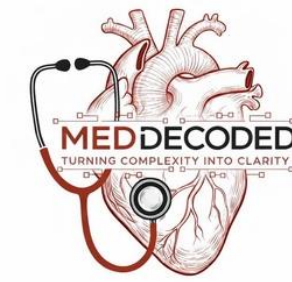


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



HISTOLOGY

MID | Lecture 8

Glands

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ وَنَعَلَهُمَّا تَوْسُوسًا بِهِ نَفْسُهُ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

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Secretory Epithelia s Glands

- 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**.

This is best seen in the stomach, stomach synthesizes and releases materials like HCL and enzymes such as pepsinogen.

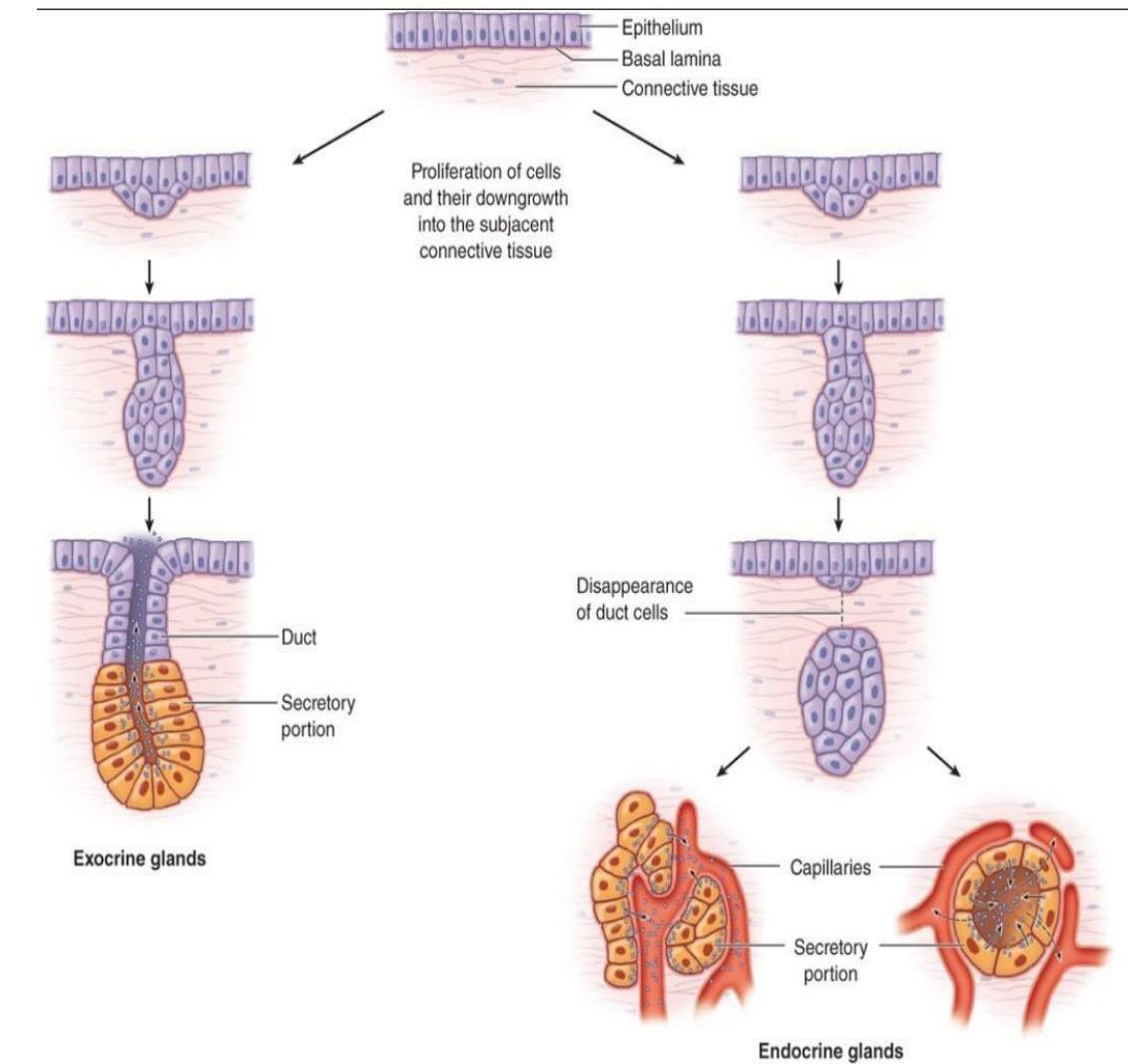
In addition, glands are originally from epithelium tissue.

Secretory Epithelial Glands

- Synthesize and release of substances; proteins, lipids, carbs, and proteins. every gland or secretory cell could make one of each.
- In special locations such as the mammary gland in the female they combine all or three of them .
- The classification of glands based on the presence of a system that carries the secretion which glands produce
- Types based on the presence of duct system:
 - A. Exocrine glands (duct) they have duct system that carry their secretion such as salivary gland , lacrimal gland secrete an important part of tears then it delivers it to the eye.
 - B. Endocrine glands (no duct) they rely on the blood stream and the blood vessels that reach them to pick up the hormones to be redistributed to the target tissue
- Types based on number of cells: another classification for glands:
 - A. Unicellular Such as the goblet cells
 - C. Multicellular

