification Of Exocrine Glands

↳ Based on complexity of the ducts.

- Simple glands: glands with unbranched duct.
- Compound glands: the ducts have two or more branches.
- The secretory portions can be tubular or acinar (different in the nature of the secretory material).

SIMPLE Glands **(Ducts Do Not Branch)**

Class	Simple Tubular	Branched Tubular	Coiled Tubular	Acinar (or Alveolar)	Branched Acinar
					
Features	Elongated secretory portion; duct usually short or absent	Several long secretory parts joining to drain into 1 duct	Secretory portion is very long and coiled	Rounded, saclike secretory portion	Multiple saclike secretory parts entering the same duct
Examples	Mucous glands of colon; intestinal glands or crypts (of Lieberkühn)	Glands in the uterus and stomach	Sweat glands	Small mucous glands along the urethra	Sebaceous glands of the skin

COMPOUND Glands **(Ducts from Several Secretory Units Converge Into Larger Ducts)**

Class	Tubular	Acinar (Alveolar)	Tubuloacinar
			
Features	Several *elongated* coiled secretory units and their ducts converge to form larger ducts	Several *saclike* secretory units with small ducts converge at a larger duct	Ducts of both tubular and acinar secretory units converge at larger ducts
Examples	Submucosal mucous glands (of Brunner) in the duodenum	Exocrine pancreas	Salivary glands

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	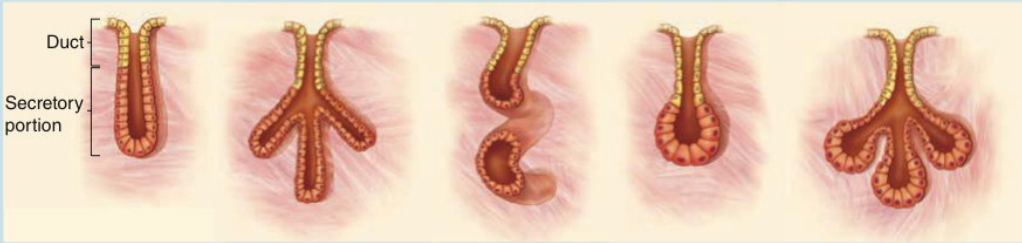				
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Note : all Tubular glands are related to GIT

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	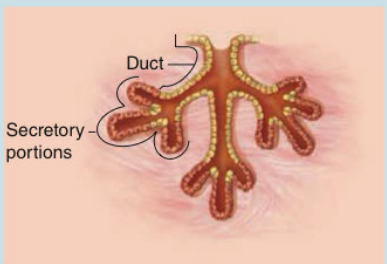		
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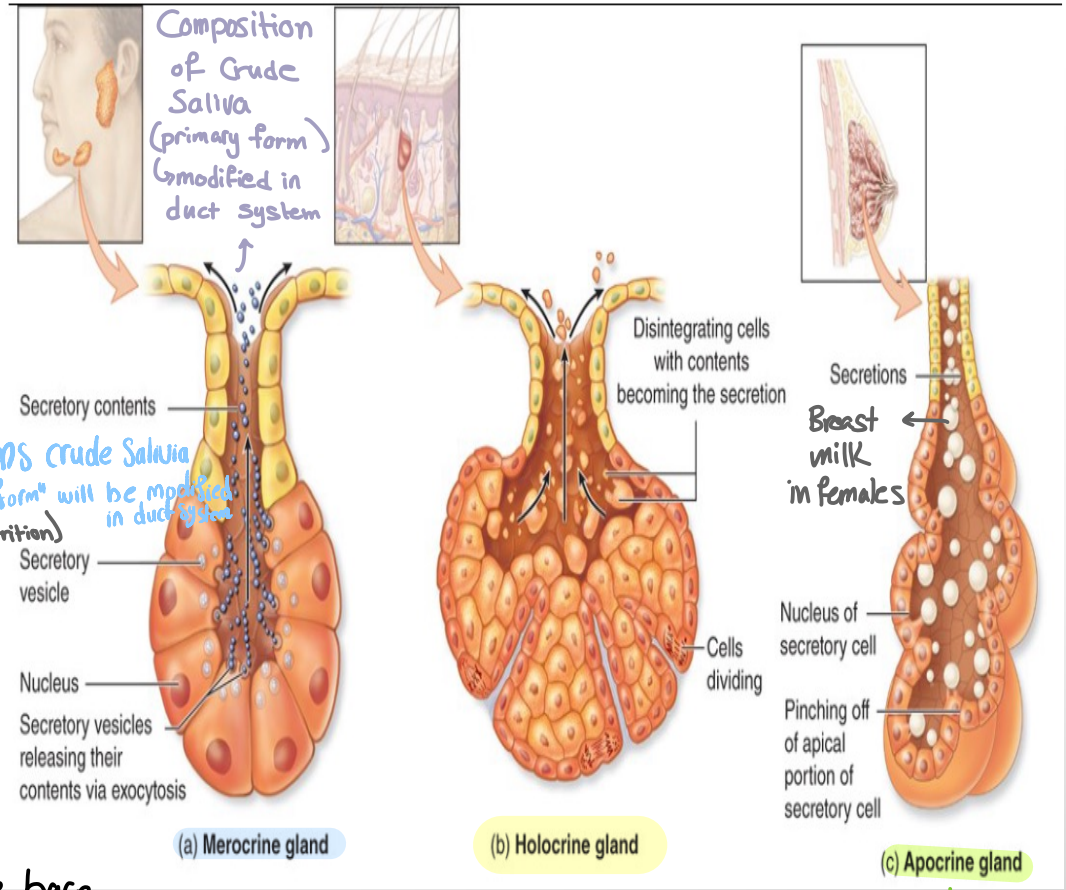
how does it release its secretory molecules / How it get out from secretory cells to the ducts then to exterior?

