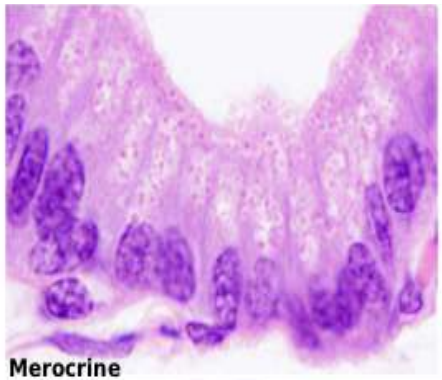
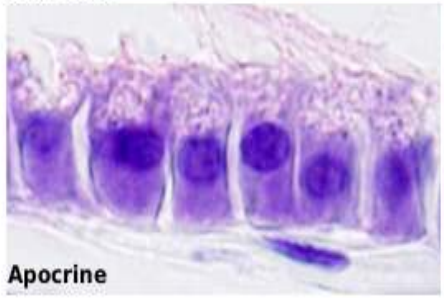
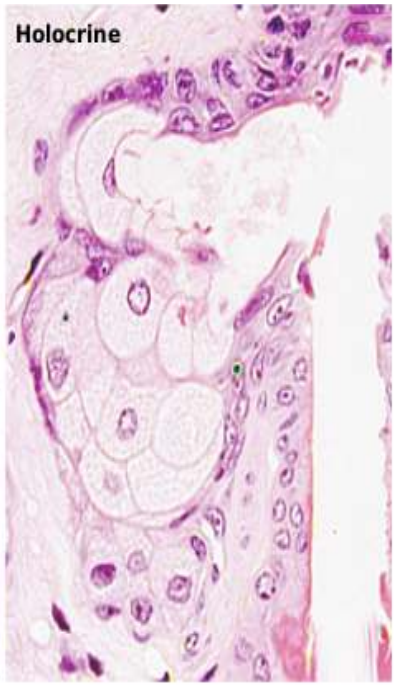
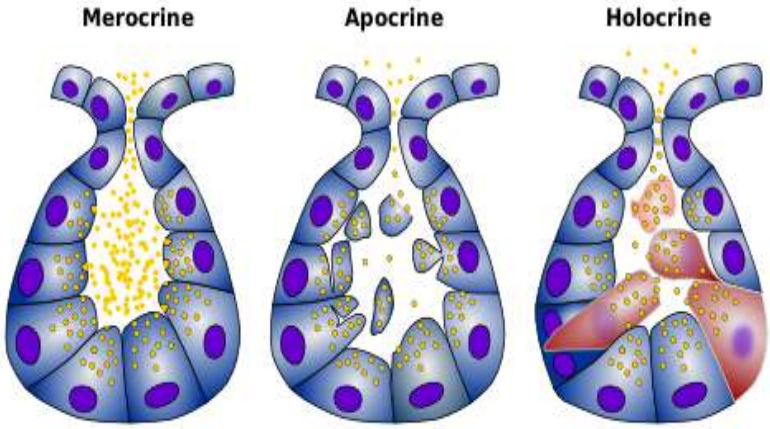


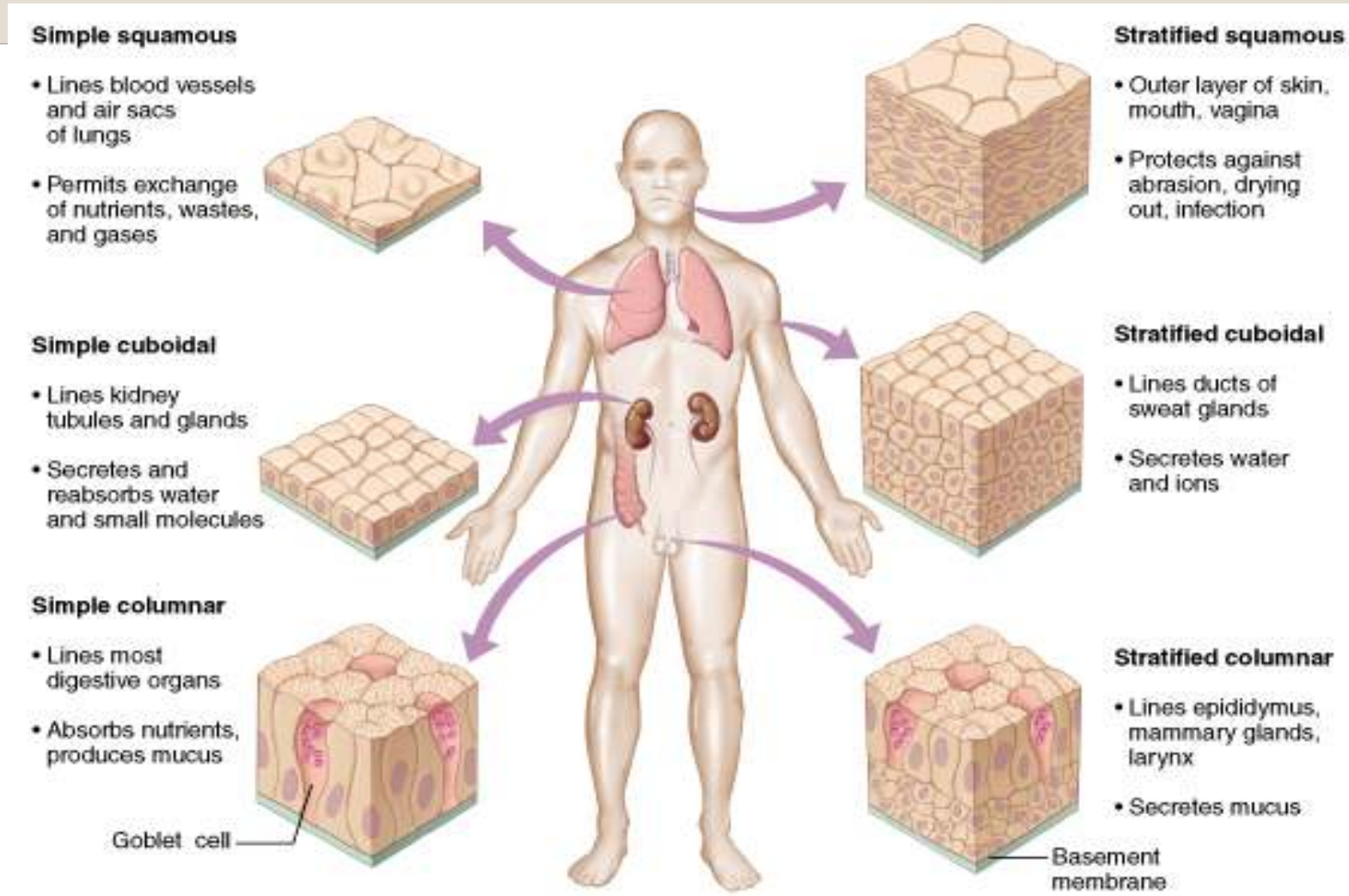




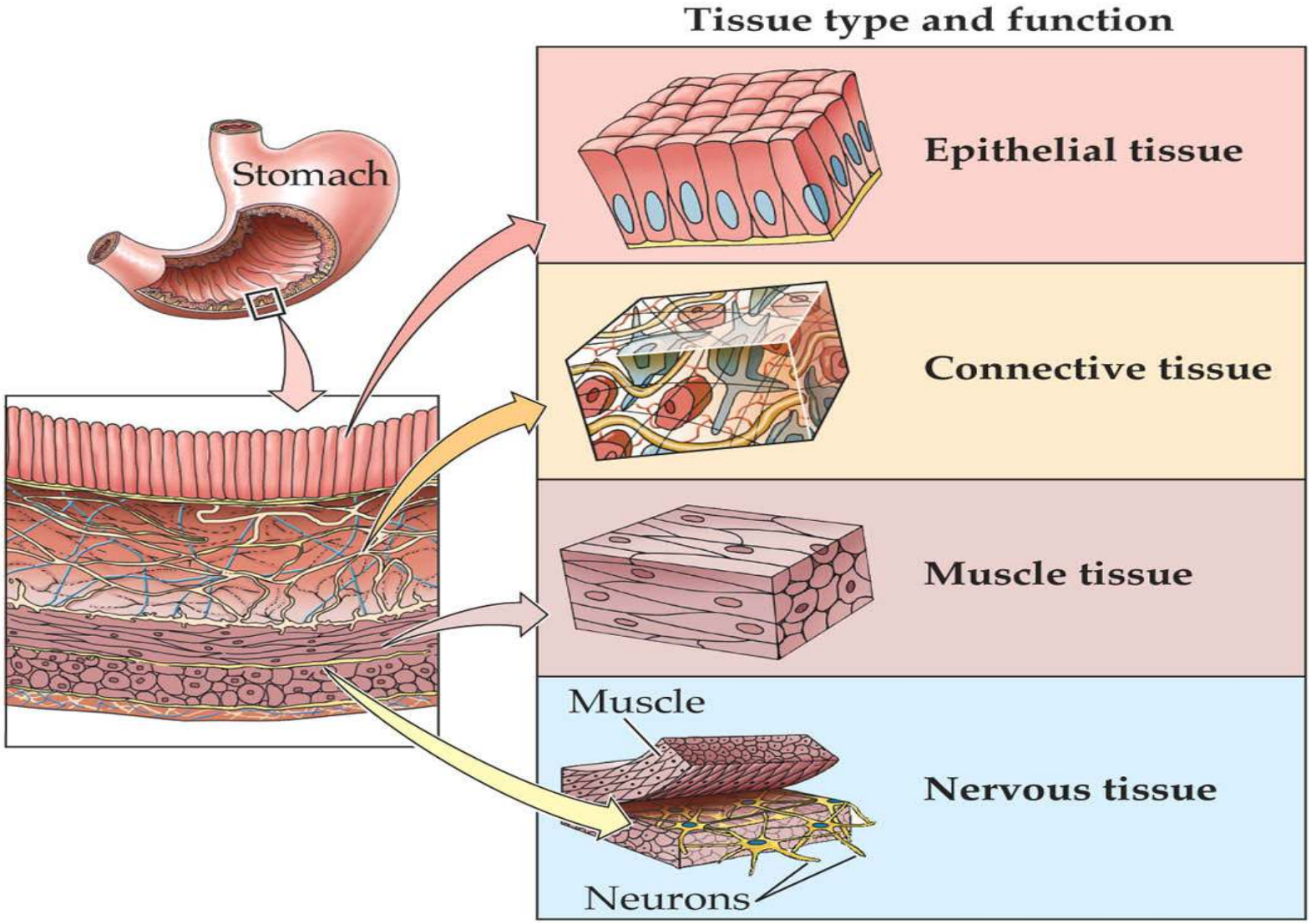


Glandular tissues

Danil Hammoudi.MD



(a) Most epithelial tissues line or cover surfaces or body cavities



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 41.2 Four Types of Tissue**

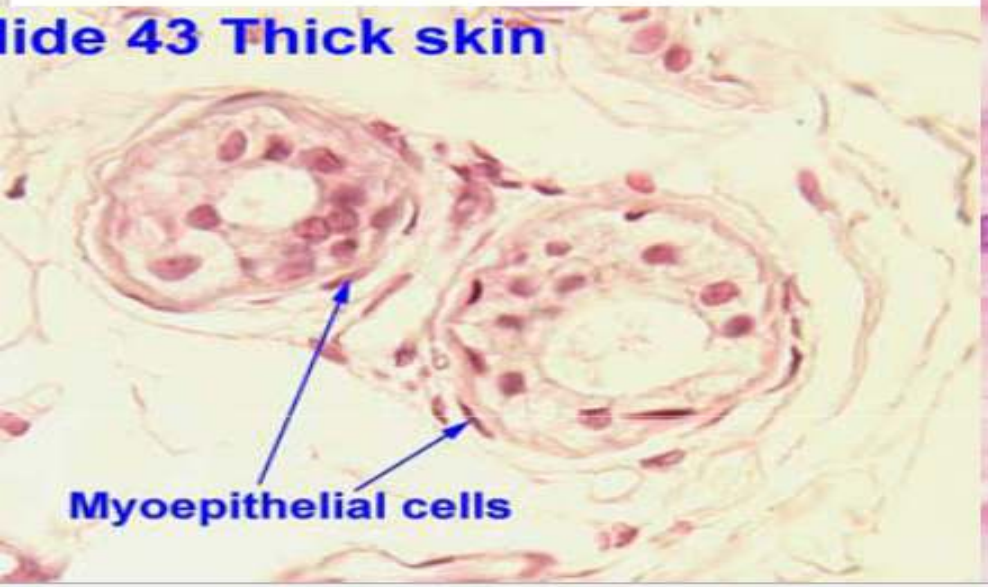
Histologically, glands are described using some standard vocabulary, with

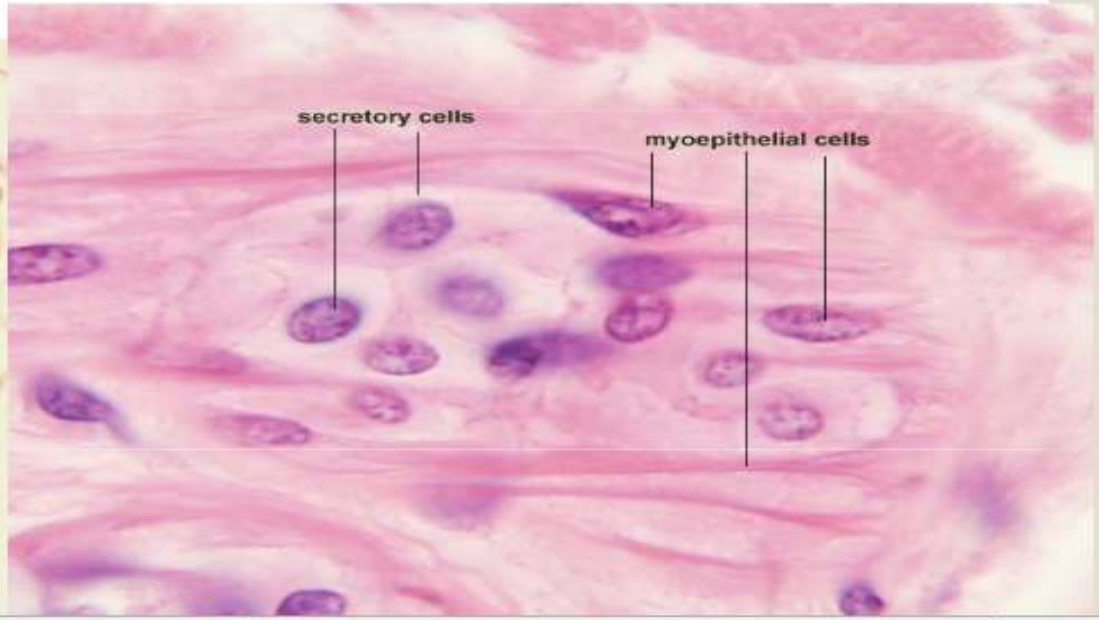
Destination of product:	**exocrine / endocrine**
Nature of product:	**serous / mucous / mixed**
Location of gland:	**mucosal / submucosal**
Arrangement of secretory cells:	**acinus / tubule / cord**
Number of interconnected units:	**simple / compound**
Duct function:	**intercalated / striated** **secretory / excretory**
Duct location:	**intralobular / interlobular / interlobar**
Tissue composition:	**parenchyma / stroma**

Myoepithelial Cells

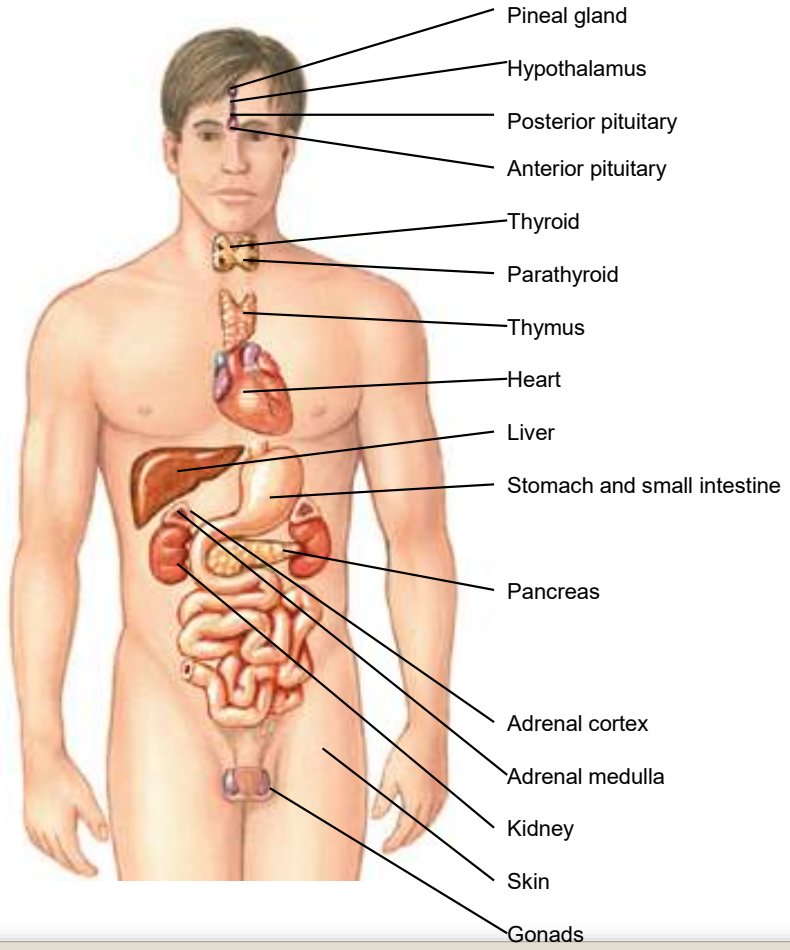
- These are contractile cells that lie within the basal lamina in the secretory portion of glands and intercalated ducts, which form the initial portion of the duct system.