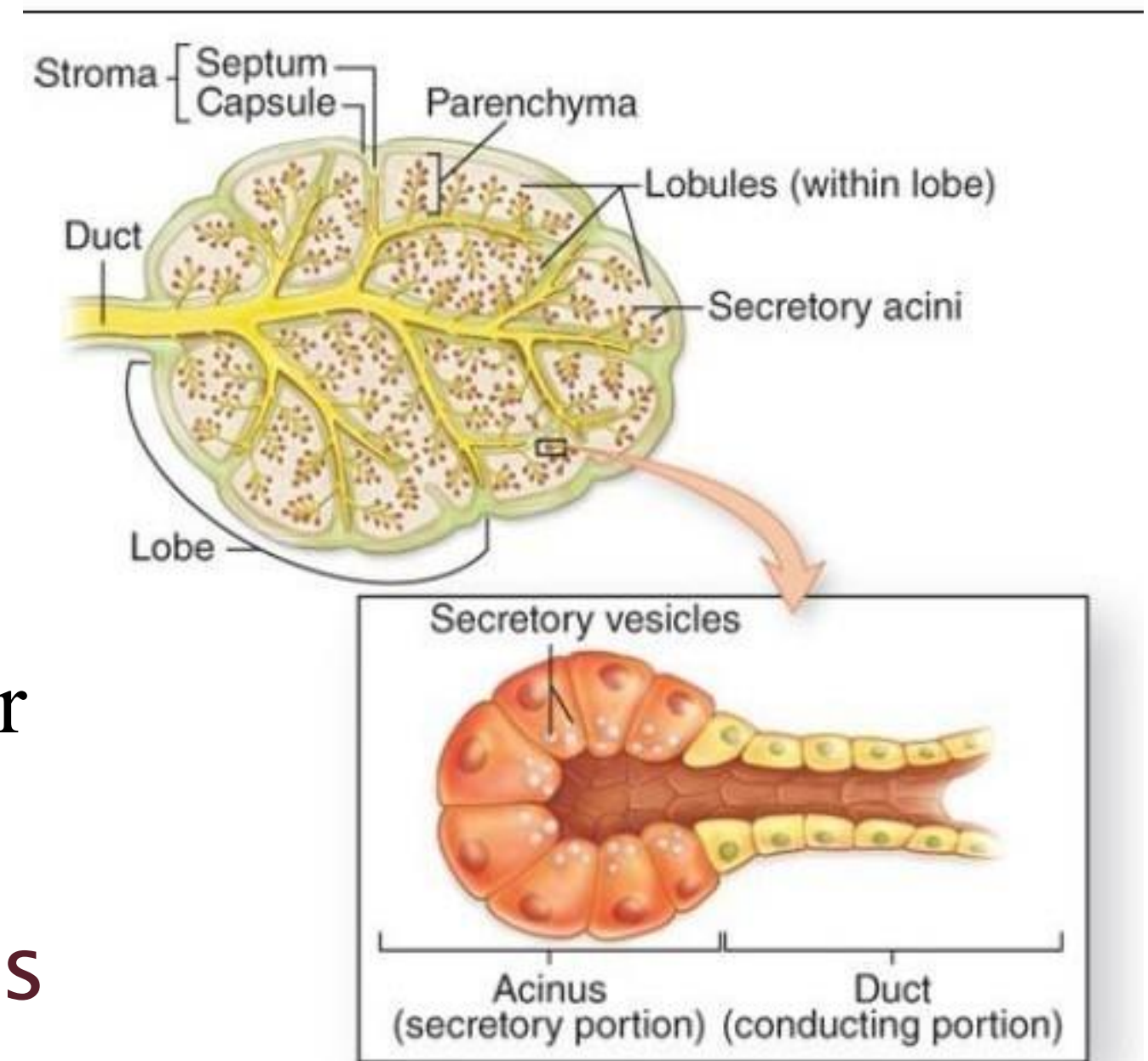
Glands' Formation

- 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).
- Those events happen in embryo life during embryo genesis, the epithelium is running on the surface giving that we have a specific pathway that has been upregulated in this particular region this will signal the cells to have more downward growth that means epithelium will grow towards the underlying connective tissue
- The cells are proliferating means thy are multiplying in the same time they are differentiating
- Differentiating= become a new cell different than the parent cell



Gland Structure

- Glands are organized into secretory part and ducts.
- 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.
- Glands are not just secretory cells and duct cells organized on their own, there is also the stroma that guides and protects the parenchyma and also creates the septum.



Exocrine gland

Functions of Parenchyma in Glands

• Secretion

- In **exocrine glands** (like salivary glands, pancreas, sweat glands), parenchymal cells produce and release enzymes, saliva, mucus, or sweat.
- In **endocrine glands** (like thyroid, adrenal, pituitary), parenchymal cells synthesize and secrete hormones directly into the bloodstream.

• Storage

- Some glands store their secretions temporarily in vesicles or follicles (e.g., thyroid follicles store thyroglobulin before releasing thyroid hormones).

• Regulation

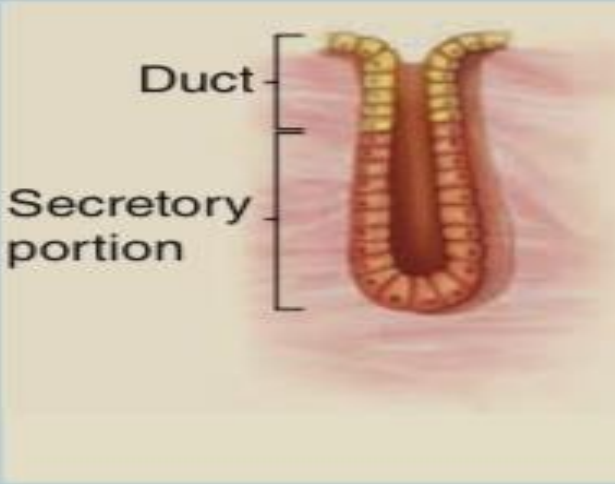


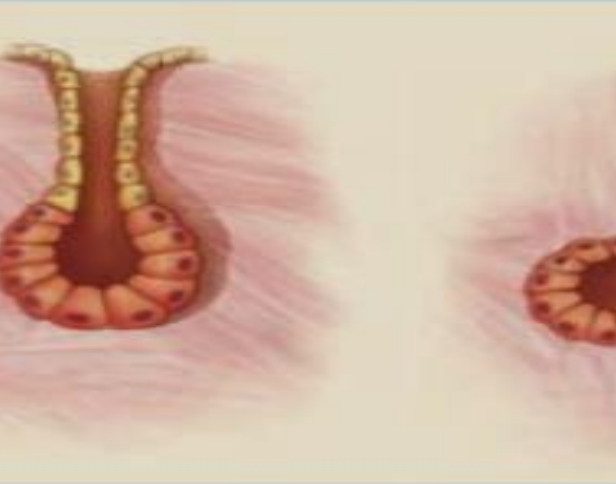

- Parenchymal cells respond to signals (nervous or hormonal) to adjust secretion rates depending on the body's needs.