Types Of Secretion



- **Merocrine** (salivary): most common method of protein or glycoprotein secretion---exocytosis from membrane-bound vesicles or secretory granules. → contains crude Saliva "primary form" will be modified in duct system
  ↳ synthesize the required material (All we need as nutrition)
- **Apocrine** (mammary): product accumulates at the cells' apical ends, portions of which are then extruded to release the product together with small amounts of cytoplasm and cell membrane
  ↳ Associated with hair follicles at the base
- **Holocrine** (sebaceous): cells accumulate product continuously as they enlarge and undergo terminal differentiation, culminating in complete cell disruption which releases the product and cell debris into the gland's lumen.

usually seen in pregnant ladies → After they have a baby or way before that there's a poliferation of the glands + they acquire a secretory function

Sebaceous cells synthesize the sebum and the content of the sebum → it becomes bigger and bigger till they reach their final maturation → Terminal differentiation

›› MEDICAL APPLICATION

The holocrine sebaceous glands are the primary structure involved in the common form of **acne**, acne vulgaris. Excessive holocrine secretion of sebum and keratin triggered by the surge of the steroid hormone testosterone that occurs in both genders at puberty frequently leads to blocked ducts within the gland. Activity of the normal commensal skin bacterium *Propionibacterium acnes* within the blocked duct commonly produces localized inflammation.

Nature Of Secretory Products.

- Exocrine glands secretion is categorized based on the nature of their secretory products into serous or mucous. → it gives distinct staining properties to the cell
- **Serous** cells synthesize proteins (mostly not glycosylated; digestive enzymes)--- well-developed RER and Golgi complexes and are filled apically with secretory granules in different stages of maturation---stain intensely with basophilic or acidophilic stains. → more watery nature

  e.g → Pancreas and parotid salivary glands.
- **Mucous** cells filled apically with secretory granules contain heavily glycosylated proteins called mucins (when released from the cell---become hydrated and form a layer of mucus)---hydrophilic mucins are usually washed from cells during routine histological preparations, causing the secretory granules to stain poorly. → thicker nature (mucous rich).

Nature Of Secretory Products

- Some salivary glands are mixed **seromucous** glands, having both serous acini and mucous tubules → They produce the watery and mucus(thick) secretion

  digestive enzymes + watery mucus

- Myoepithelial cells: contractile at the basal ends of the secretory cells. Long processes of these cells embrace an acinus. Are rich in actin and myosin filament--- strong contractions serve to propel secretory products from acini into the duct system.

  → from the name = they have a muscle element in them = Actin + myosin filaments.