- They are instrumental in moving the secretions toward the excretory duct.





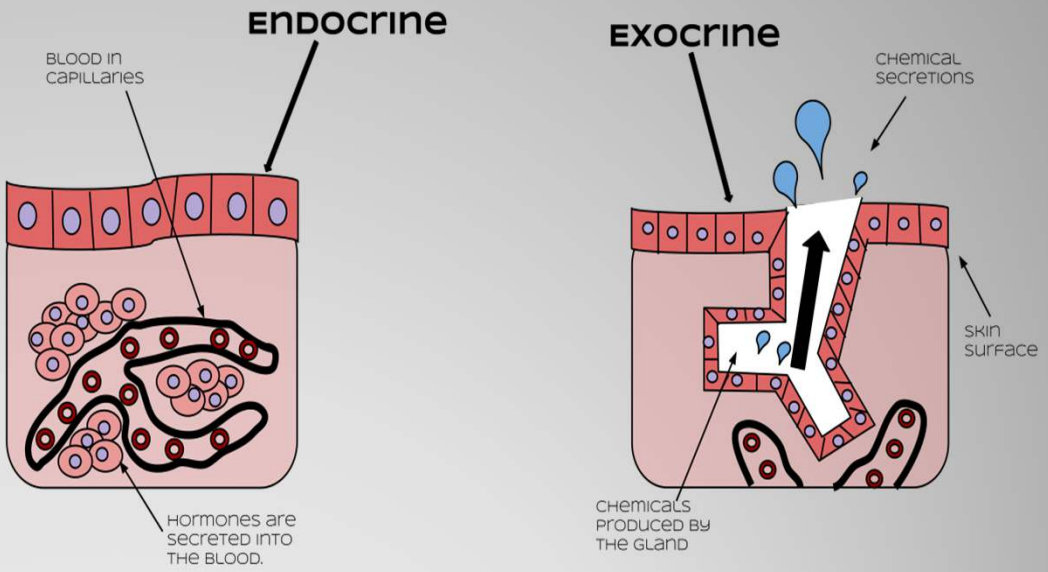
The endocrine system of humans



Silverthorn, Human Physiology, 3rd edition
Figure 7-2

- A gland is one or more cells that makes and secretes an aqueous fluid

- Classified by:
  - Site of product release – **endocrine or exocrine**
  - Relative number of cells forming the gland **– unicellular or multicellular**



Epithelia: Glandular

Major Types of Glands: **3 types are based on the mechanism of their secretion.**

Exocrine Glands –

- **Glands that secrete their products onto the apical (or epithelia)** surface directly OR via epithelial ducts or tubes that are connected to the apical surface.
  - These exocrine glands are composed of highly specialized epithelial cells and thus are classified as **glandular epithelia**.

Endocrine Glands –

- Glands that release their products basally, so the **secretion goes through the basal lamina, moves into the underlying connective tissue, and enters the vascular system.**
  - **Endocrine glands lack a duct system.**

Paracrine Glands –

- These glands are similar to endocrine glands, but their secretions **reach target cells by diffusion through the extracellular space or immediately subjacent connective tissue**.
  - **These secretory products are not delivered to their target tissue via ducts or the bloodstream.**

Endocrine Glands (Ductless Glands):

•Endocrine glands release hormones directly into the bloodstream.
•Hormones are chemical messengers that travel throughout the body and regulate various functions.
•Endocrine glands are ductless, meaning they don't have a direct connection to an organ or cavity where they release their secretions.

Examples of Endocrine Glands and their Hormones:
•**Pituitary Gland:** Often referred to as the "master gland," it produces several hormones that control other endocrine glands. (e.g., growth hormone, thyroid-stimulating hormone)
•**Thyroid Gland:** Located in the neck, it secretes thyroid hormones that regulate metabolism, growth, and development.
•**Parathyroid Glands:** Situated near the thyroid gland, they produce parathyroid hormone, which is crucial for calcium homeostasis in the body.
•**Adrenal Glands:** Located on top of the kidneys, they produce several hormones, including cortisol (stress hormone), adrenaline (epinephrine), and aldosterone (regulates blood pressure and fluid balance).
•**Pancreas** (Endocrine Portion): Although also functioning as an exocrine gland (see below), the pancreas has clusters of cells called islets of Langerhans that produce insulin and glucagon, hormones essential for regulating blood sugar levels.
•**Gonads (Ovaries and Testes):** These glands produce sex hormones like estrogen, progesterone, and testosterone, which influence sexual development, reproduction, and other functions.

Exocrine Glands (Ducted Glands):

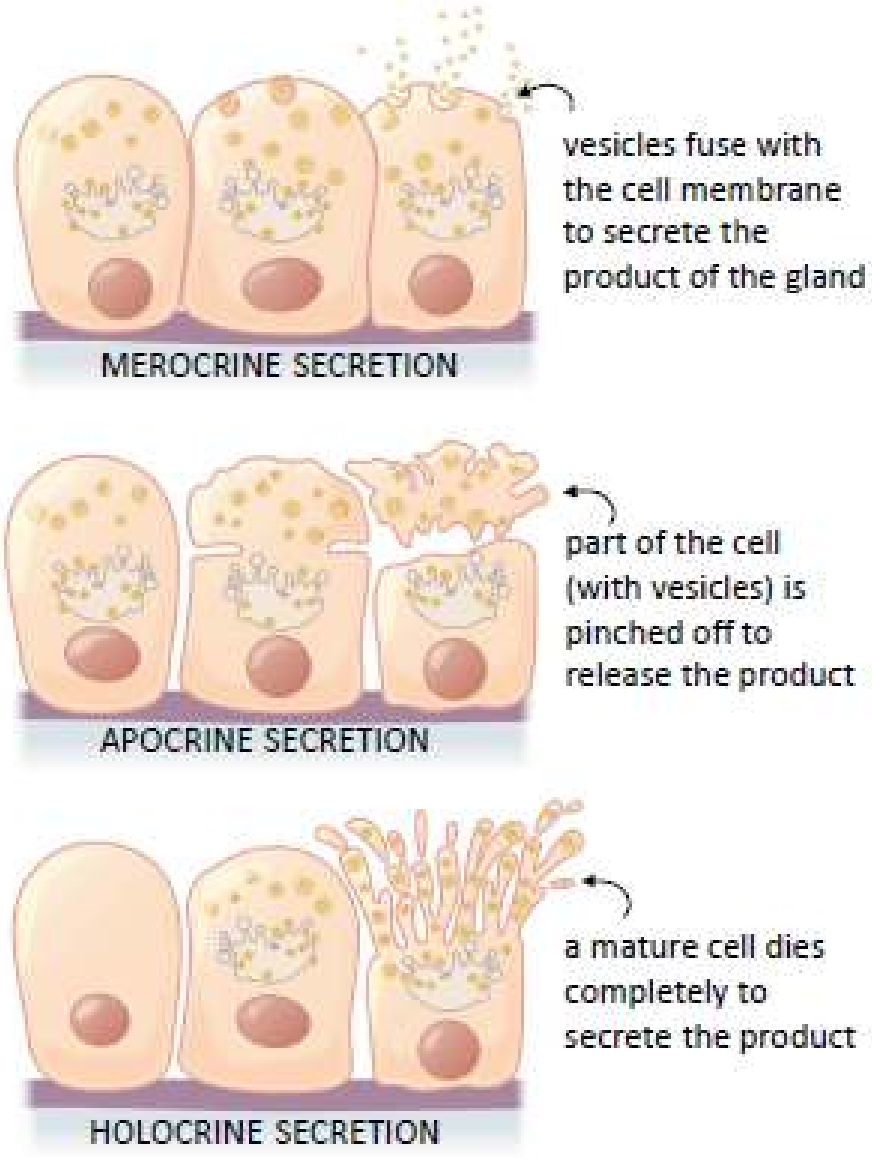
•Exocrine glands release their secretions through ducts onto an epithelial surface or into a body cavity.
•The secretions can have various functions, including lubrication, digestion, waste elimination, and more.

Examples of Exocrine Glands and their Secretions:

•**Sweat Glands:** Located in the skin, they produce sweat to regulate body temperature.
•**Sebaceous Glands:** Found in the skin, they secrete sebum, an oily substance that lubricates the skin and hair.
•**Salivary Glands:** Located in the mouth, they produce saliva to aid digestion and moisten the mouth.
•**Lacrimal Glands:** Situated near the eyes, they produce tears to lubricate the eyes and wash away irritants.
•**Mucous Glands:** Found throughout the respiratory tract and digestive system, they produce mucus to trap dust particles, lubricate surfaces, and protect underlying tissues.
•**Mammary Glands:** Located in the breasts, they produce milk to nourish newborns.

Mechanism of secretion

- **Merocrine ,**
- **Apocrine ,**
- **Holocrine secretions**



Merocrine secretion (aka eccrine secretion) -

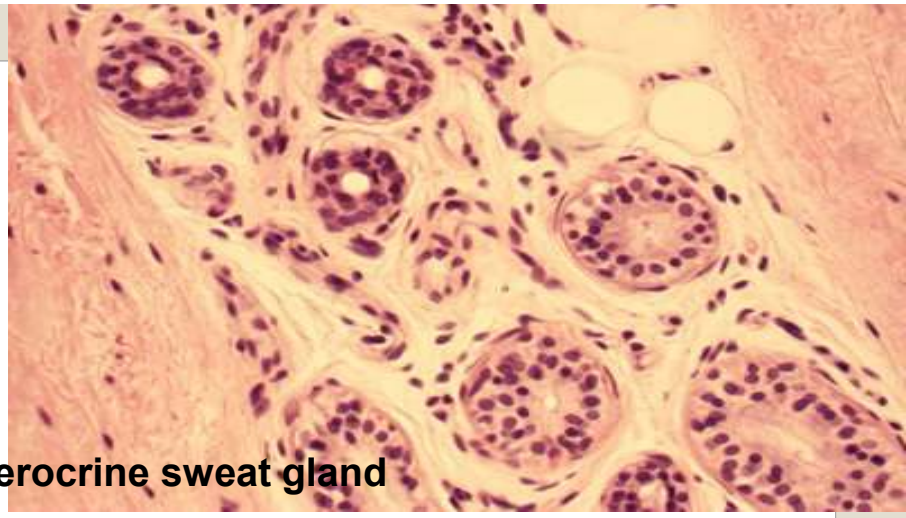
•This is the most common type of glandular epithelium secretion **where secretory granules within the cytoplasm of the cell gather at the apical region of the cell.**

• Then, the granule's limiting membrane fuses with the apical membrane and the contents of the granule are opened and released.

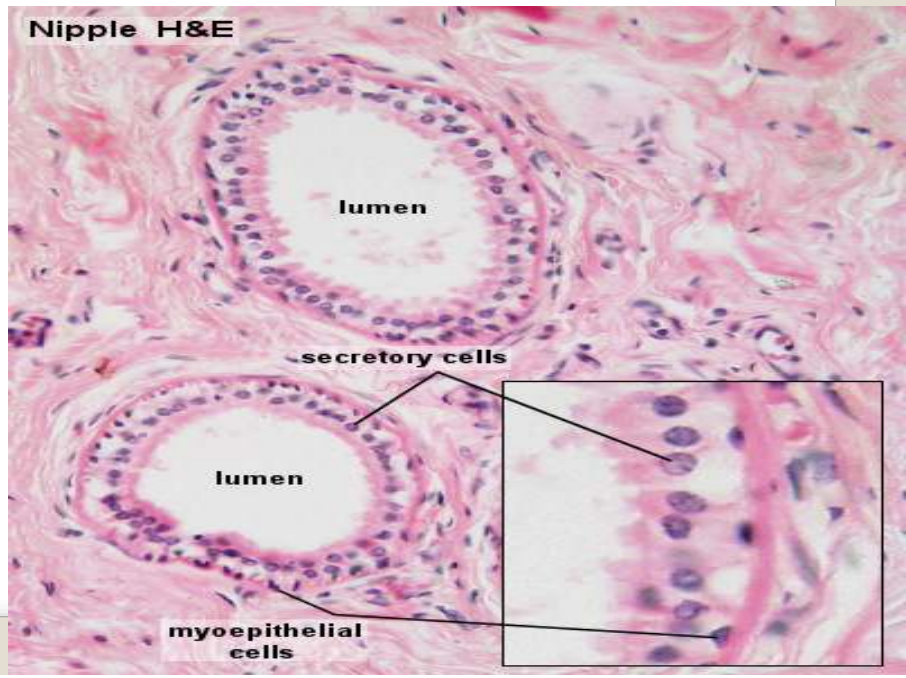
•**This process of fusion and release are collectively referred to as exocytosis.**

•The secretory granules leave the cell with no loss of other cellular material.

•Mucous and serous cells exhibit this type of secretion.

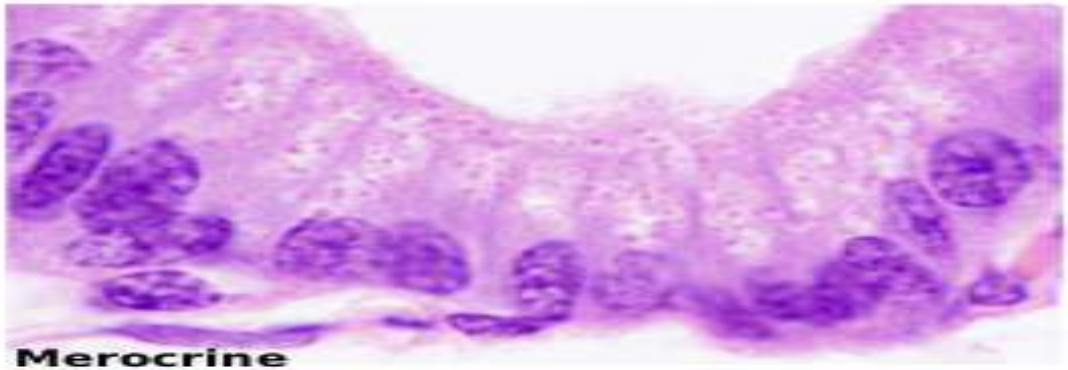


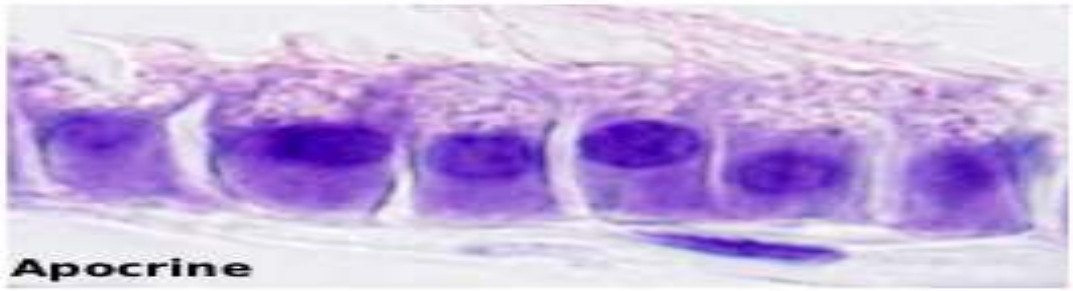
merocrine sweat gland

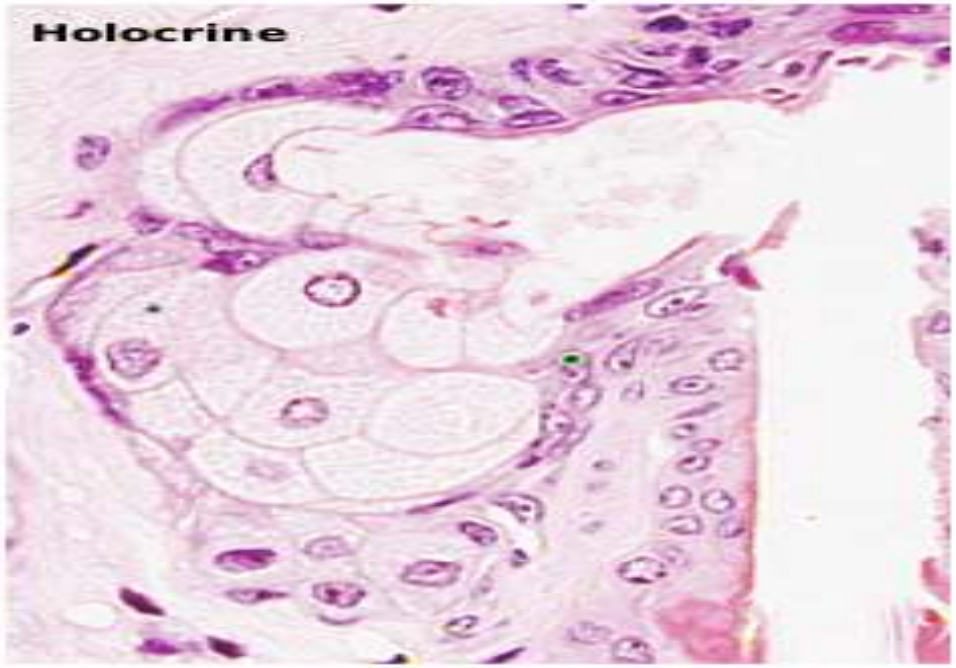


merocrine glands:

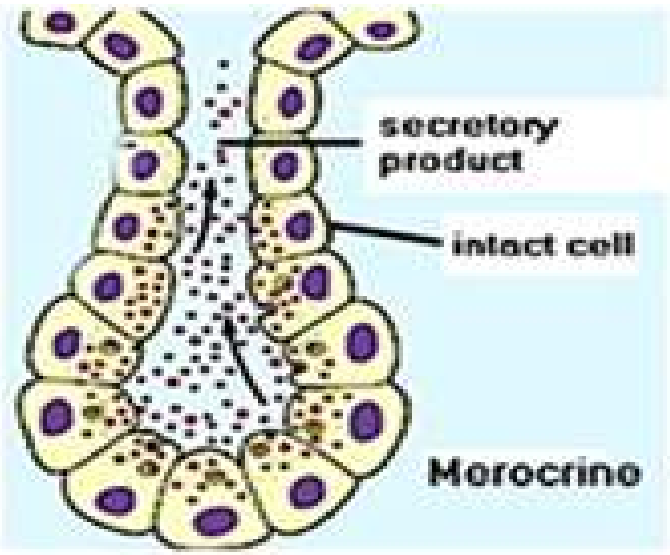
- **Sweat glands (Eccrine sweat glands):** These are widely distributed throughout the skin and are responsible for producing sweat to regulate body temperature. Sweat secretion is triggered by factors like exercise, hot weather, and emotional stress.
- **Salivary glands:** There are three pairs of major salivary glands (parotid, submandibular, and sublingual) in the mouth, along with numerous minor salivary glands throughout the oral cavity. They produce saliva, which plays a crucial role in digestion by moistening food, initiating carbohydrate breakdown by enzymes like amylase, and lubricating the passage of food through the esophagus.
- **Lacrimal glands:** Located near the eyes, these glands produce tears, which keep the eyes lubricated, wash away dust and debris, and contain enzymes with antimicrobial properties to protect the eyes from infections.
- **Mammary glands (milk production):** While mammary glands also have some apocrine secretory function, the primary mode of milk production is merocrine. Milk is a nutritious fluid produced after childbirth to nourish newborns.
- **Pancreatic exocrine glands:** The pancreas acts as both an endocrine and exocrine gland. The exocrine portion of the pancreas releases digestive enzymes like trypsin, chymotrypsin, and lipase through ducts into the small intestine. These enzymes break down proteins, carbohydrates, and fats, respectively, facilitating nutrient absorption.
- **Gastric glands:** Found in the lining of the stomach, these glands produce gastric juices containing digestive enzymes (pepsin) and hydrochloric acid. Hydrochloric acid creates an acidic environment that aids protein digestion and activates pepsin, while also having a bactericidal effect.
- **Goblet cells:** These are specialized epithelial cells found throughout the respiratory tract and intestines. They produce mucus, a sticky secretion that traps dust particles, pathogens, and debris, protecting the underlying tissues.

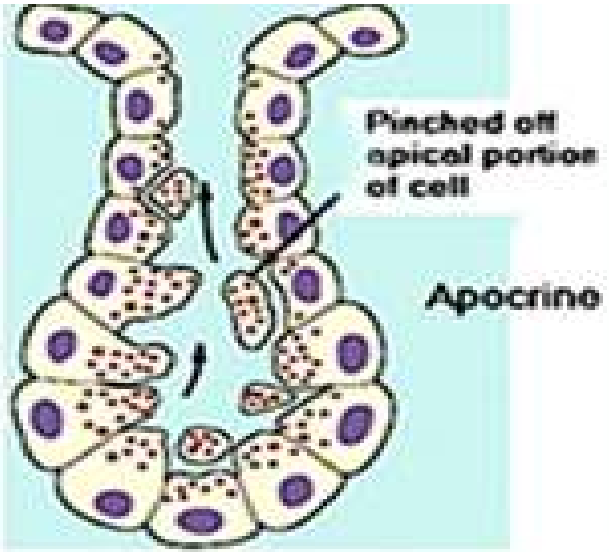

Merocrine

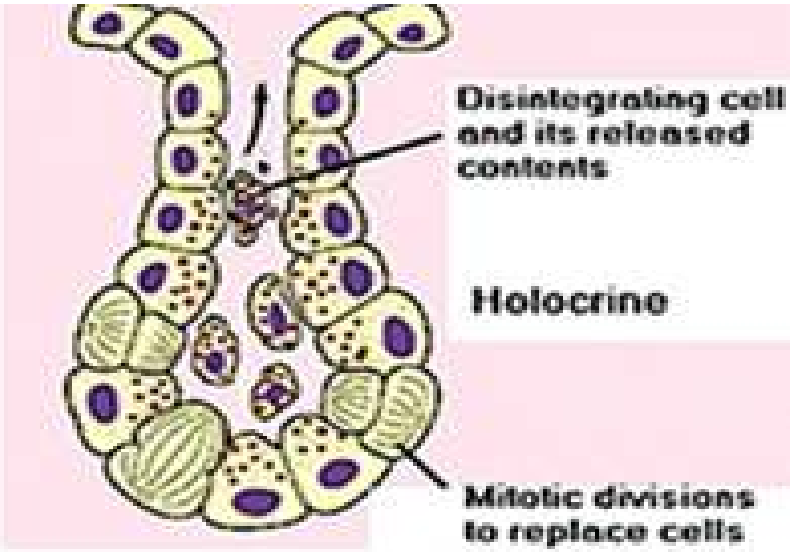

Apocrine

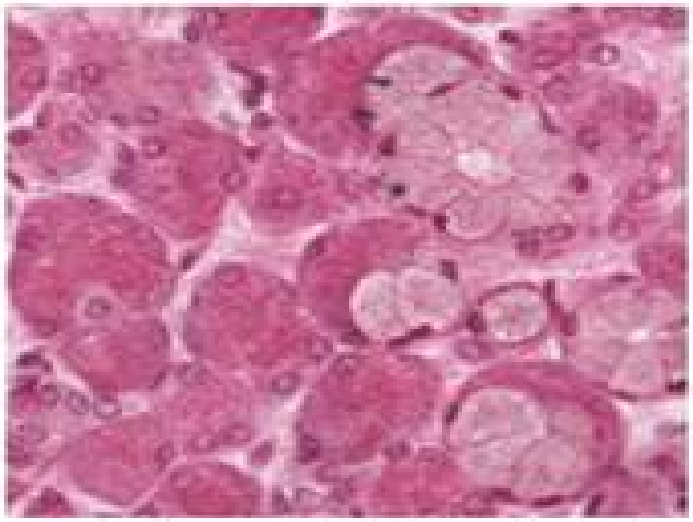

Holocrine


Merocrine
Apocrine
Holocrine

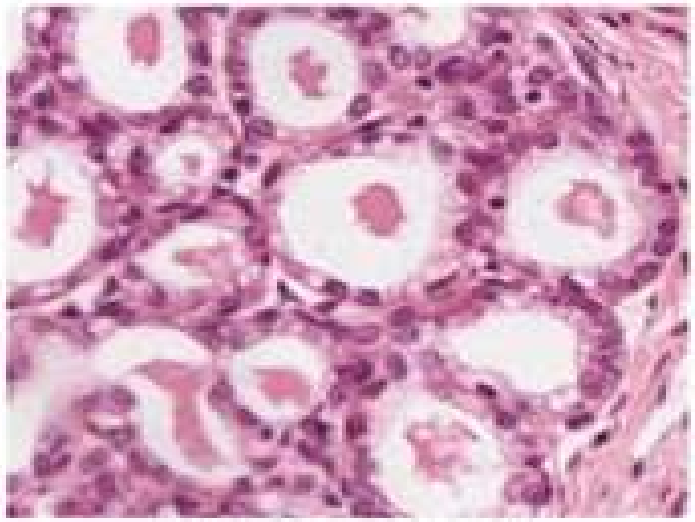








Submandibular gland



Mammary gland

Sebaceous gland

Merocrine glands have three primary functions:

- ***Thermoregulation.*** Sweat cools the surface of the skin and reduces body temperature.
  - This cooling is the primary function of sensible perspiration, and the degree of secretory activity is regulated by neural and hormonal mechanisms.
  - When all of the merocrine sweat glands are working at maximum, the rate of perspiration may exceed a gallon per hour, and dangerous fluid and electrolyte losses can occur.
  - For this reason athletes in endurance sports must pause frequently to drink fluids.

- ***Excretion.*** **Merocrine** sweat gland secretion can also provide a significant excretory route for water and electrolytes, as well as for a number of prescription and nonprescription drugs.

- ***Protection.*** Merocrine sweat gland secretion provides protection from environmental hazards by diluting harmful chemicals and discouraging growth of microorganisms.

Examples and Functions of merocrine glands:

some specific examples of merocrine glands and their functions:

•**Sweat glands:** Regulate body temperature by producing sweat for evaporation and cooling.

•**Salivary glands:** Secrete saliva for moistening food, initiating carbohydrate digestion, and lubricating the passage of food.

•**Lacrimal glands:** Produce tears for lubrication, washing away dust and debris, and protecting the eyes from infections.

•**Pancreatic exocrine glands:** Release digestive enzymes to break down proteins, carbohydrates, and fats in the small intestine.

•**Gastric glands:** Produce gastric juice containing enzymes and acid to aid protein digestion and kill bacteria in the stomach.

•**Goblet cells:** Secrete mucus to trap dust particles, pathogens, and debris in the respiratory tract and intestines.

Merocrine (eccrine) glands: stratified cuboidal, small lumen
Apocrine glands: simple cuboidal, large lumen
Within Dermis of Skin

Apocrine glands

are a specialized type of exocrine gland found in humans and other mammals. Unlike merocrine glands, which release secretions without cell damage, apocrine glands undergo a unique secretory process.

Structure and Function:

•**Location:** Apocrine glands are primarily located in areas with abundant
- •hair follicles, such as the armpits,
- •groin,
- • around the nipples.

•**Secretion:** *Apocrine glands produce a milky or oily fluid rich in proteins and lipids.*
- •*This secretion initially has no odor.*

•**Secretion Mechanism:** Apocrine glands exhibit a unique mode of secretion involving two mechanisms:
•

- **Merocrine secretion:** Similar to merocrine glands, apocrine glands can release some secretory products through exocytosis without cell damage.

- **Apocrine secretion:** In this primary mode, the apical portion of the cell (the top part facing the surface) bulges and detaches, releasing the secretory components along with some cytoplasmic material.

Apocrine secretion –

•A rare type of secretion dependent on sex hormones where **secretory granules within the cytoplasm gather at the apical region of the cell.**

• Then, a portion of the cytoplasm of the cell simply pinches off enclosing the granules.

•Within the lumen, this small secretory vesicle breaks down and releases the gland's products.

•**Apocrine glands become functional at puberty**.

•They respond to emotional or sensory stimuli (not to heat).

Examples of apocrine glands include see next slide

- **lactating mammary glands,**
- **apocrine glands of skin in the pubic and axilla regions,**
- **ciliary (Moll's) glands of the eyelid,**
- **and the ceruminous glands of the external acoustic meatus.**

Activation and Odor:

•**Apocrine glands become functional after puberty due to hormonal stimulation, particularly by sex hormones like testosterone.**

•The apocrine secretion itself is **odorless.**

- •However, after it reaches the skin surface, it is broken down by bacteria naturally present on the skin.
- •This bacterial breakdown produces the characteristic body odor associated with apocrine glands.

Examples of Apocrine Glands:

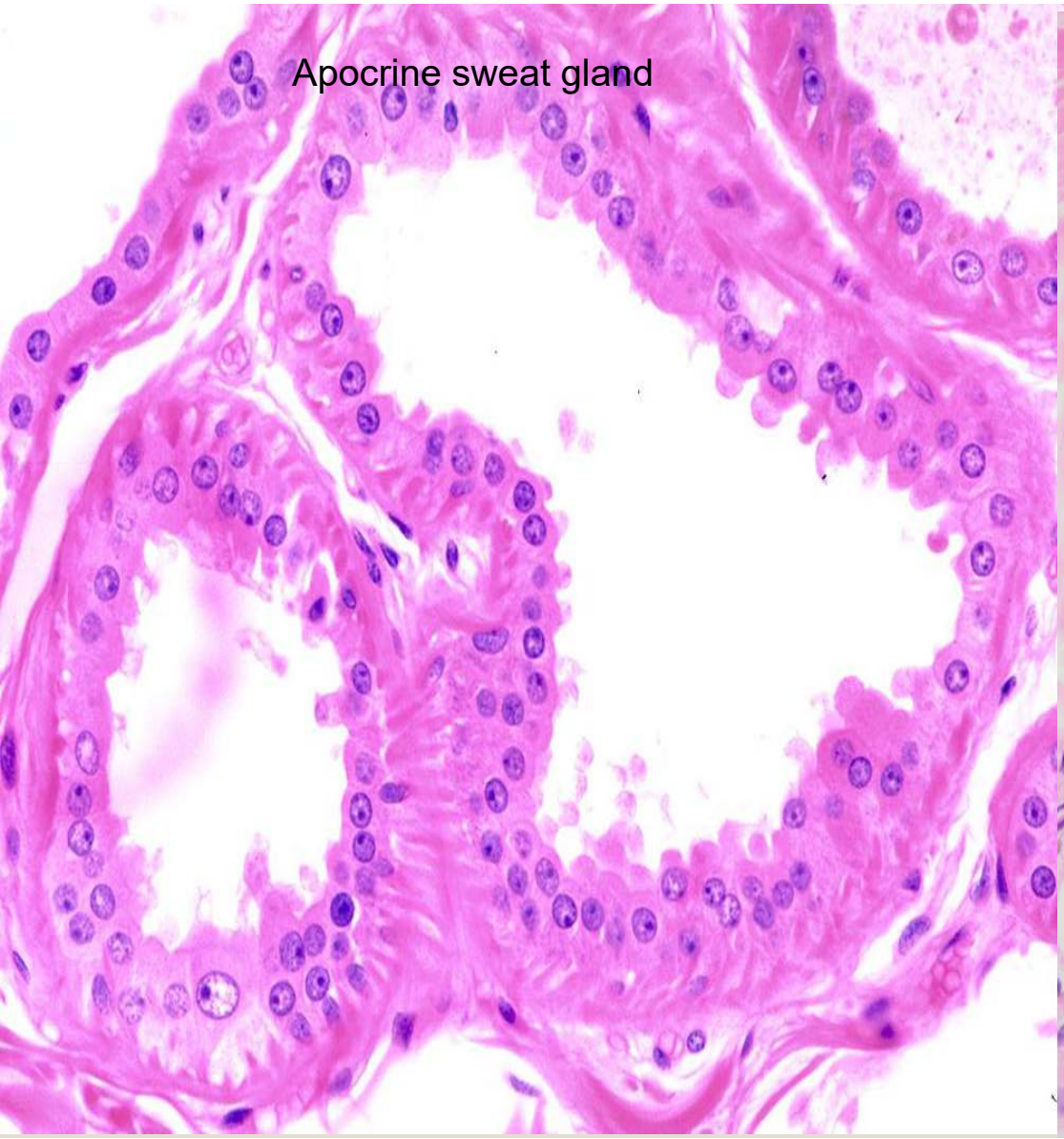
•**Axillary glands:** Located in the armpits, these are the most prominent apocrine glands in humans.
•**Apocrine sweat glands:** These are found in the pubic region and around the anus.
•**Montgomery glands:** Situated around the areola of the breasts, these glands have a lubricating function during breastfeeding.
•**Ceruminous glands:** Located in the external auditory canal, these glands contribute to the production of earwax.