• Metabolic activity

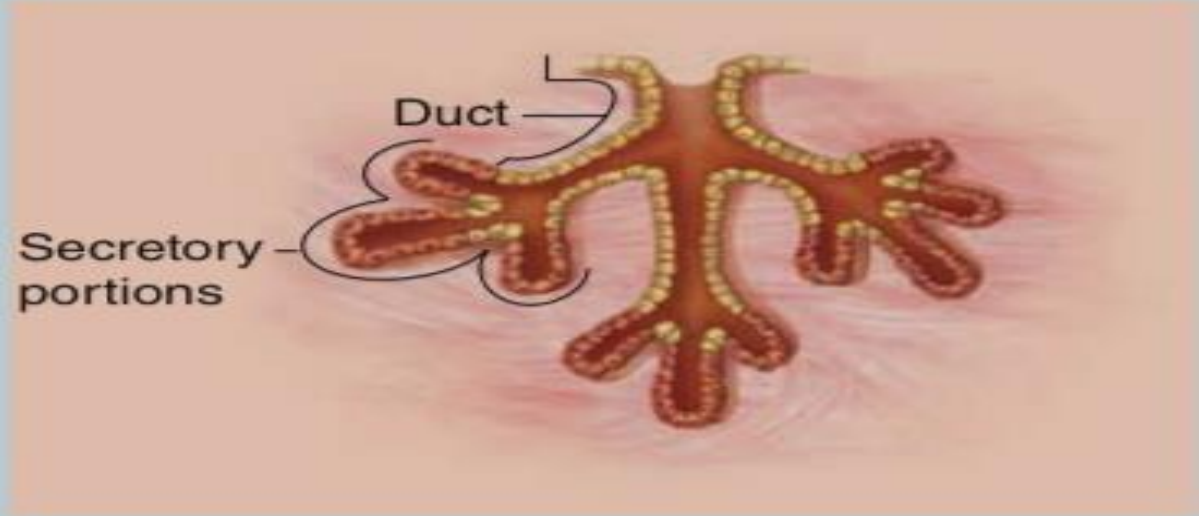


- In glands like the liver (which is both a gland and metabolic organ), hepatocytes (parenchymal cells) carry out detoxification, metabolism, and bile secretion.

Classification Of Exocrine Glands

- This classification depend on the 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).

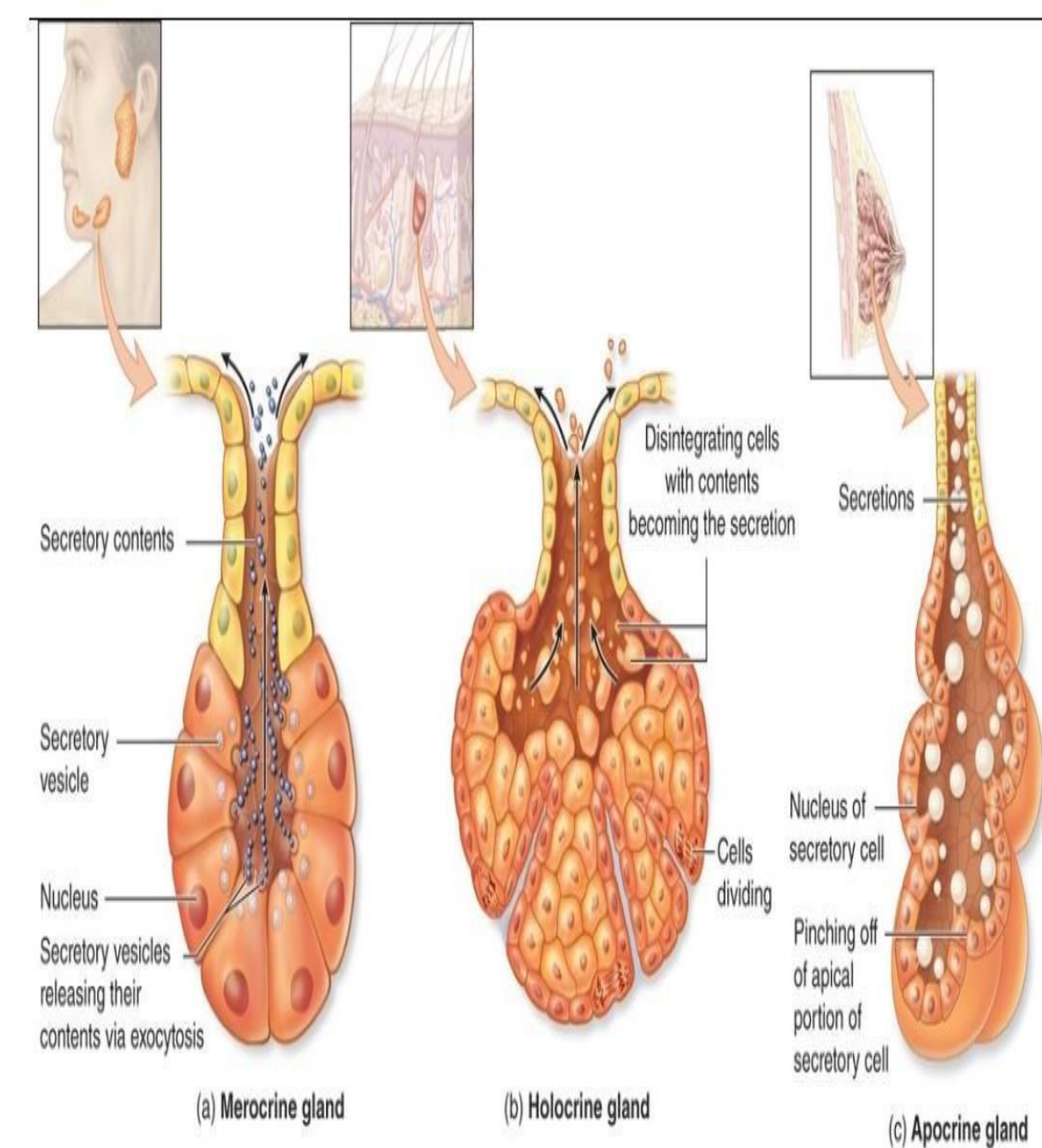
Class	Simple Tubular	Branched Tubular	Coiled Tubular	Acinar (or Alveolar)	Branched Acinar
					