Another element

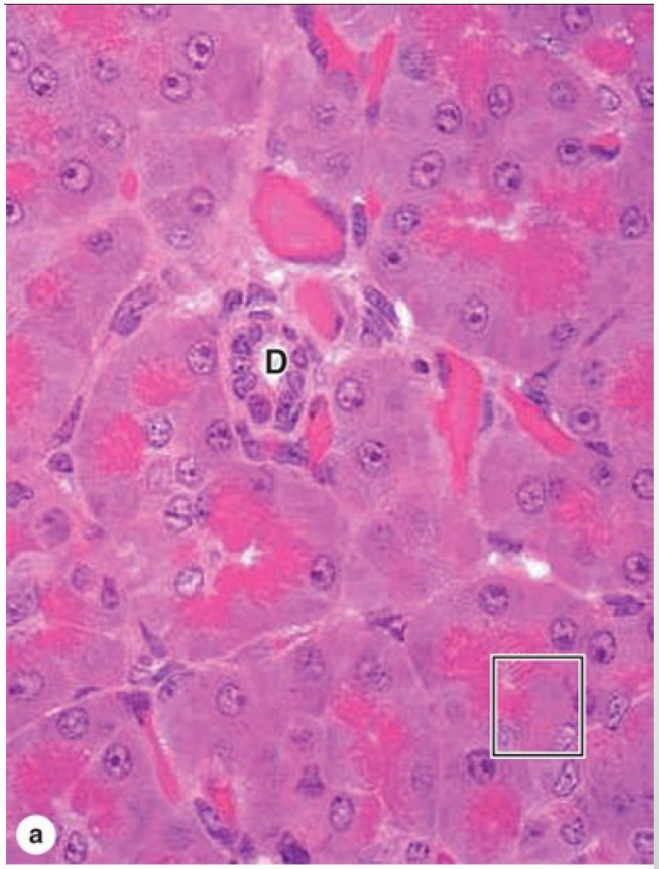
Exocrine glands

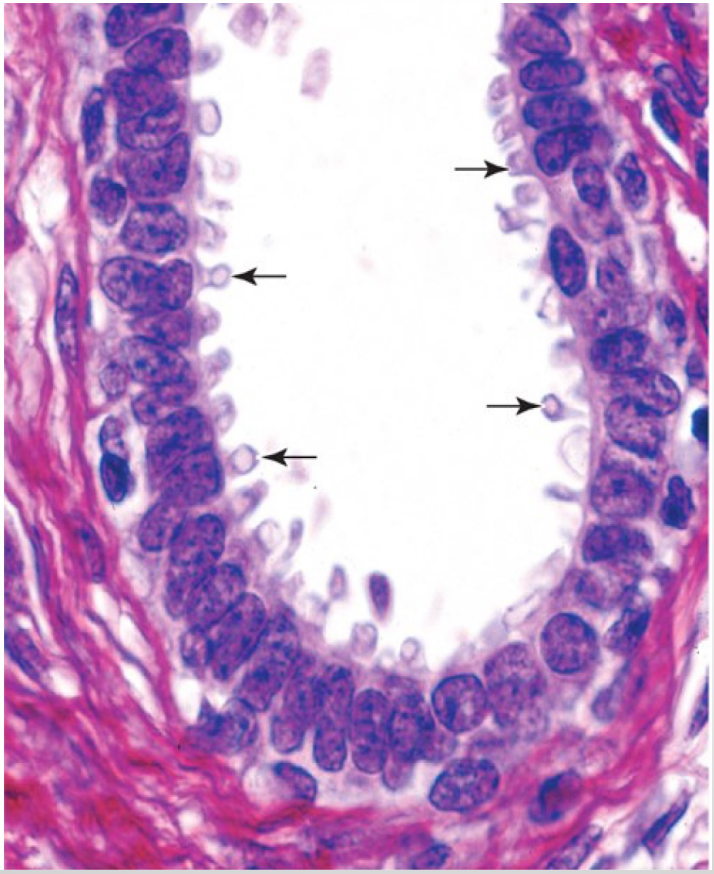
examples → Sweat, lachrymal, Salivary, mammary glands