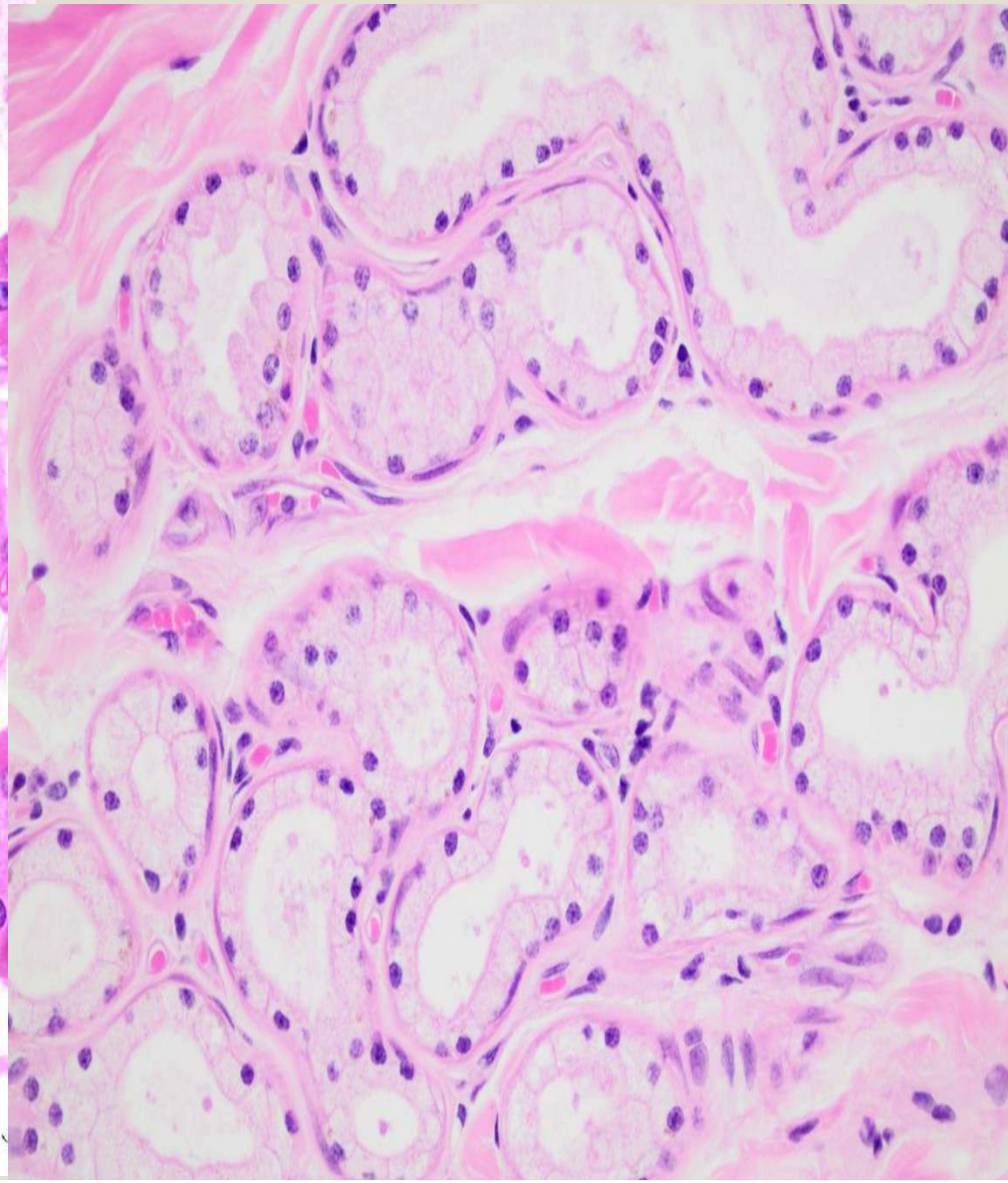
Importance and Health

- **Considerations:**

- Apocrine glands play a role in **pheromone** production,
  - potentially influencing social behavior and communication (although this is not fully understood in humans).
- Excessive sweating or bacterial activity in areas with apocrine glands can contribute to body odor.
  - Maintaining hygiene and using deodorants can help manage this.

  - Certain medical conditions can affect apocrine glands.
    - apocrine hidradenitis suppurativa can lead to inflammation and blockage of apocrine sweat glands.


Apocrine sweat gland



Holocrine secretion –

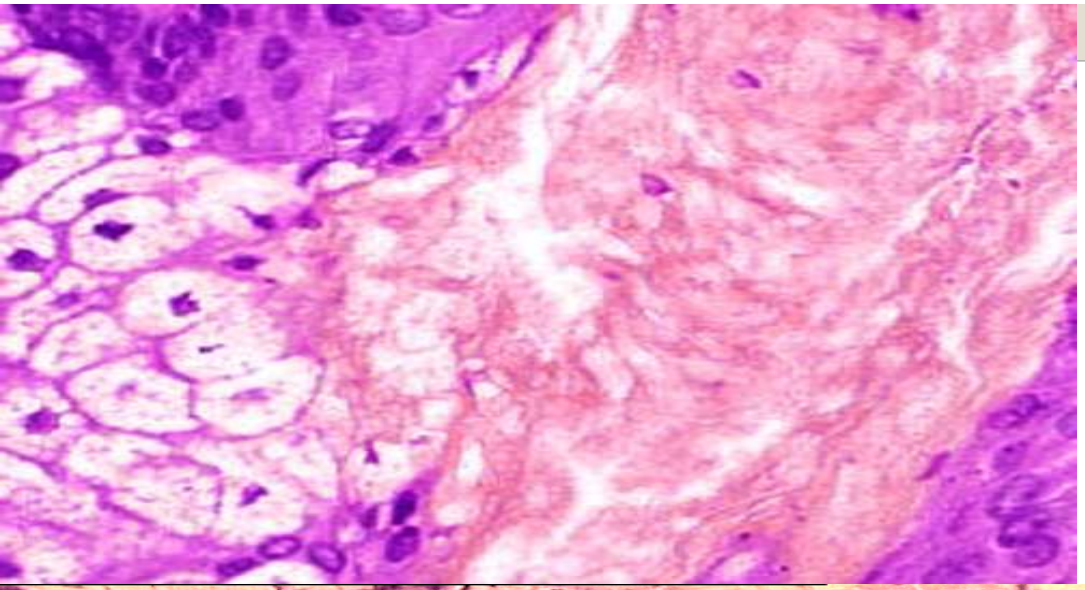
•This secretion consists of **disintegrated cells of the gland itself.**

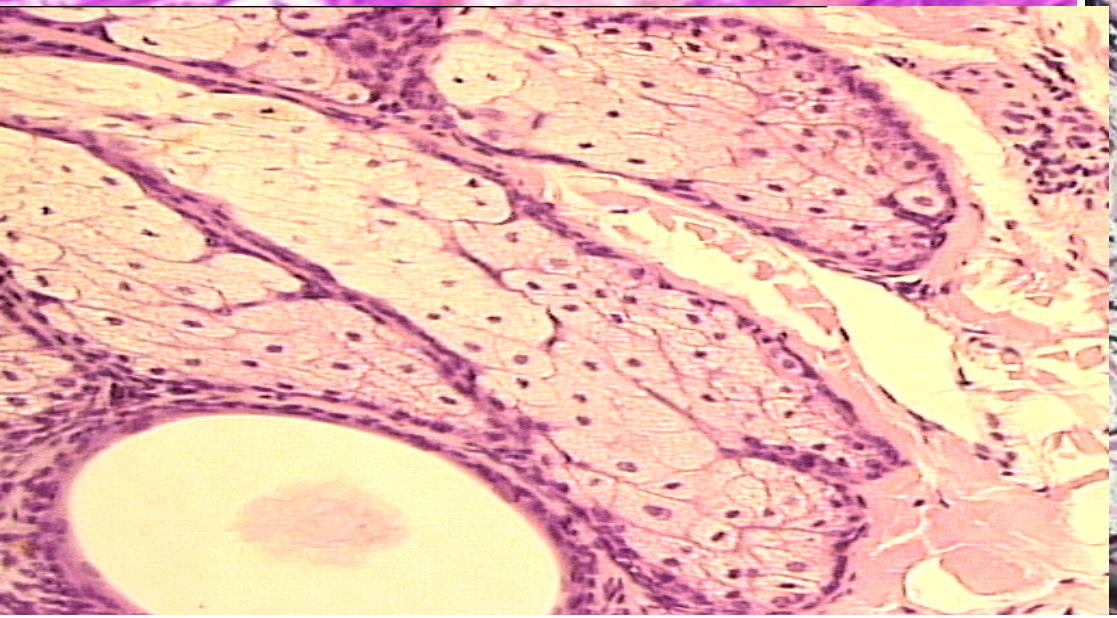
• Granules fill the cell until the entire cell becomes “bloated” with secretory products.

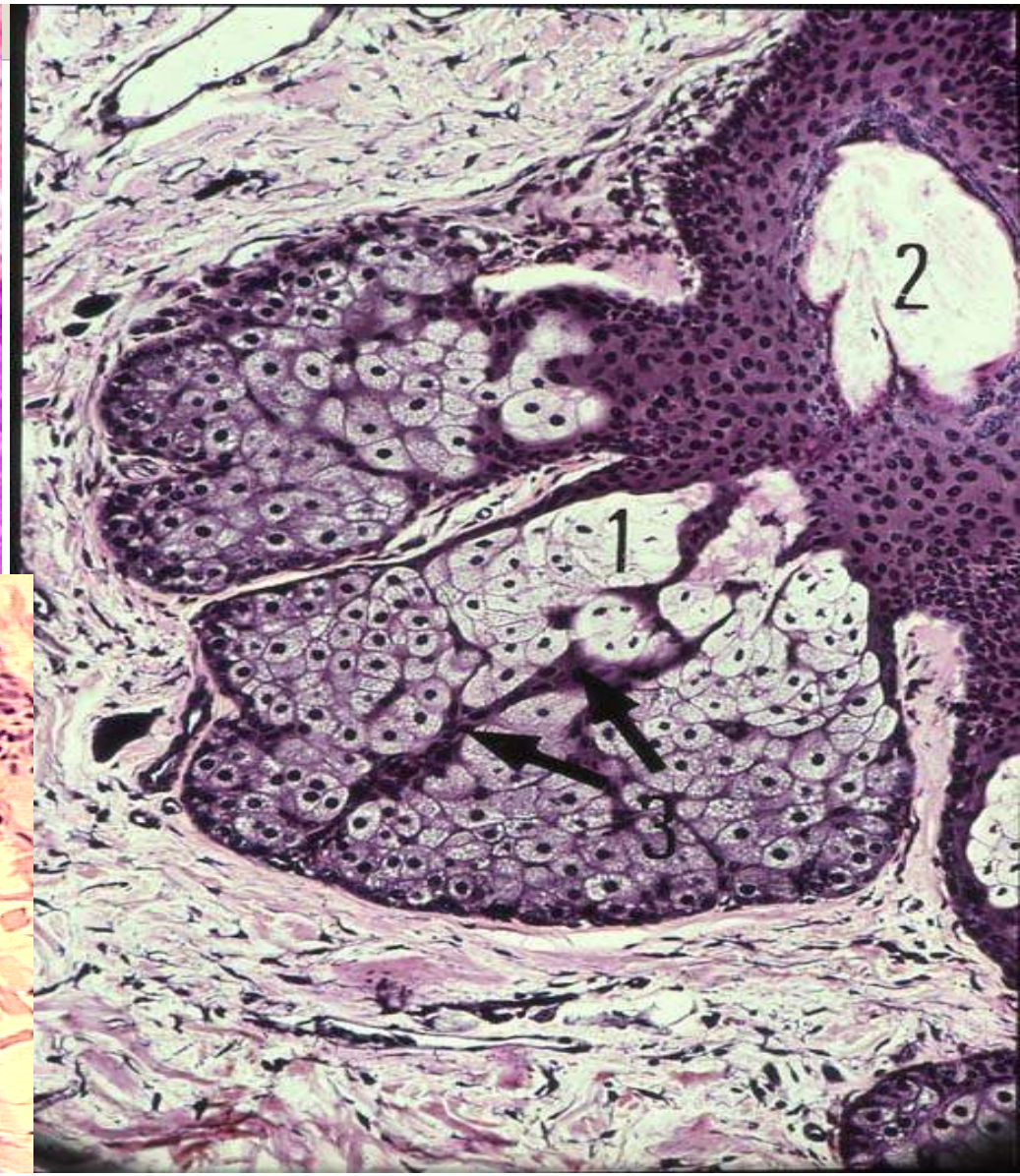
• Instead of being released (merocrine) or pinched off (apocrine), the whole cell is discharged into the lumen.

• Once inside the lumen, the cell degenerates and the secretory products are released.

•This type of secretion occurs primarily in **sebaceous glands within the skin, but also in the tarsal (Meibomian) glands of the eyelid.**



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Structure and Secretion:

•**Location:** Holocrine glands are found in limited areas of the body, primarily in the skin.
    •Examples include sebaceous glands in the hair follicles and meibomian glands in the eyelids.

•**Secretion:** Holocrine glands produce oily or waxy secretions.

•**Secretion Mechanism:** Unlike other exocrine glands, holocrine glands employ a destructive method for releasing their products. Here's what happens:

- **Accumulation:** Secretory products are synthesized within the holocrine cell and accumulate over time.
- **Cell Death:** As the cell fills with secretory material, the entire cell undergoes programmed cell death (apoptosis).
- **Secretion:** The dead cell membrane ruptures, releasing the accumulated secretion along with cellular debris.

Unique Features:

•**Cell Destruction:** The self-destruction of the cell is a defining characteristic of holocrine glands, setting them apart from merocrine and apocrine glands which release secretions without cell death.

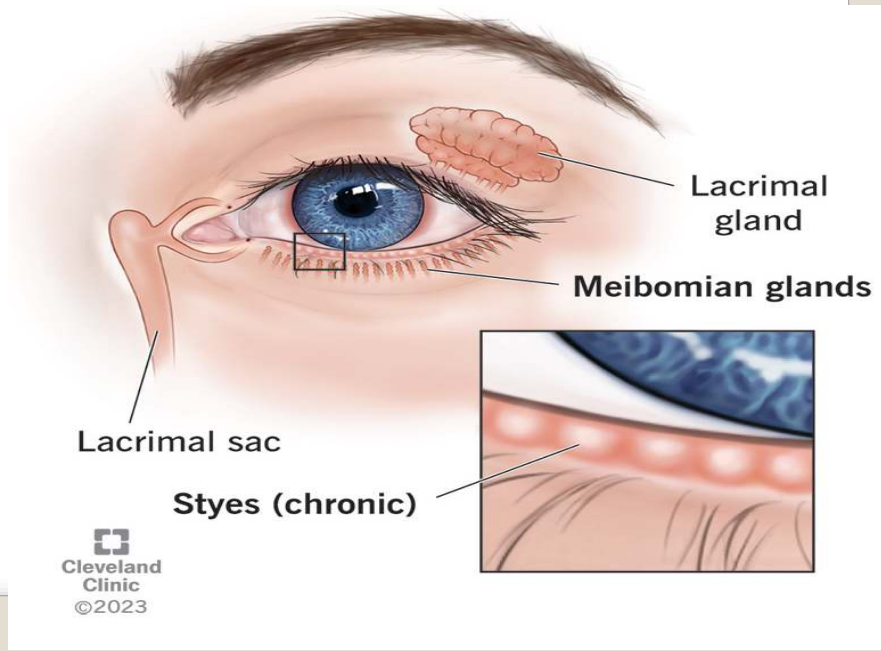
•**Continuous Regeneration:** Due to their destructive secretory process, holocrine glands require constant renewal.

- Stem cells in the underlying tissue continuously divide and differentiate to replace the expended cells.

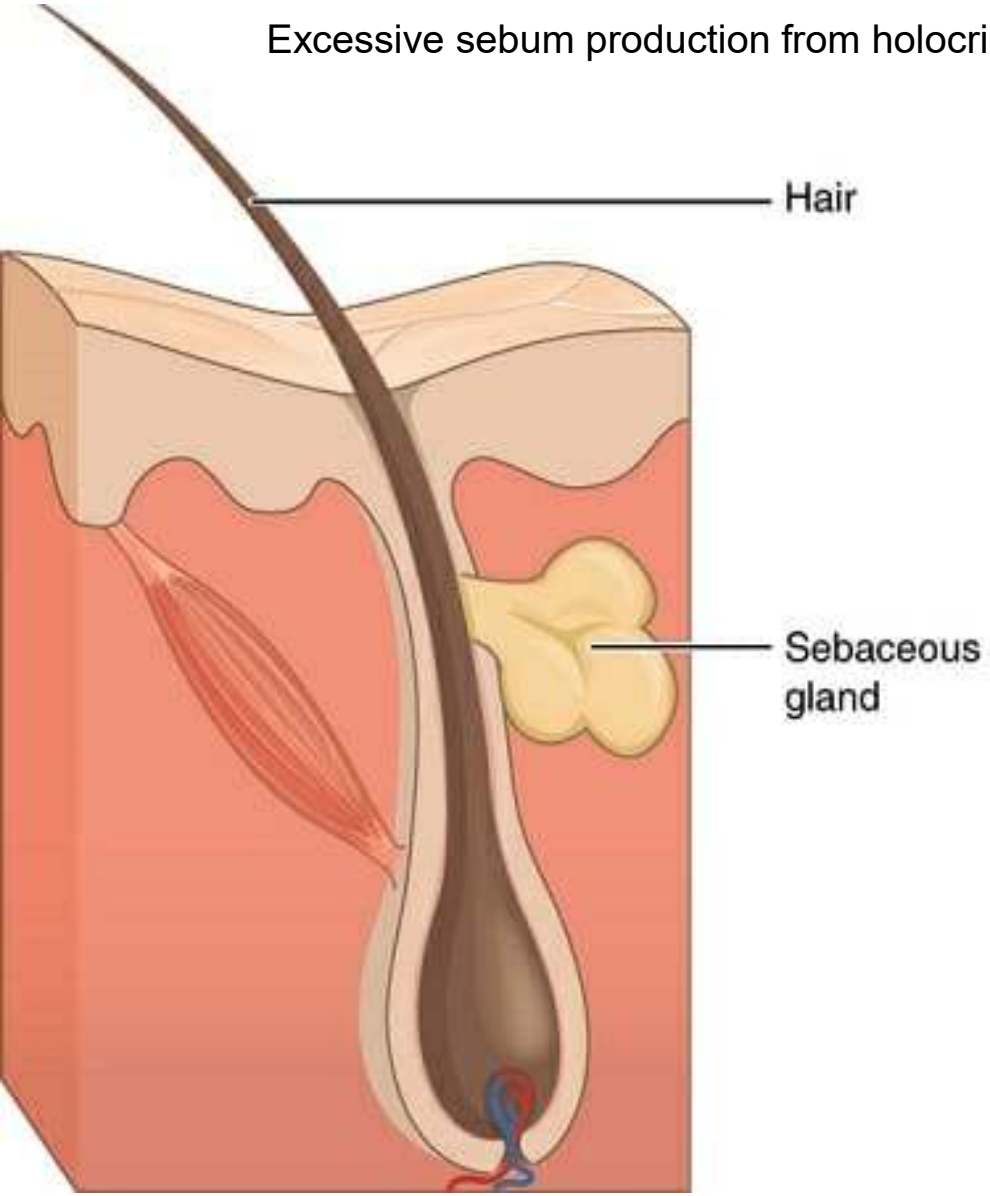
Examples and Functions:

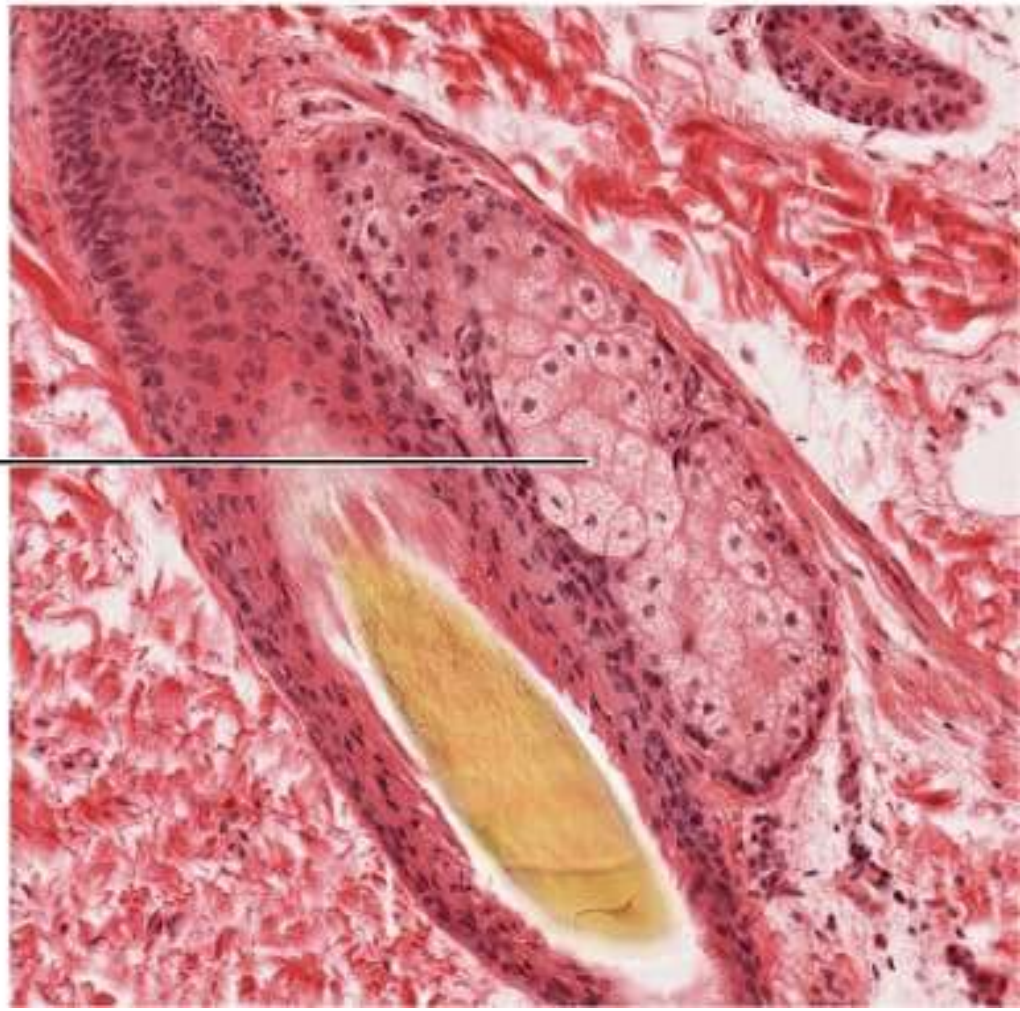
•**Sebaceous glands:** Located within hair follicles, sebaceous glands produce sebum, an oily substance that lubricates the skin and hair, preventing dryness and protecting against pathogens.

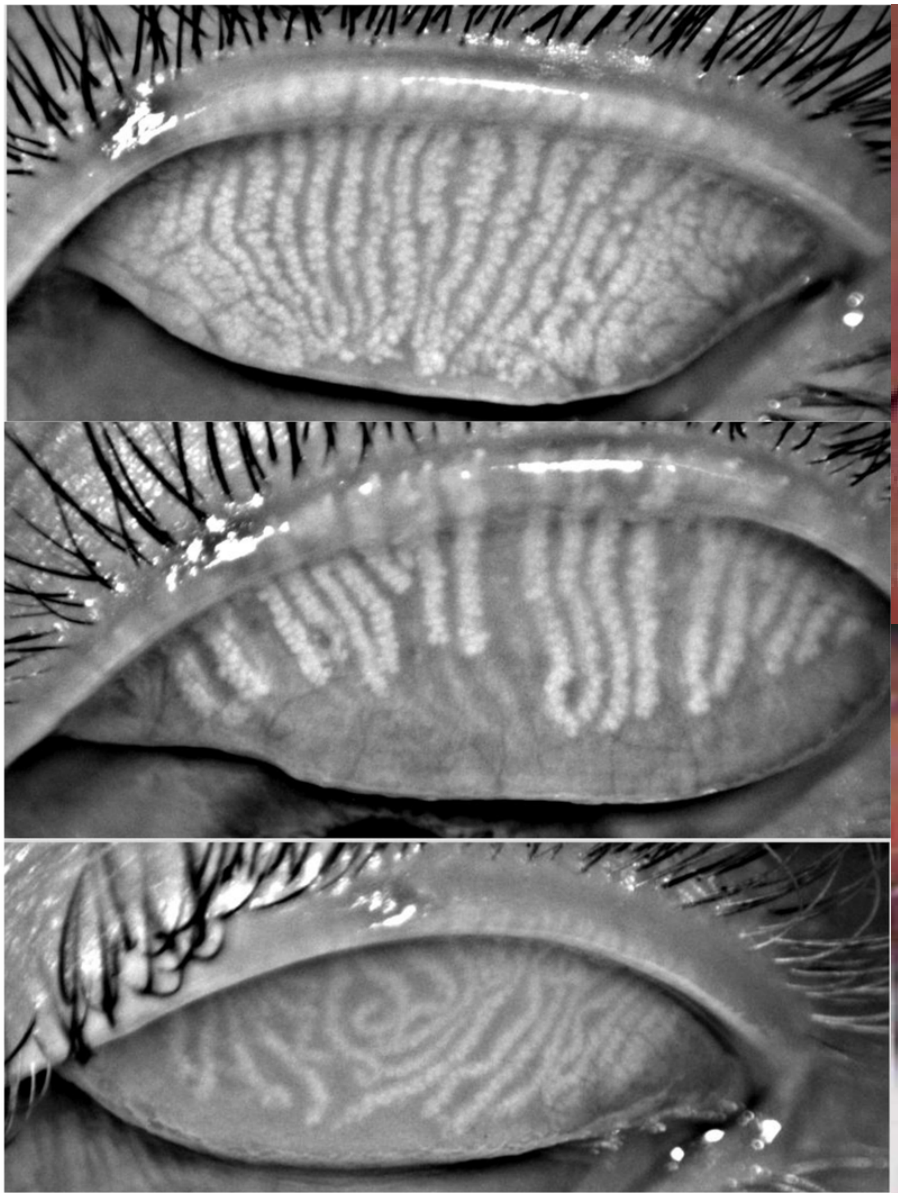
•**Meibomian glands:** Found in the eyelids, these glands produce meibum, an oily component of tears that helps maintain a tear film over the eye, preventing dryness and irritation.



Excessive sebum production from holocrine glands can contribute to acne vulgaris (common acne).



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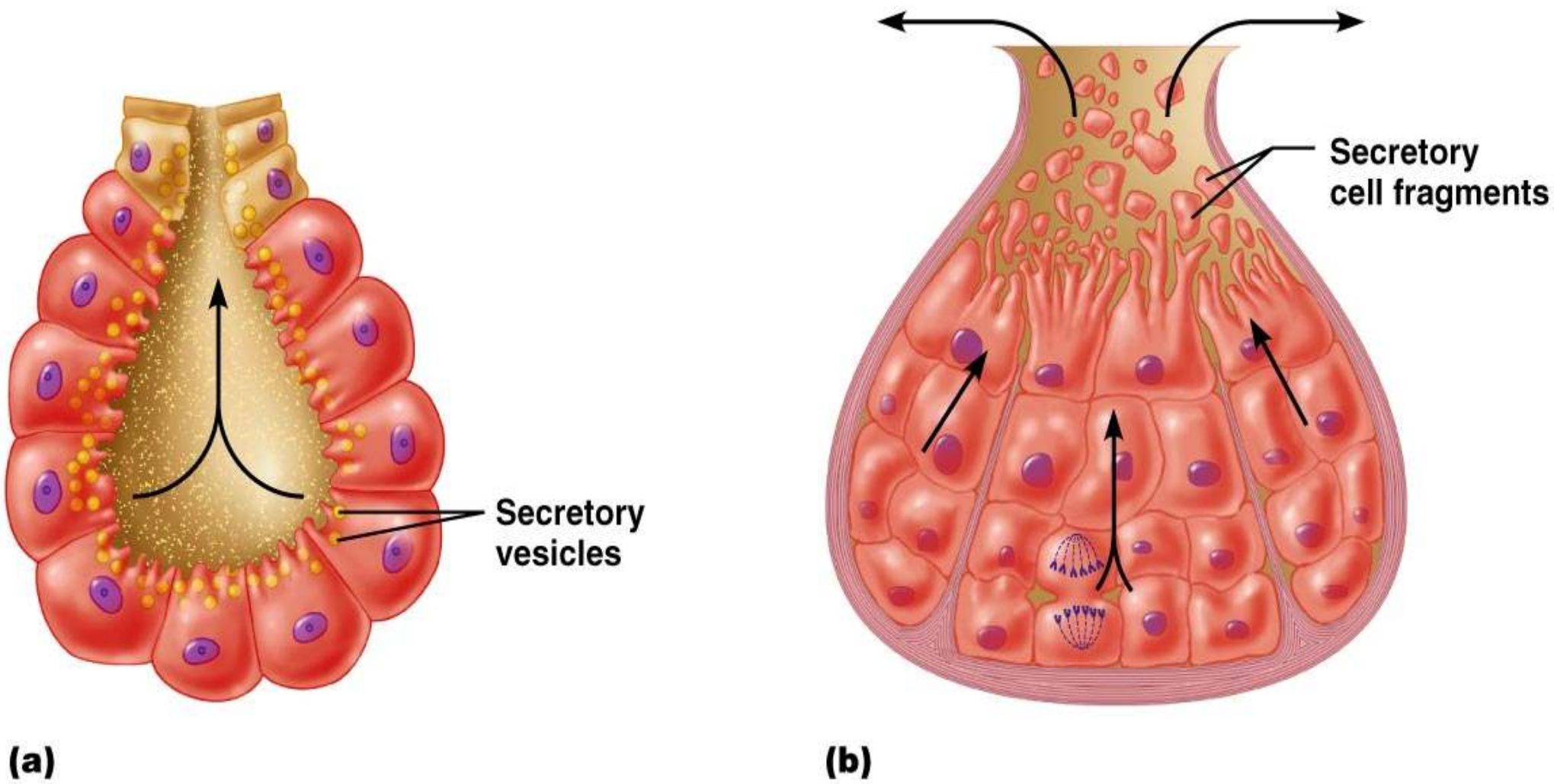
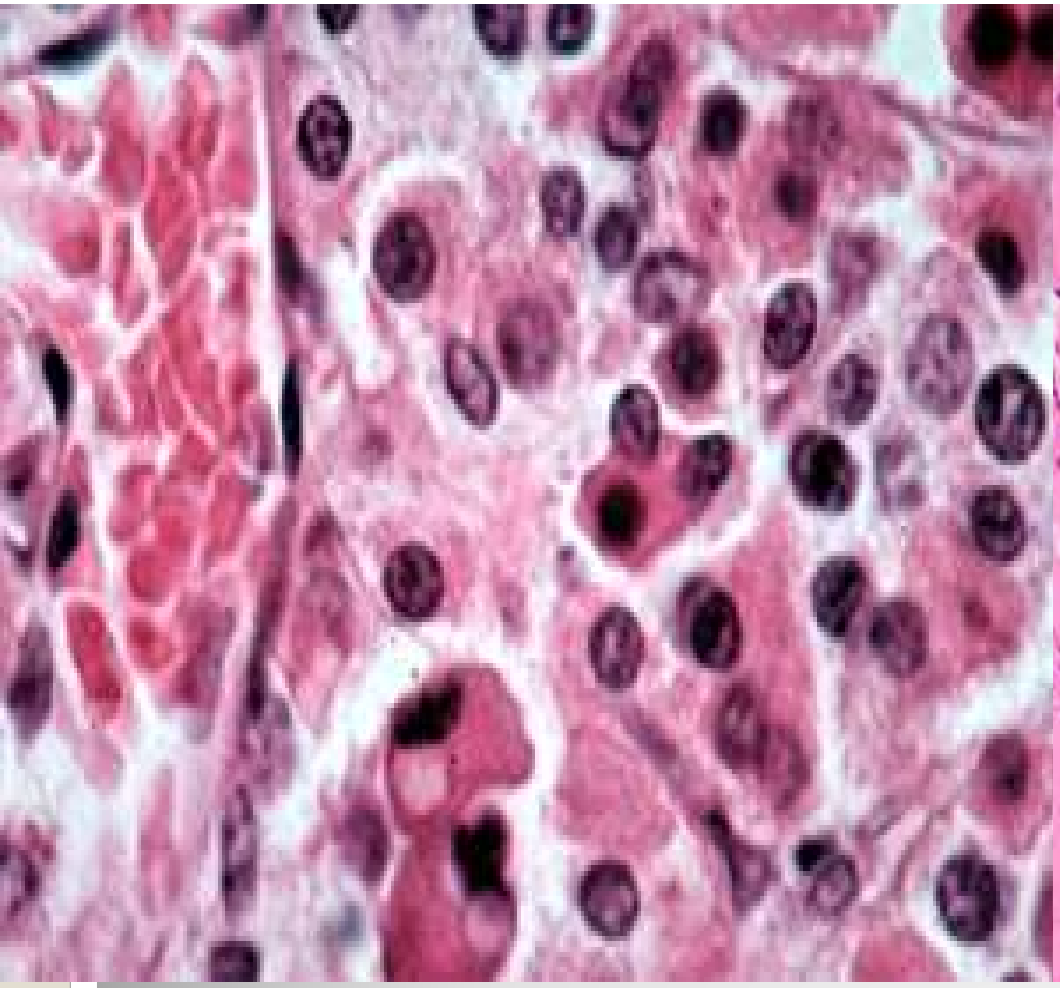


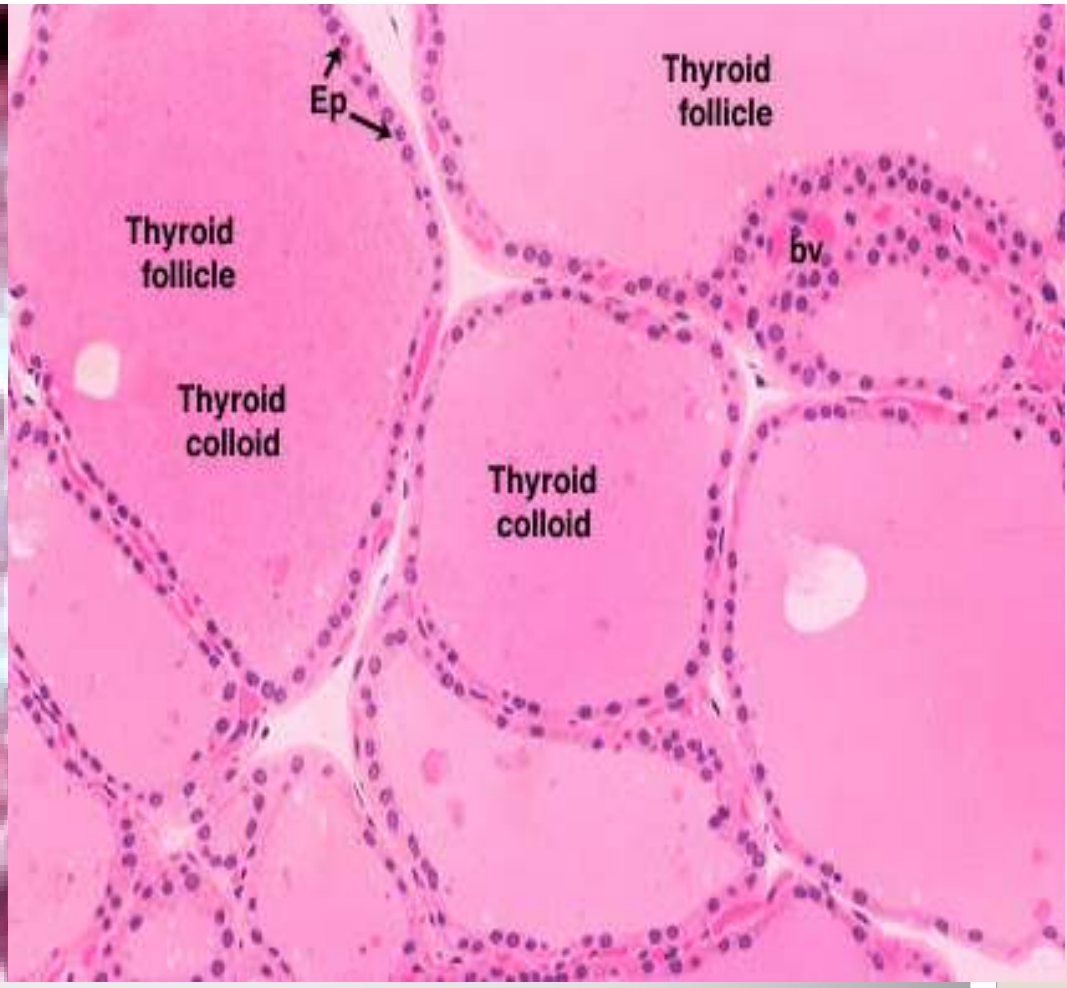
Figure 4.5

Endocrine Glands	Exocrine Glands
No duct system	Ducts to release products
Secretions directed into the extracellular fluid (basal side), move into vascular system	Secretions released to the apical cell surface, move out of ducts to outside environment

- Ductless glands that produce hormones
- Secretions include amino acids, proteins, glycoproteins, and steroids

Endocrine Glands





Endocrine Gland

Anterior pituitary

thyroid gland

Exocrine Glands

- More numerous than endocrine glands
- **Secrete their products onto body surfaces (skin) or into body cavities**
- **Examples include mucous, sweat, oil, and salivary glands**
- **The only important unicellular gland is the goblet cell**
- **Multicellular exocrine glands are composed of a duct and secretory unit**

Type of glands structures and function

- Tubular glands
- Alveolar glands

There are two main types of tubular secretory structures:

•**Tubular glands: These are exocrine glands**, meaning they release secretions onto an epithelial surface through a duct.