Features	Elongated secretory portion; duct usually short or absent	Several long secretory parts joining to drain into 1 duct	Secretory portion is very long and coiled	Rounded, saclike secretory portion	Multiple 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 <i>elongated</i> coiled secretory units and their ducts converge to form larger ducts	Several <i>saclike</i> 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

Types Of Secretion

- **Merocrine** (salivary): most common method of protein or glycoprotein secretion---exocytosis from membrane-bound vesicles or secretory granules. These granules leave the apical surface and they represent crude (primary) saliva which will be modified in the duct system.
- **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
- **Holocrine** (sebaceous) (associated with hair follicles, they synthesize sebum and its content): 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.



Nature Of Secretory Products.

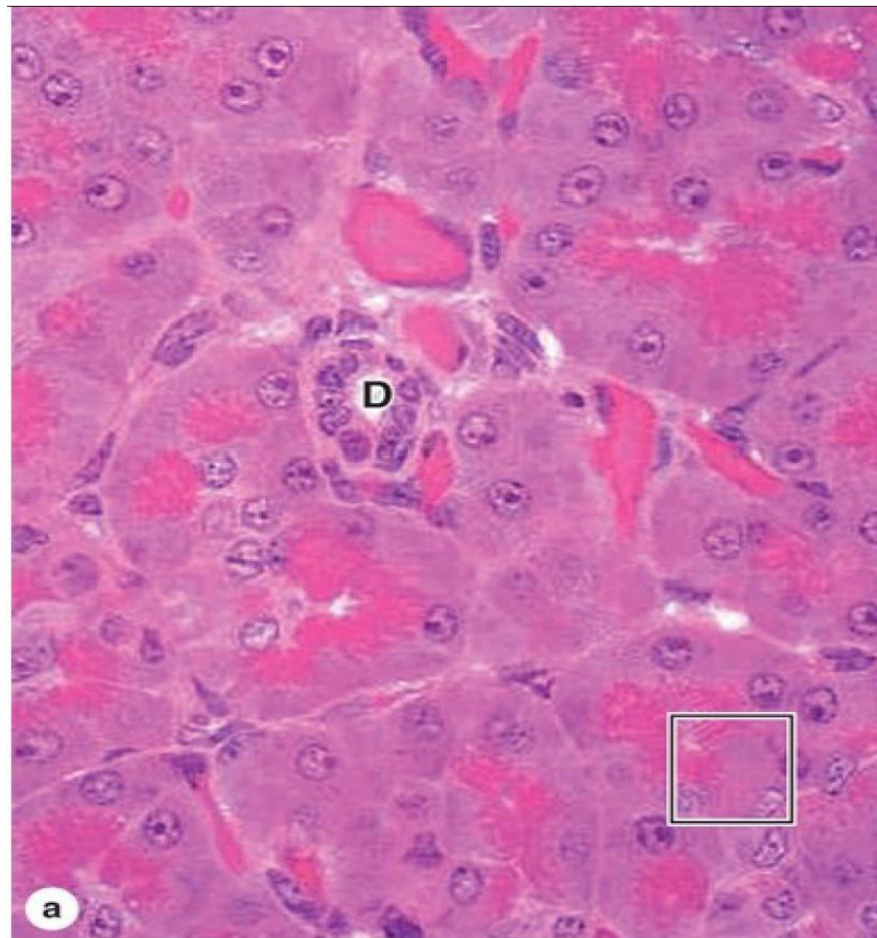
- Exocrine glands secretion is categorized based on the nature of their secretory products into serous or mucous.
- **Serous (watery secretion)** cells synthesize proteins (mostly not glycosylated; digestive enzymes)--- well-developed RER and Golgi complexes and are filled apically with secretory granules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