Merocrine

Apocrine

Holocrine



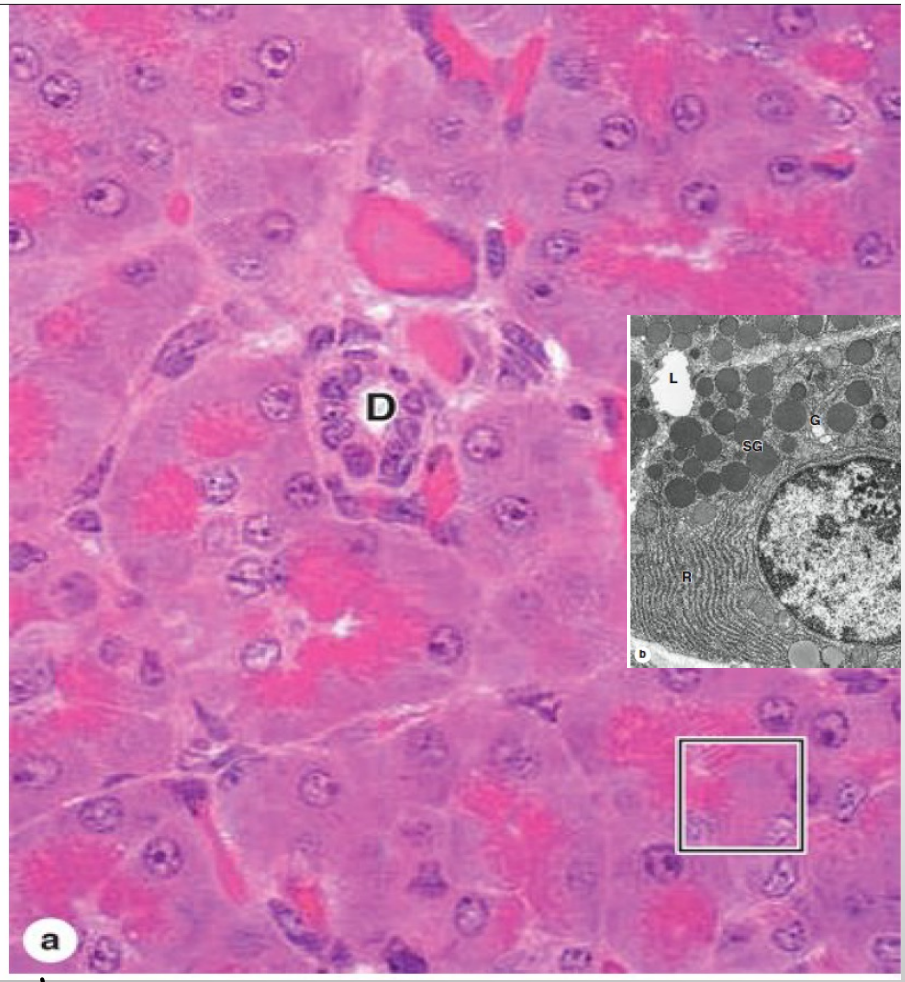


watery ↩

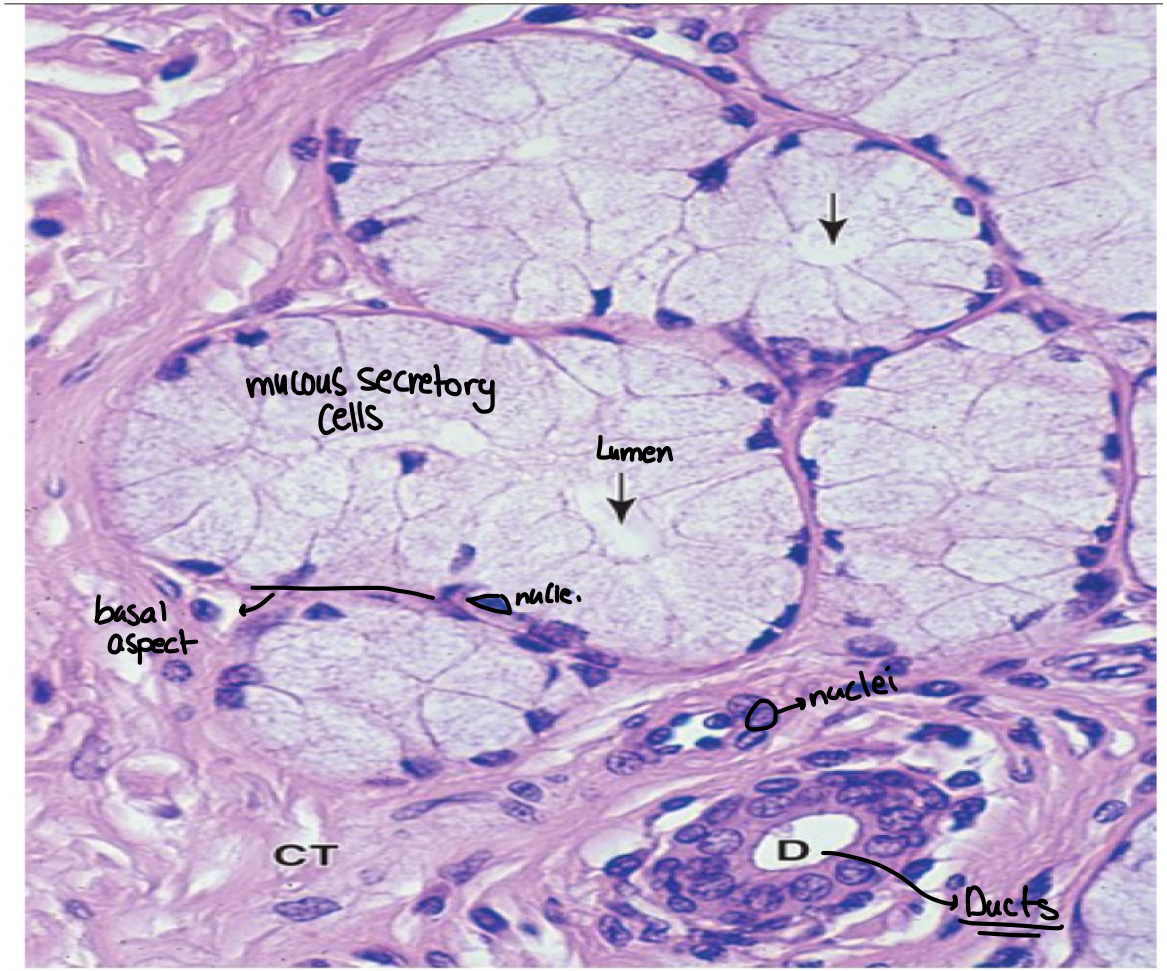
Serous and Mucous Secretory Cells

↳ thick

Mucous cell

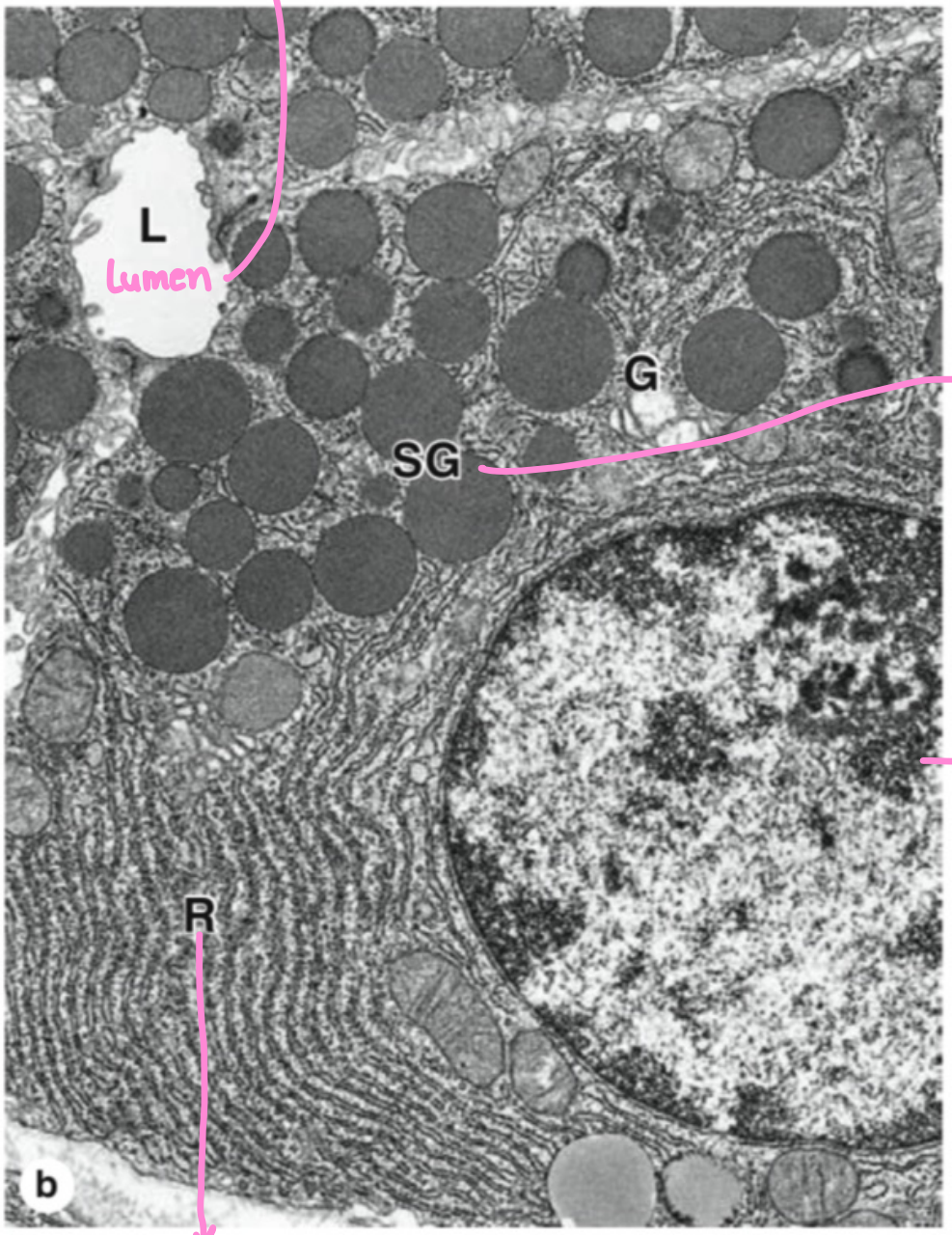


↳ enlarged → by using diff. microscope to see finer details.



→ the whitish or washed out appearance is due to the hydrophilic nature of the glycosylated protein.

Lumen → of secretory portion where granules will open and let go of their content inside the lumen that will be carried away.