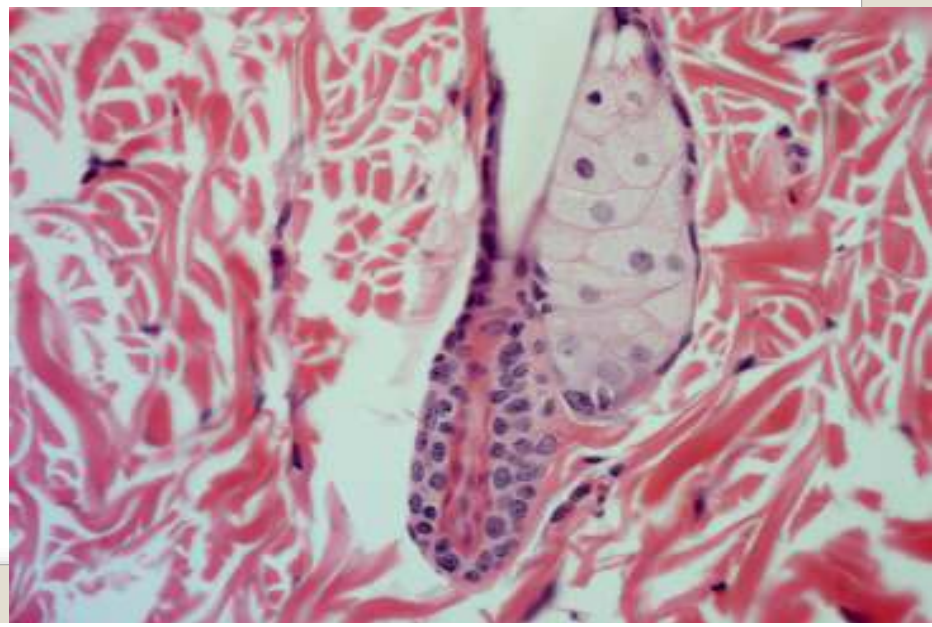
•They are named for the shape of their secretory unit, which resembles a tube. They are classified based on the structure of their secretory portion and can be further categorized into different types based on their function and location in the body.

•Tubular glands are found in many parts of the body, including the:

- Digestive tract: They line the lining of the stomach, intestines, and esophagus and secrete digestive enzymes and mucus.
- Respiratory tract: They line the trachea and bronchi and secrete mucus to trap dust and particles.
- Reproductive system: They are found in the uterus, penis, and vagina and secrete lubricating fluids.
- Skin: They include sweat glands and mammary glands. Sweat glands help regulate body temperature, while mammary glands produce milk.

Nephrons: These are the microscopic filtering units of the kidneys.

- They are not technically glands because they don't release secretions externally, but they do contain tubular structures that are involved in secretion.
- The nephron tubules help remove waste products from the blood and regulate blood pressure and pH.



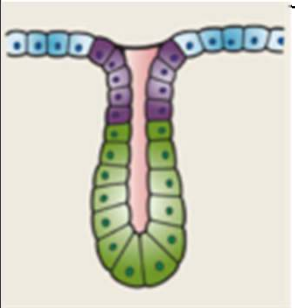
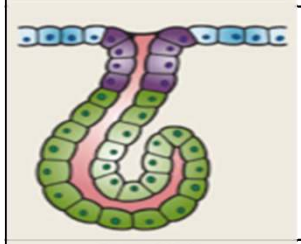
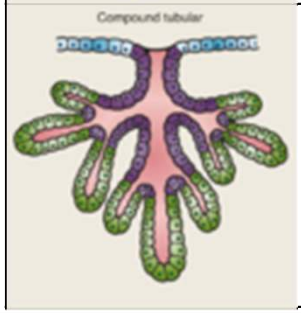
1.Types(see table next slides)

1. **Simple Tubular Glands**: These glands have a single, unbranched tubule.
   - **Examples include the intestinal glands (crypts of Lieberkühn) found in the lining of the small intestine.**
2. **Simple Coiled Tubular Glands**: These glands have a single, coiled tubule.
   - **Sweat glands (eccrine glands) are examples of simple coiled tubular glands found in the skin.**
3. **Simple Branched Tubular Glands**: These glands have a branched tubule, but the branches do not themselves branch further.
   - **Examples include the gastric glands found in the lining of the stomach.**
4. **Compound Tubular Glands**: These glands have a branched tubule with further branching of the ducts.
   - **Examples include the mucous glands in the respiratory tract and salivary glands in the mouth.**

2. **Function**:
   1. Tubular glands **produce and secrete** various substances, including :
      - **mucus, sweat,**
      - **digestive enzymes,**
      - **hormones,**
      - **saliva, depending on their location and type.**
   2. The secretions produced by tubular glands serve a variety of functions, such as
      - **lubrication,**
      - **protection,**
      - **digestion,**
      - **thermoregulation, a**
      - **maintaining homeostasis.**

3.Regulation:

1. The activity of tubular glands is regulated by a combination of **neural, hormonal, and local factors.**
2. Stimuli such as nerve impulses, hormonal signals, and changes in the local environment can trigger the release of glandular secretions.

	Type	Description	Location
	simple tubular *or* simple straight tubular *or* straight tubular	the gland is a uniform tube	Small intestine • Crypts of Lieberkühn, • uterine glands
	coiled tubular *or* simple coiled tubular	the gland is coiled without losing its tubular form	**sweat glands**
	simple branched tubular *or* compound tubular	branching occurs in the tubes	pyloric glands of stomach

https://en.wikipedia.org/wiki/Tubular_gland

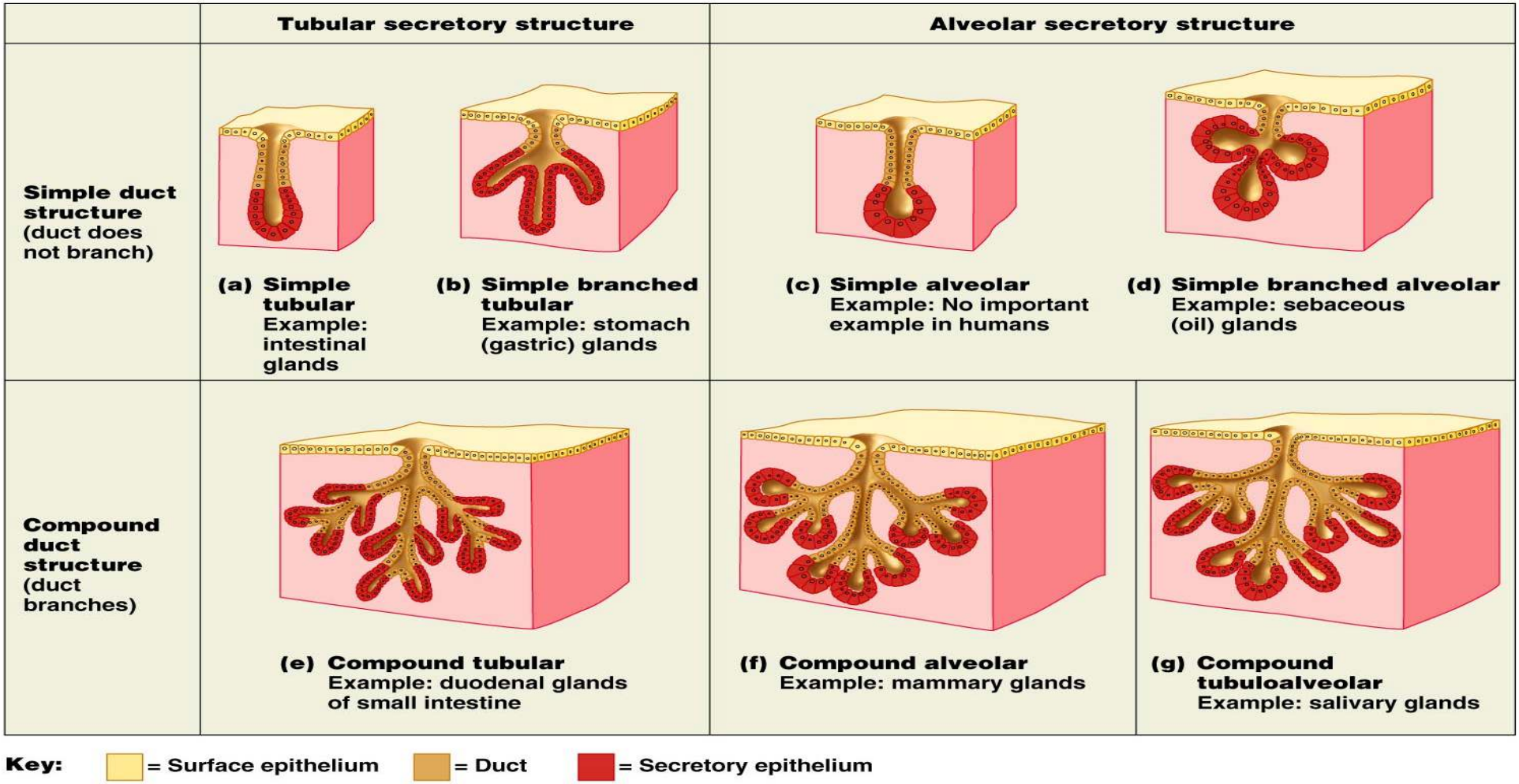


Figure 4.4

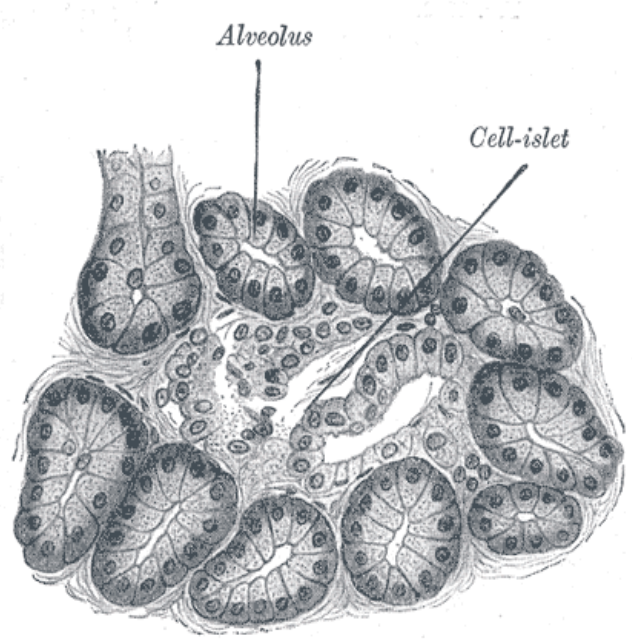
Alveolar glands

- also called saccular glands, are another **major type of secretory structure**.
- Alveolar glands, also known as acinar glands, are a type of multicellular exocrine gland
- In contrast to tubular glands, alveolar glands have a sac-like secretory portion, resembling a round berry.
- Their name comes from their similarity in **shape to alveoli**, the tiny air sacs found in the lungs.
- They typically have an enlarged lumen (cavity), hence the name: they have a shape similar to alveoli, the very small air sacs in the lungs.

•Alveolar **glands consist of clusters of small, rounded secretory sacs known as alveoli.**

•These sacs are surrounded by supportive connective tissue and are connected to a duct system that allows the secretion to be transported to the surface or target organ.

•The secretory cells lining the alveoli are typically cuboidal or columnar in shape and are responsible for producing and releasing the glandular secretion into the alveolar lumen.



•**Location:**
•Alveolar glands are found throughout the body and play diverse roles in different organs.

•Some examples include:
- •**Salivary glands:** Secrete saliva to moisten food and aid digestion.
- •**Mammary glands:** Secrete milk for nourishing offspring.
- •**Pancreas:** Secrete digestive enzymes into the small intestine to break down carbohydrates, proteins, and fats.
- •**Sebaceous glands:** Found in the skin and secrete sebum, an oily substance that lubricates the skin and hair.
- •**Wax glands:** Found in the ear canal and secrete earwax to protect the ear canal from dust and debris.

Types:

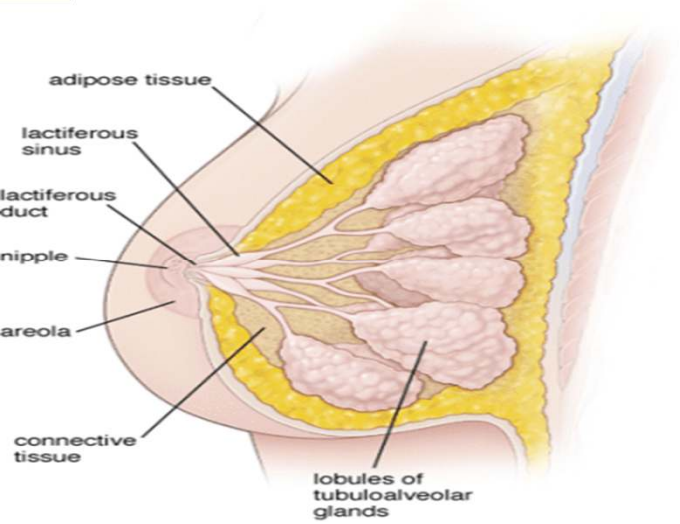
1. **Simple Alveolar Glands**: These glands have a single, unbranched alveolar structure.
   - **Examples include the sebaceous glands in the skin, which produce an oily substance called sebum.**
2. **Compound Alveolar Glands**: These glands have branched alveolar structures with multiple secretory sacs connected to a common duct system.
   - **Examples include the mammary glands, which produce and secrete milk.**

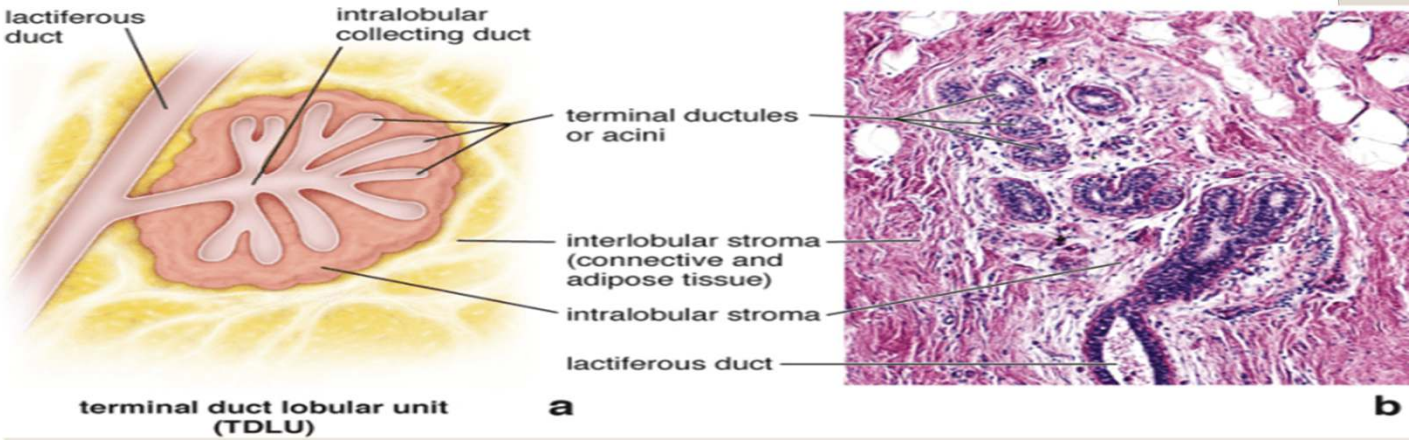
1.Function:

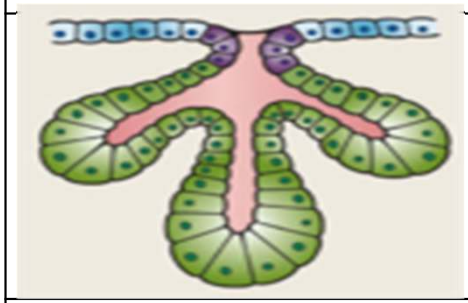
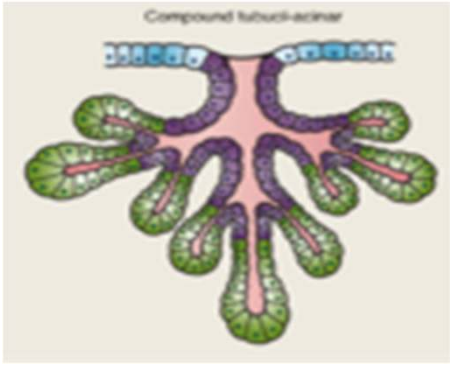
1. The secretions produced by alveolar glands vary depending on the specific type of gland and its location in the body.
2. **Sebaceous glands secrete sebum, an oily substance that lubricates the skin and hair, prevents dehydration, and inhibits the growth of bacteria and fungi.**
3. **Mammary glands produce and secrete milk, which provides nutrition and immune protection to offspring during lactation.**

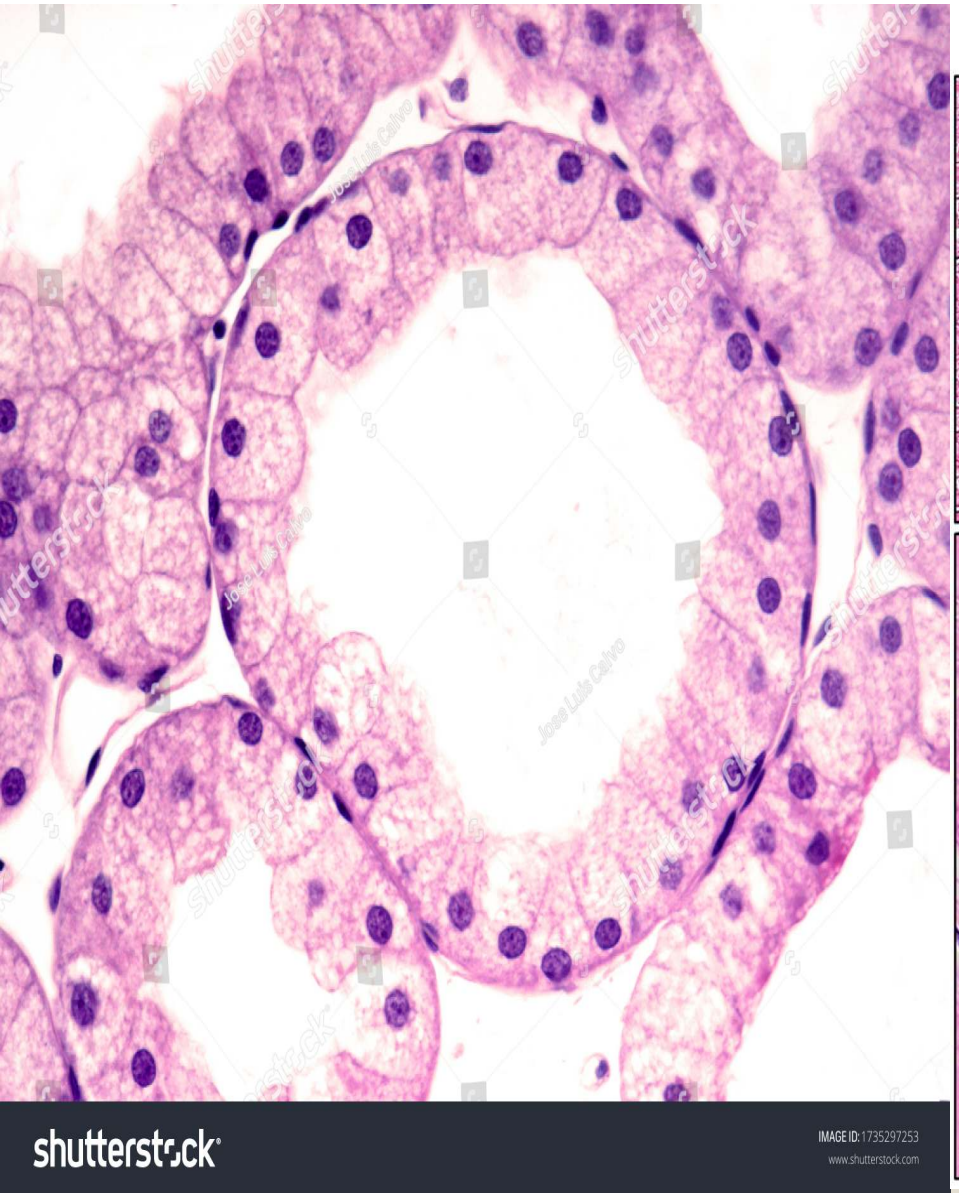
2.Regulation:

1. The activity of alveolar glands is regulated by **hormonal, neural, and local factors**.
   - Hormones such as estrogen and progesterone play key roles in the development and function of mammary glands during pregnancy and lactation.
2. **Neural signals, including autonomic nervous system activity, can stimulate or inhibit glandular secretion in response to various stimuli or environmental changes.**

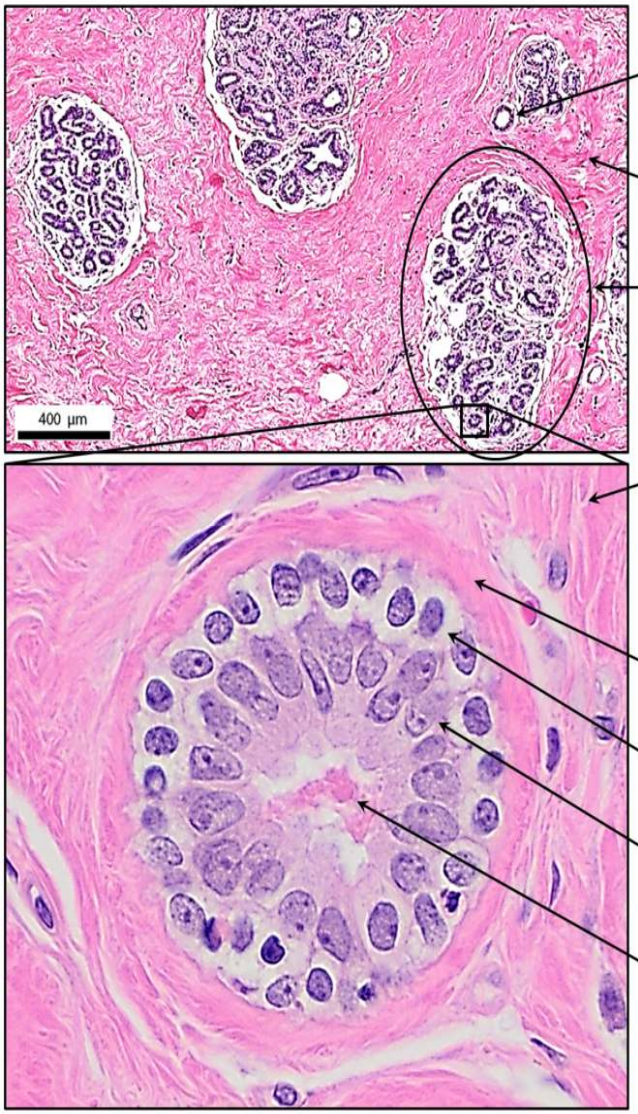




	Type	Description	Location
	simple branched acinar		thyroid glands
	• tubuloalveolar • *or* tubulo-alveolar • *or* tubulo-acinar • *or* compound tubulo-acinar • *or* compound tubul oalveolar	glands that start out as simple branched tubular, and branch further to terminate in alveoli	• salivary glands, • esophagus • mammary glands



Breast histology



Duct

Interlobular stroma

Lobule

Intralobular stroma

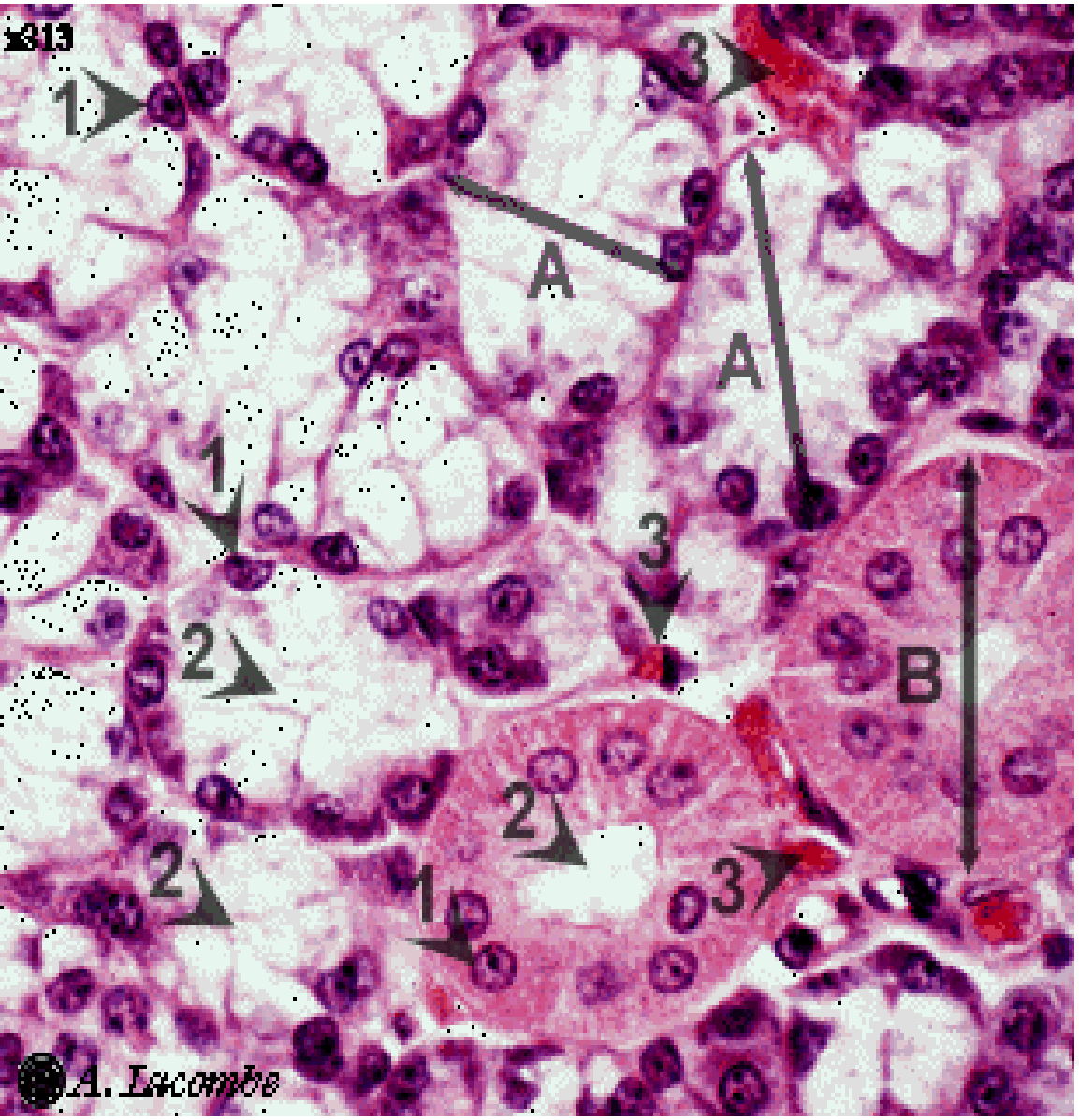
Acinus:

Basement membrane

Myoepithelial cells

Luminal epithelial cells

Lumen (with eosinophilic secretions)



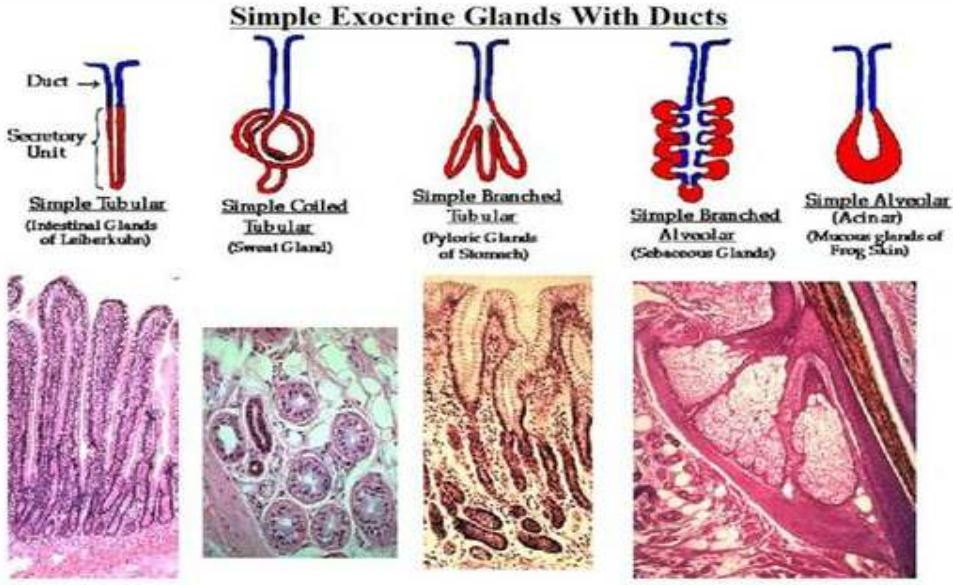
A: secretory parts of the gland: the secretory cells are full of mucus (in white)

B: duct of the gland (the nuclei of the duct cells are round --> simple cuboidal epithelium)

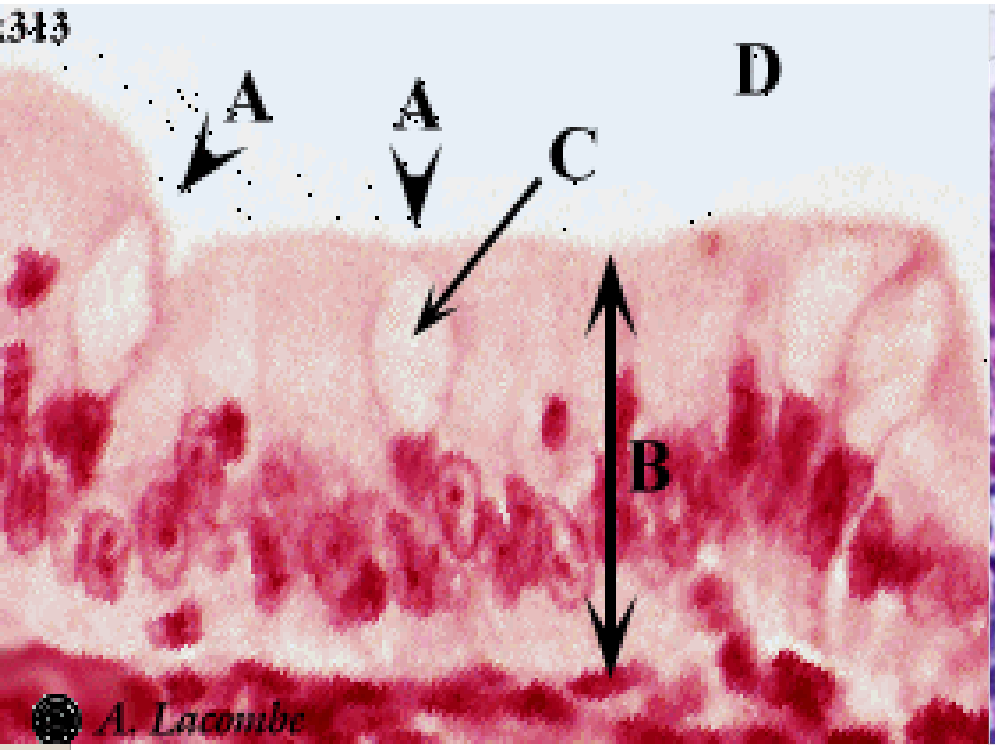
nucleus

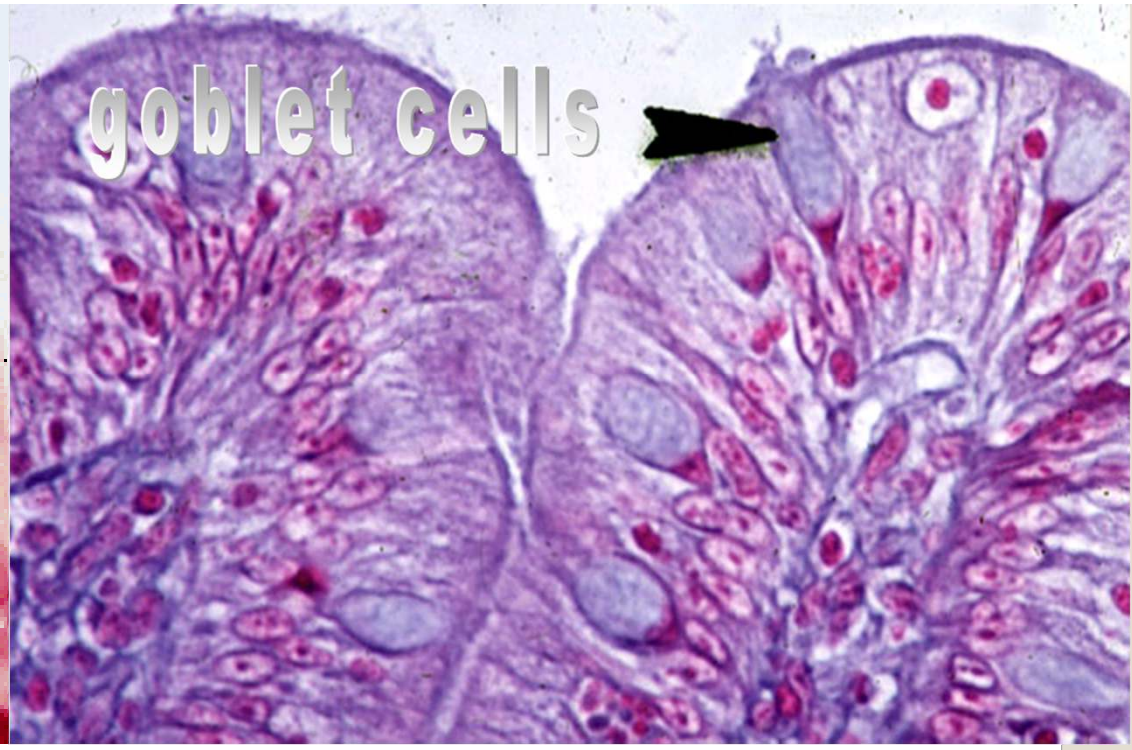
lumen

capillary (you can see the red blood cells in red and distinguish the fine simple squamous epithelium with its flat nuclei surrounding them)



Exocrine Glands - Glands that secrete substances outward through a duct





UNICELLULAR EXOCRINE GLANDS

- The epithelium (B) bordering the lumen (D) is simple columnar.
- In this photo, the unicellular glands are goblet cells (A) that manufacture and secrete mucus (C).
- In this specific case, goblet cells are unicellular glands because they do not associate with each other to form secretory units (= multicellular exocrine glands).
- They are instead scattered amongst the non secretory cells of the epithelium and secrete mucus directly in the lumen.