Nature Of Secretory Products

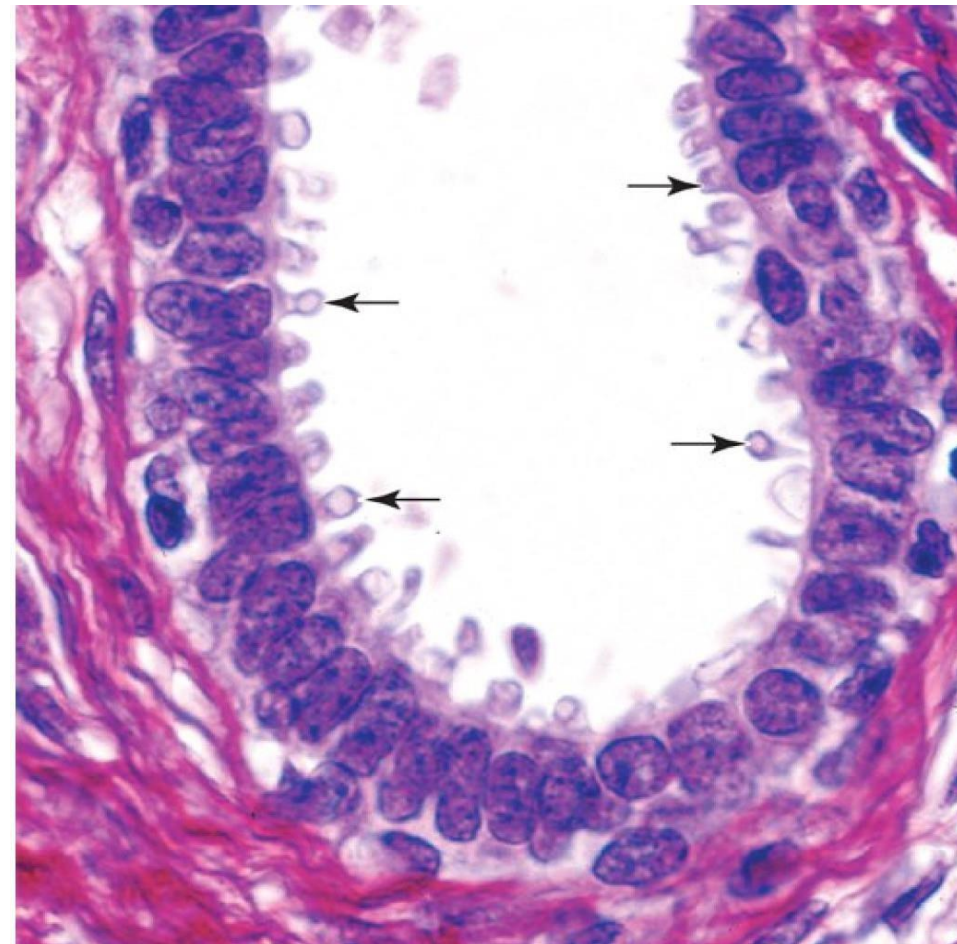
- Some salivary glands are mixed **seromucous** glands, having both serous acini and mucous tubules
- Myoepithelial cells: contractile at the basal ends of the secretory cells. Long processes of these cells embrace an acinus. Are rich in actin and myosin filament (**muscle element**)--- strong contractions serve to propel secretory products from acini into the duct system.

Different stains are used for different types of glands in terms of the mode of secretion. Holocrine image: Younger cells will find their way to the surface, finding their way means they are synthesizing and accumulating the lipids which will finally be the whole content of the cell, eventually these fully differentiated cells will be exocytosed as a whole(whole cell with its content)

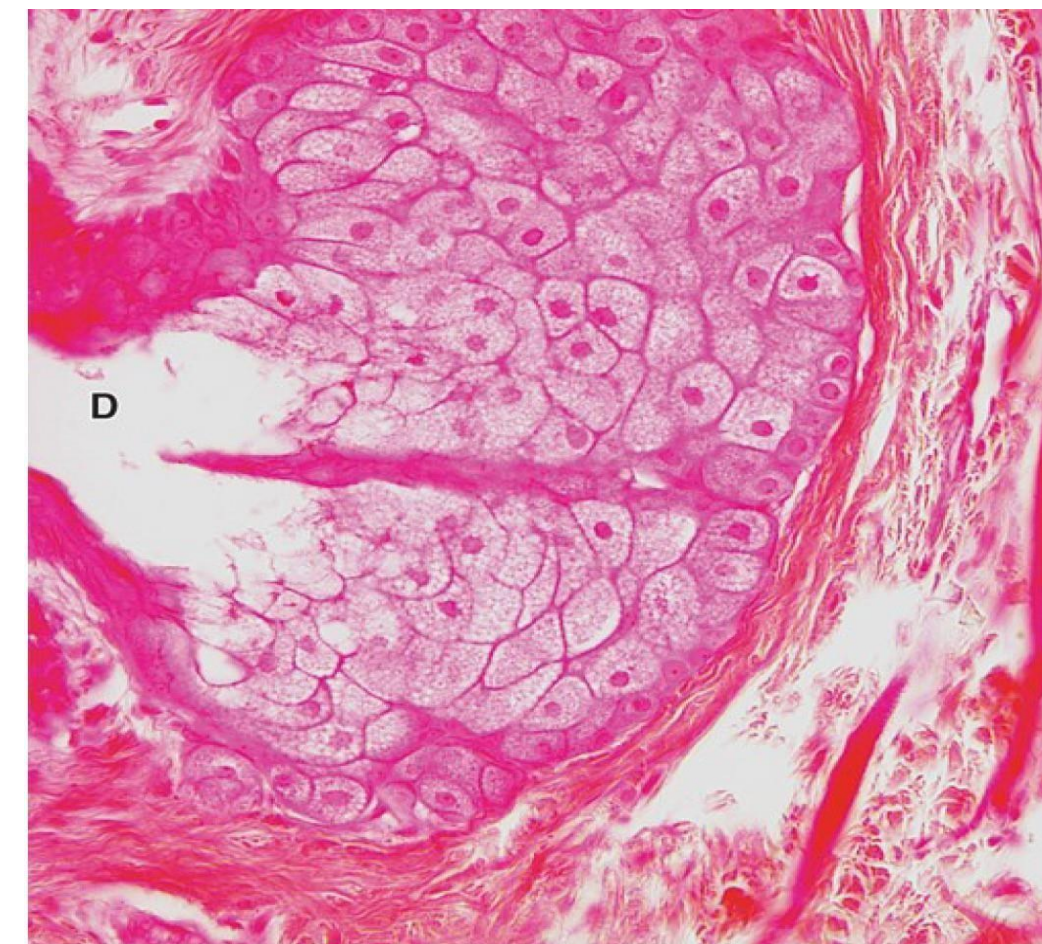
Merocrine



Apocrine:

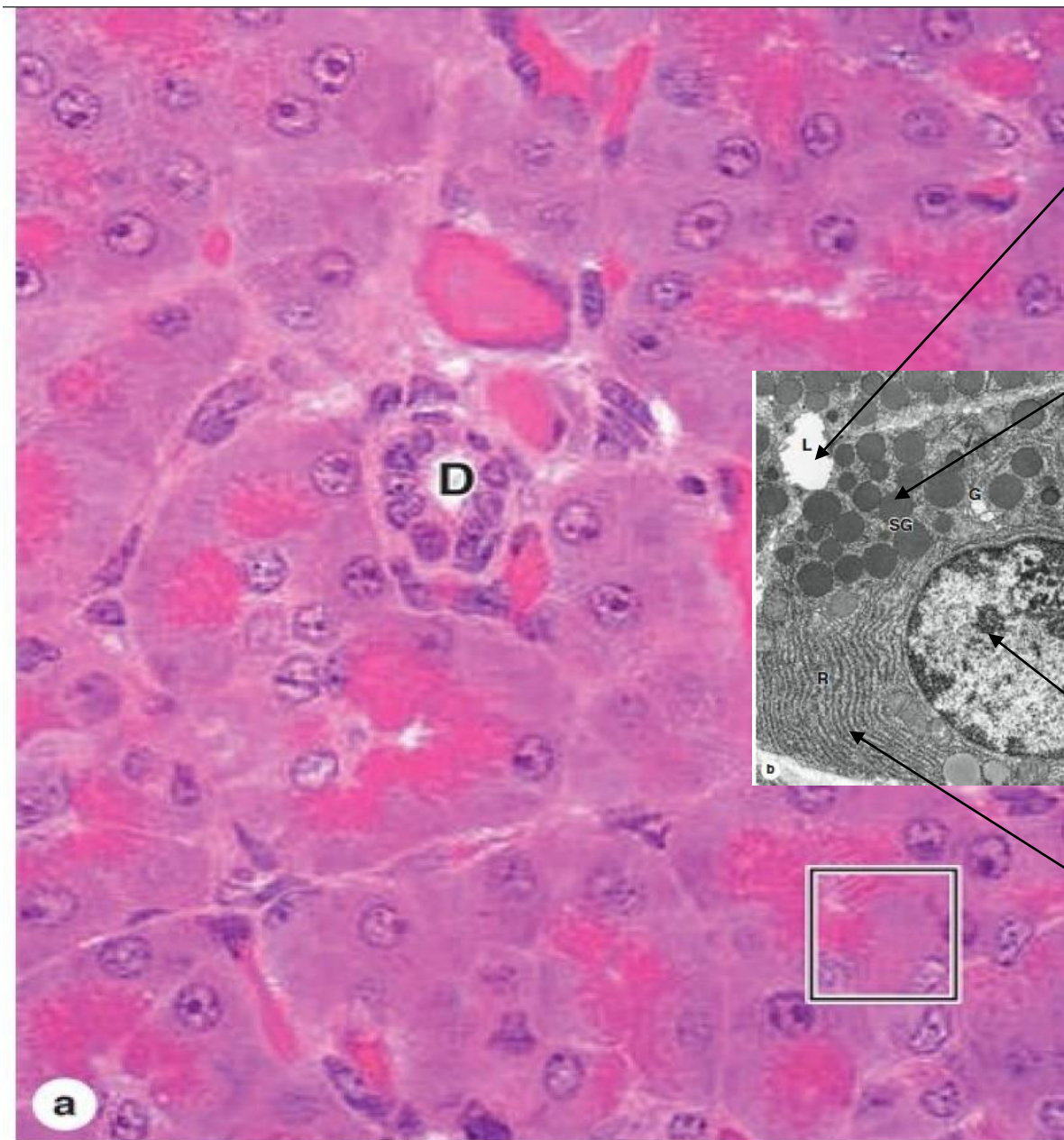


Holocrine



Serous and Mucous Secretory Cells

Serous secretory cells



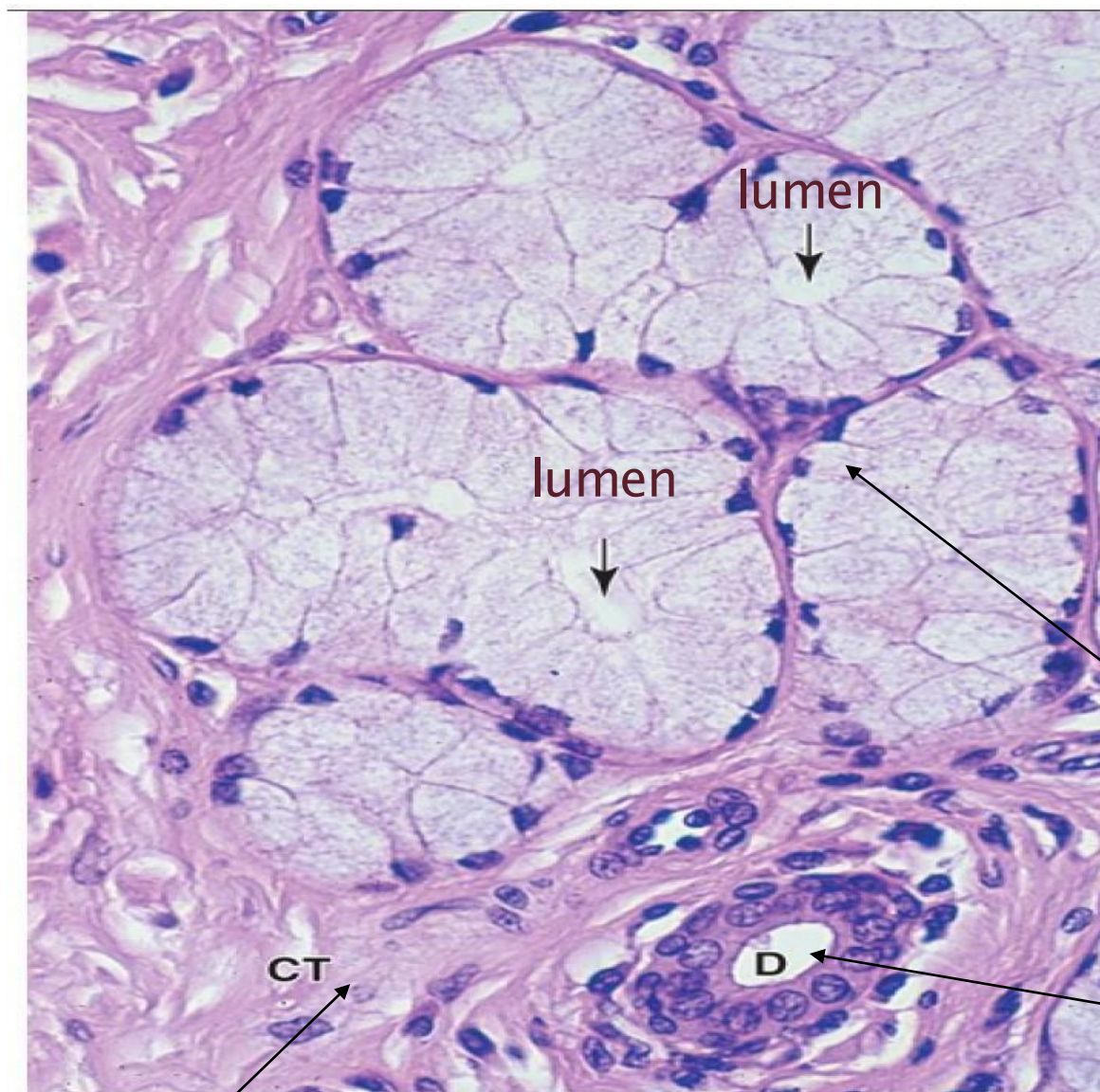
Lumen that the granules will let their content in