Serous Cell

granules → that cells have stored their secretion in

nucleus

RER → looks like threads running throughout this region

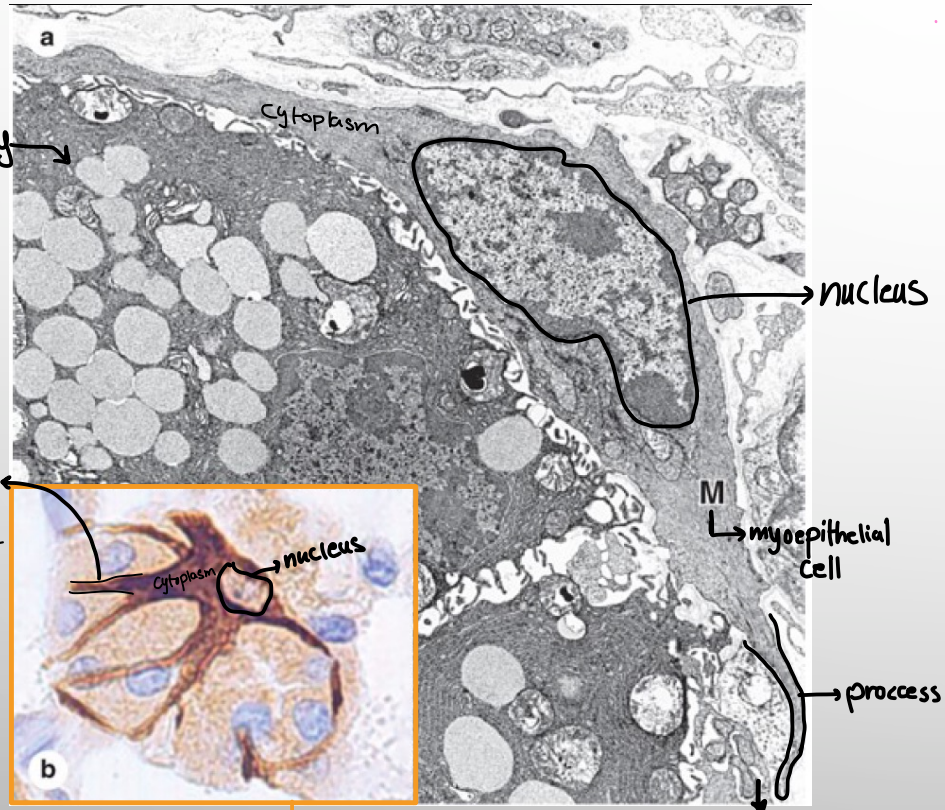
Myoepithelial Cells

- In exocrine glands only

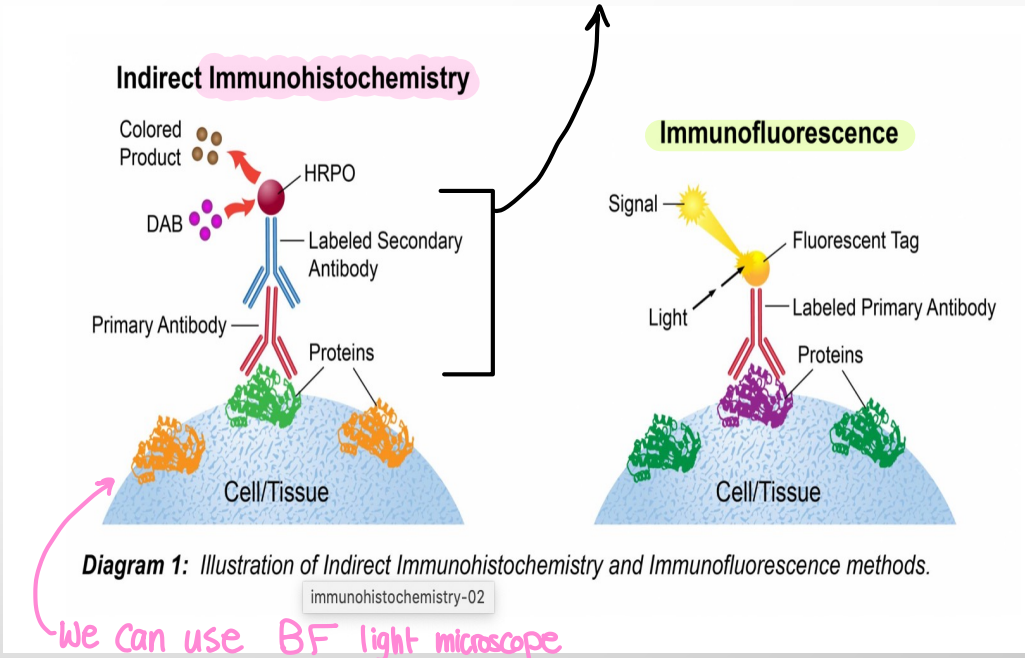
Recall ↴

- Antigen-Antibody Concept:

→ Targeting a specific protein in the cells → the primary anti-body will bind to the antigen and we always use a secondary anti-body for the amplification of the signal.



Acquired by immunohistochemistry — How do we Know?



We can use BF light microscope (The Background is light)

We do see the outline of the cell rather than the neighboring cells which we recognize by their nuclei

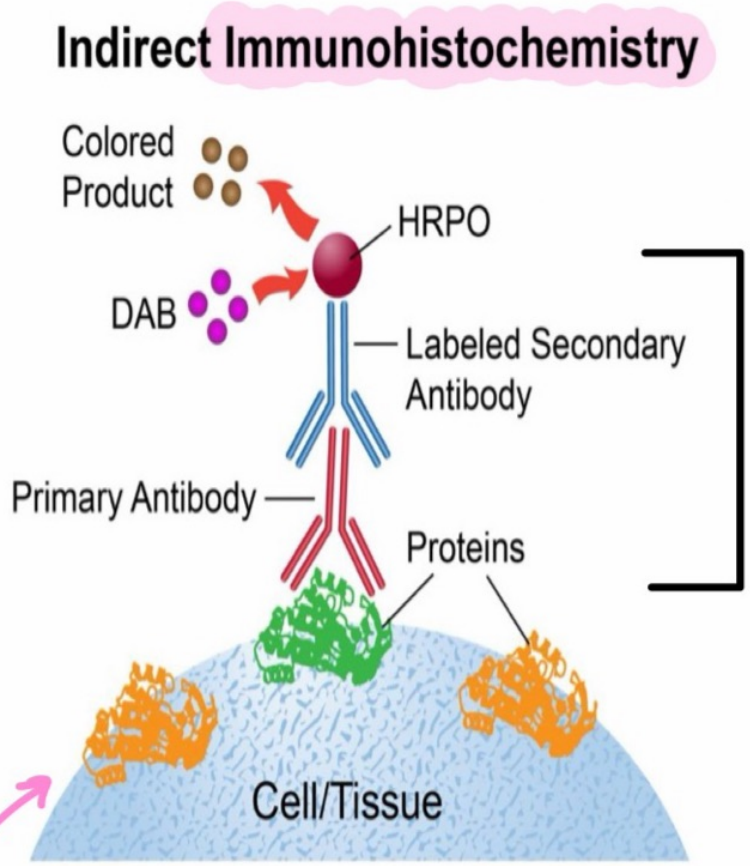
• the difference between 🟢 & 🟣

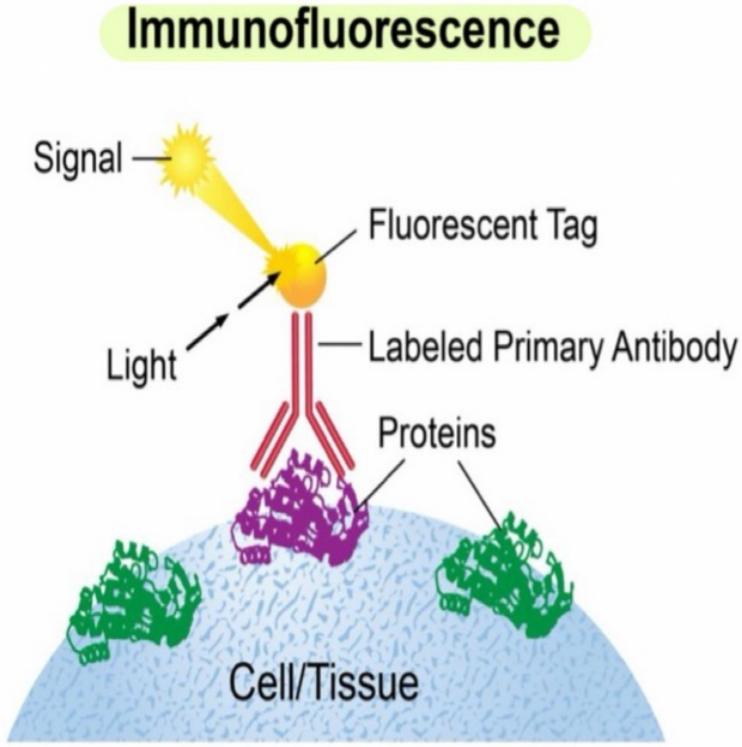
Secondary Anti-Body
Carries an enzyme

if you add a substrate,
enzyme will produce a diff color

Secondary Anti-body
Carries flourophore

excited by a specific wave length
then it emits longer wave length the
we see it as a signal in any color