Granules that the cell stored for secretion

nucleus

RER

Mucous secretory cells



Their whitish or washed out appearance is due to the hydrophilic nature of the glycosylated proteins. Once their secretion reaches the lumen, it will be carried through the ducts from smaller to bigger ones.

Flattened basal nuclei

duct

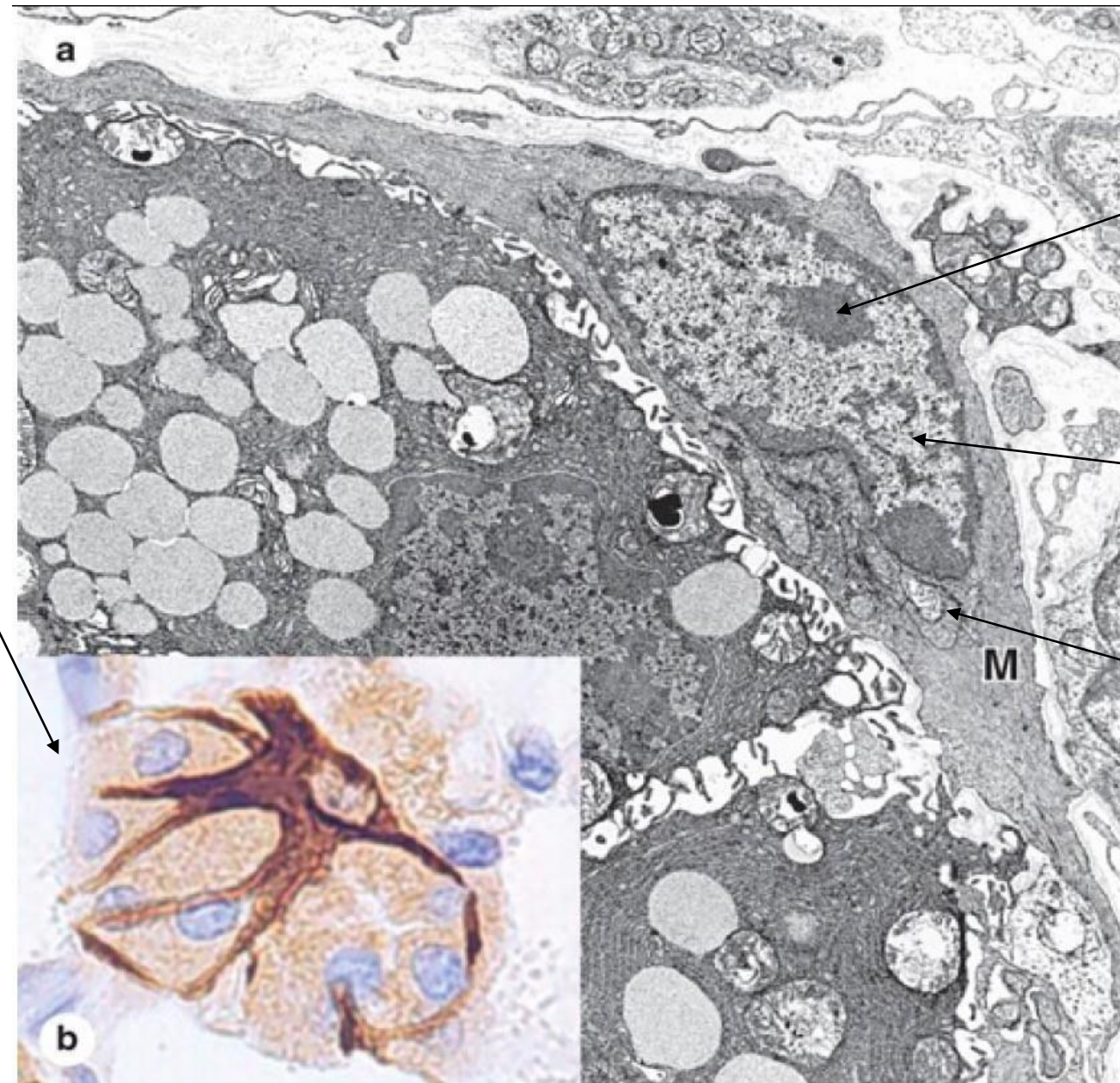
Connective tissue

Myoepithelial Cells

- In exocrine glands only

Acquired through immunohistochemistry. The processes surround the secretory cells and when they contract they squeeze out the product of the cells to enter ducts and continue its way to bigger ducts.

TEM image



Nucleus of myoepithelial cell

Cytoplasm of myoepithelial cell

Process of myoepithelial cell

Differences between Immunohistochemistry and Immunofluorescence.

We can use a bright field light microscope.