Overall view of glands

Epithelial Secretion/Glands

- The major function in many epithelial cells is synthesis and secretion of specialized products; organs composed primarily of such epithelia are called **glands**.
- **Exocrine glands** have epithelial ducts carrying secretions to specific sites; the ducts of **simple glands** are unbranched and those of **compound glands** are branched.
- The secretory portions of exocrine glands may form round, saclike **acini** (also called **alveoli**) or elongated **tubules**; both types of secretory units may themselves branch.
- **Endocrine glands** lack ducts; secreted substances are hormones carried throughout the body by the interstitial fluid and blood, with specificity produced by the hormone receptors of target cells.
- Glands have three basic secretory mechanisms: **merocrine**, which uses exocytosis; **holocrine**, in which terminally differentiated cells filled with lipid product are released; and **apocrine**, in which apical, product-filled areas of cells are extruded.
- Exocrine glands producing mucus, or similar individual cells called **goblet cells**, are called **mucous glands**; oligosaccharide components of mucus stain poorly with routine dyes but stain well with PAS stain.
- Exocrine glands producing largely enzymes (proteins) are called **serous glands** and stain darkly with H&E due to the cells' content of RER and secretory granules.

Book questions

6. The release of lipid droplets from cells is which type of secretion?
   a. Merocrine
   b. Serous
   c. Apocrine
   d. Mucous
   e. Holocrine

7. Exocrine glands in which the acini all produce a secretion of heavily glycosylated, hydrophilic proteins are an example of which type of gland?
   a. Serous gland
   b. Mixed gland
   c. Mucous gland
   d. Tubuloacinar gland
   e. Simple gland

Past Question

24. The products of endocrine glands are called:

A. Enzymes
B. Hormones
C. Antibodies
D. None of above

Test bank

Q48) Derived by modification of epithelium into secretory structures

A)Cartilages

B)Merocrine

C)Goblet

D)Glands

Q49)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

Q50)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

Q51)The mammary glands secrete

A)Proteins ✓

B)Lipids ✓

C)Complexes of Carbohydrates and Proteins ✓

D)All of the above are correct

Q52)Most of our glands are MULTICELLULAR GLANDS such as

A)Salivary glands ✓

B)Goblet glands ✗ unicellular

C)Thyroid glands ✓

D)A and C are correct

Q53)The products of endocrine glands are called

A)Enzymes

B)Hormones

C)Antibodies

D)None of the above

Q54)Membrane bounded vesicles can be found in

A)Apocrine secretion

b)Merocrine secretion

c)Salivary glands

d)b and C are correct

Q58)Branched Tubular glands can be classified as

A)Simple Glands

B)Compound glands

C)Multicellular glands

D)Exocrine glands

E)All of the above are correct except B

Q59)an Example of branched acinar glands:

A)Glands of uterus

B)Glands of stomach

C)Intestinal glands

D)Sebaceous glands of the skin

E)A and B are correct

Q60)Compound Alveolar glands have

A)Several elongated secretory units

B)Several saclike secretory units

C)Several coiled secretory units

D)A and C are correct

E)None of the above

Q61)The goblet cells have in their apical region

A)Secretory granules

B)Nucleus

C)RER

D)Mucin

E)A and D are correct

cells have heavily glycosylated granules containing mucins

Q62)Sweat glands

A)Have high synthesizing activity

B)Have low synthesizing activity

C)Have long and coiled secretory portions

D)A and C are correct

E)B and C are correct

Q63) The release of lipid droplets from cells is which type of secretion:

A. Merocrine

B. Serous

C. Apocrine

D. Mucous

E. Holocrine

Q64) Which of the following pairs is mismatched:

A. Simple tubular gland/mucous glands of colon, intestinal glands or crypts (of Lieberkühn)

B. Simple branched tubular gland/sweat glands → coiled

C. Simple coiled tubular/glands in the uterus and stomach → branched tubular

D. Sweat glands/low synthesizing activity

E. b and c

Q65) All of the following are secreted by glandular epithelial except:

a. Lipids

B. Proteins

C. Urea ? ✗

D. Complex of carbohydrates and protein

Q66) 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

Q67) 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 (apically) of the cell

C. They secrete lubricating mucin

D. Highly polarized

E. They are classified as endocrine (exocrine) glands

Q68) Choose the false statement of the following regarding to glands classification:

A. Exocrine products are released directly or through a duct onto a surface

B. Thyroid (Produces hormones) gland is an example for exocrine glands

C. Endocrine release hormones into the blood stream

D. Exocrine glands can be unicellular and multicellular

E. B+D

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سبحانك

إني كنت من الظالمين