The primary antibody binds to a specific protein(antigen) and a secondary antibody(to amplify the signal) carries an enzyme and when a substrate is added, a reaction occurs and color appears.

We use a fluorescence microscope.

The antibody carries a fluorophore which when it is excited with a specific wavelength will emit a longer wavelength which we see and it could be any color.

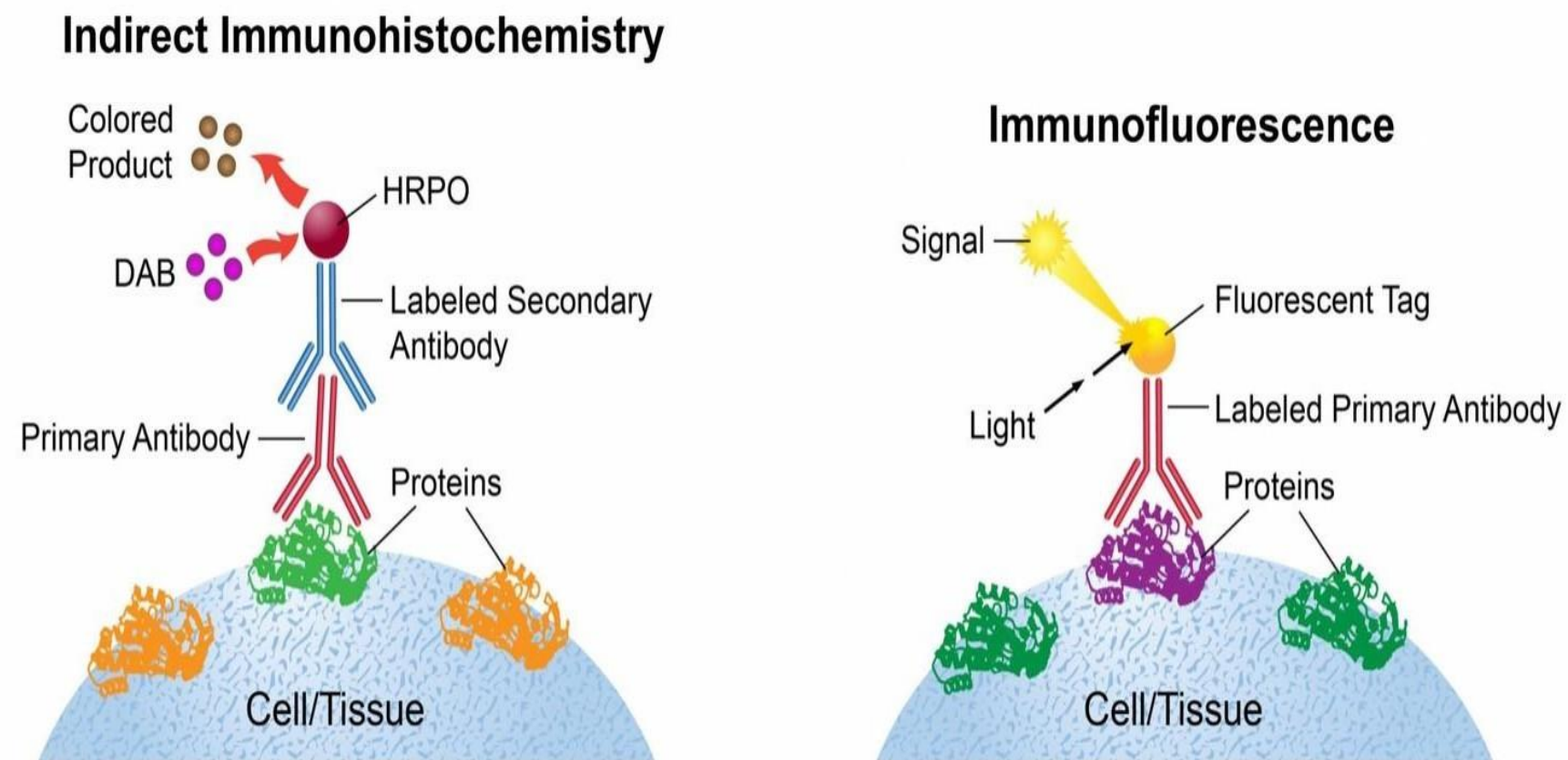


Diagram 1: Illustration of Indirect Immunohistochemistry and Immunofluorescence methods.

Which of the following statements is incorrect:

A. Endocrine glands have no ducts.

B. The stroma in glands is formed of connective tissue.

C. Both serous and mucous exocrine glands stain intensely with basophilic or acidophilus stains.

D. Glands are originally from epithelium tissue.

Answer : C

Which secretion method is the most common for protein and glycoprotein secretion:

A. Merocrine

B. Apocrine.

C. Holocrine

D. A & B .

Answer : A

Which type of cells contractile at the basal ends of secretory cells:

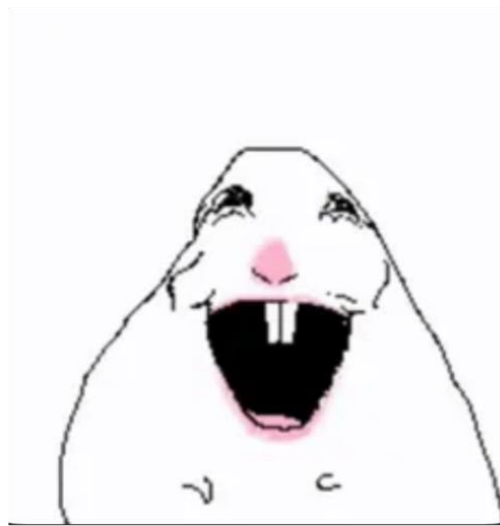
A. Goblet cells

B. Myoepithelial cells.

C. Serous cells

D. mucous cells.

Answer : B



Additional Resources:

رسالة من الفريق العلمي:

اللهم يسر علينا أمورنا، وافتح علينا فتوح العارفين، وانفعنا بما علمتنا، وعلمنا ما ينفعنا في الدنيا والآخرة.



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Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			