Goblet Cell

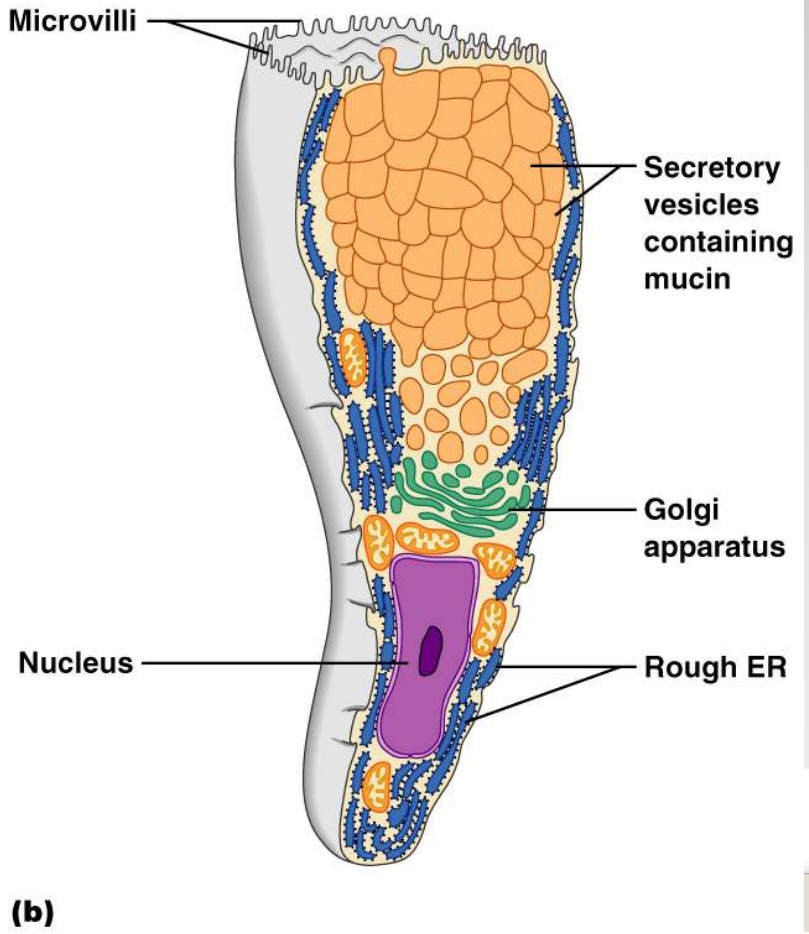
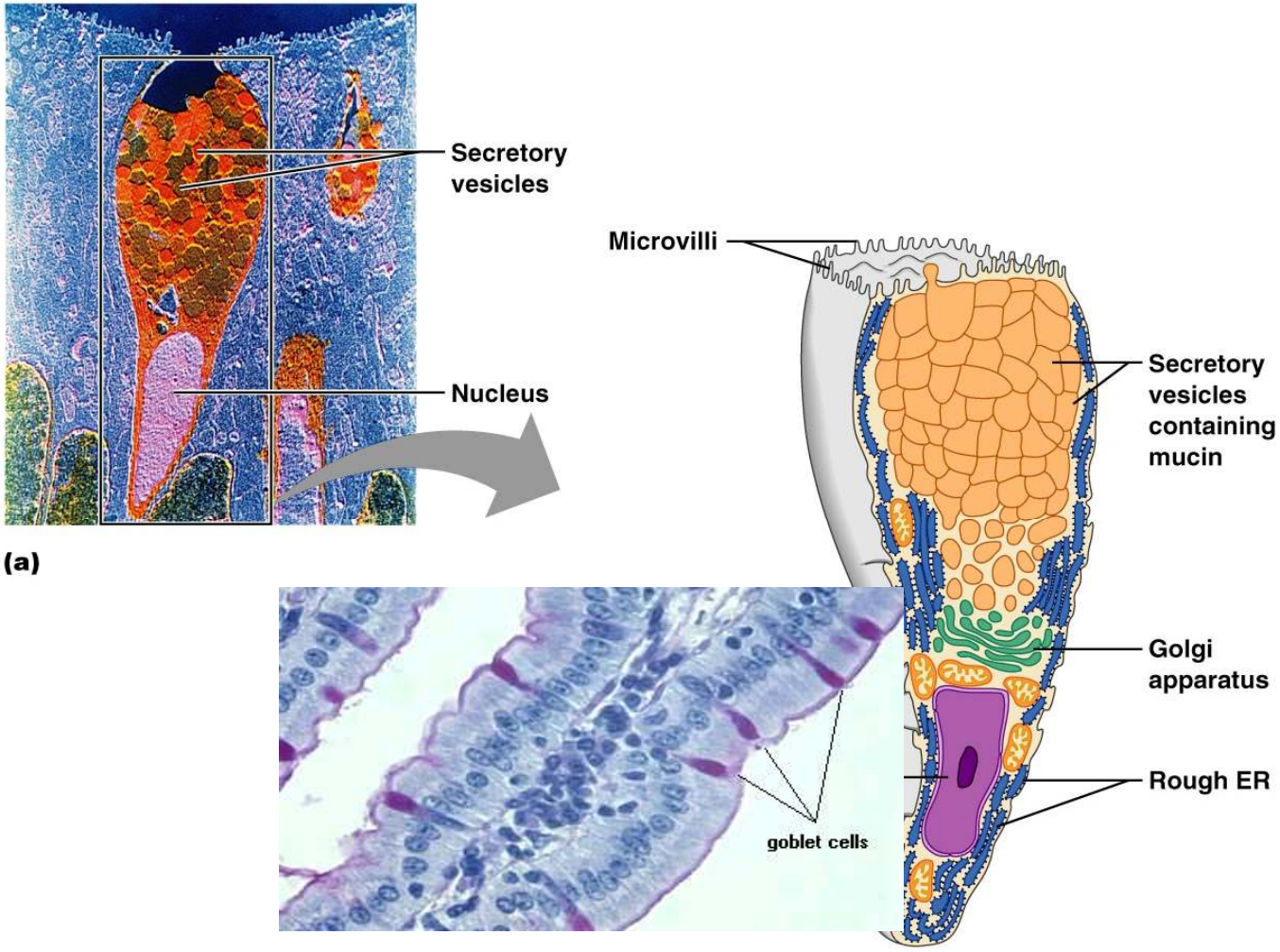
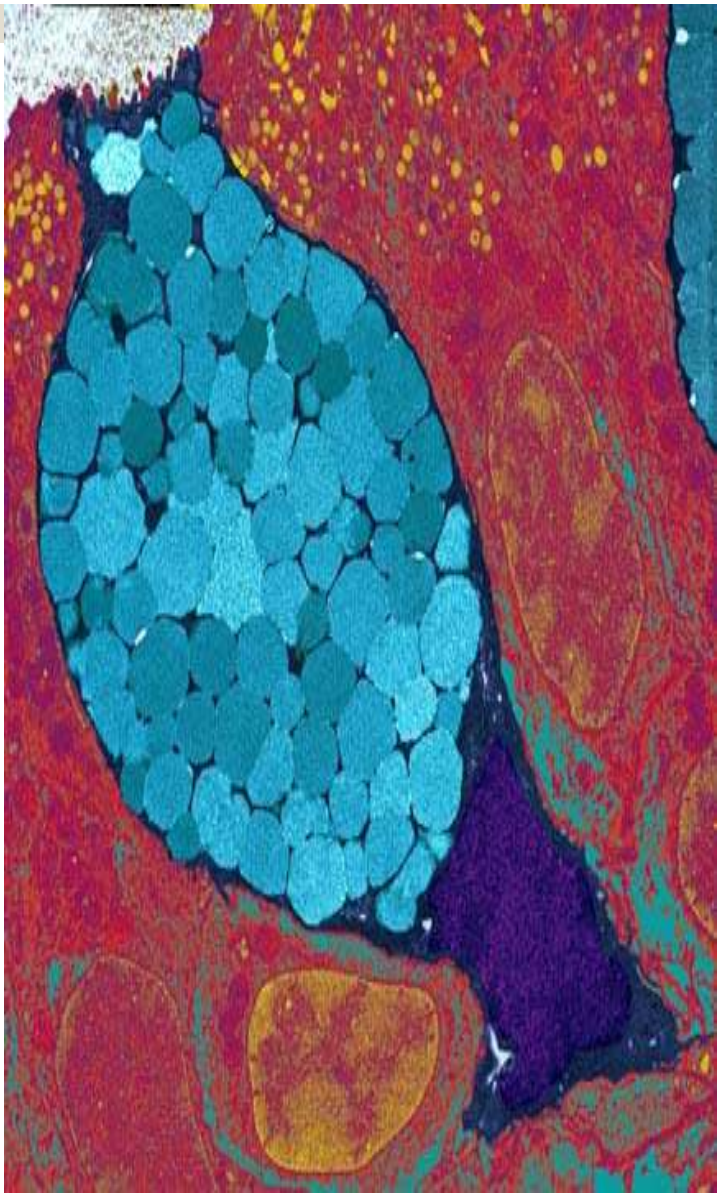


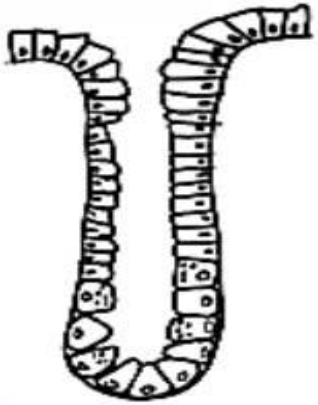
Figure 4.3b





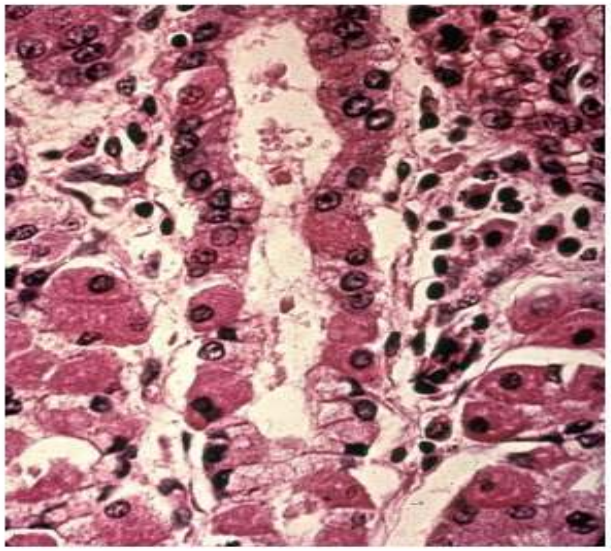
Simple Exocrine Gland Without Ducts

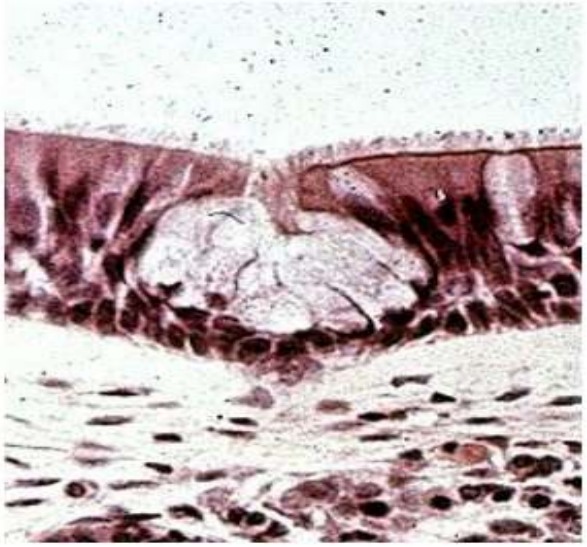
Unicellular Glands
(mucose or goblet cells
of intestinal mucosa)



Secretory Sheet
(gastric pit chief
and parietal cells)

Intraepithelial Gland
(efferent ducts
of urethra)



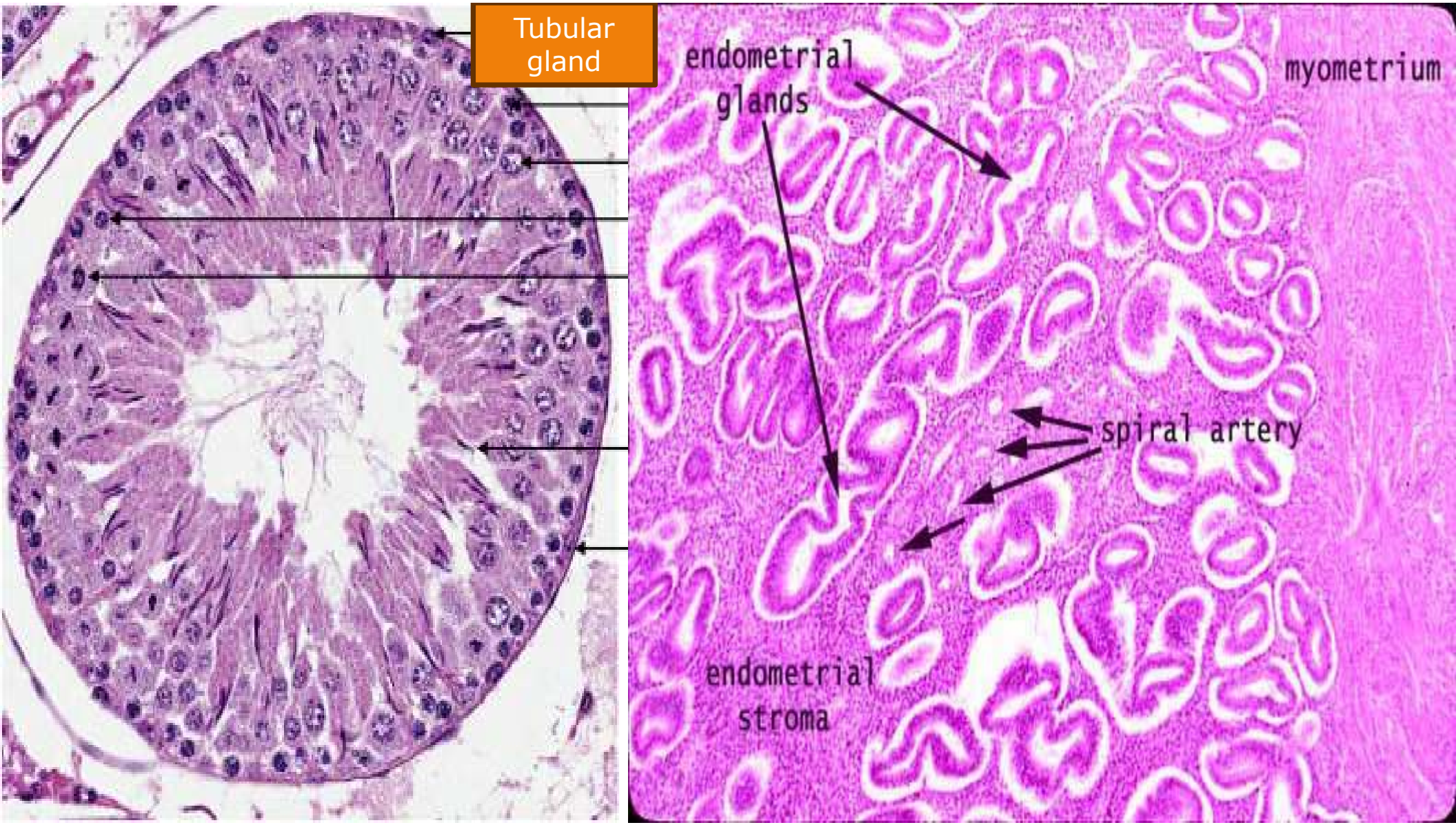


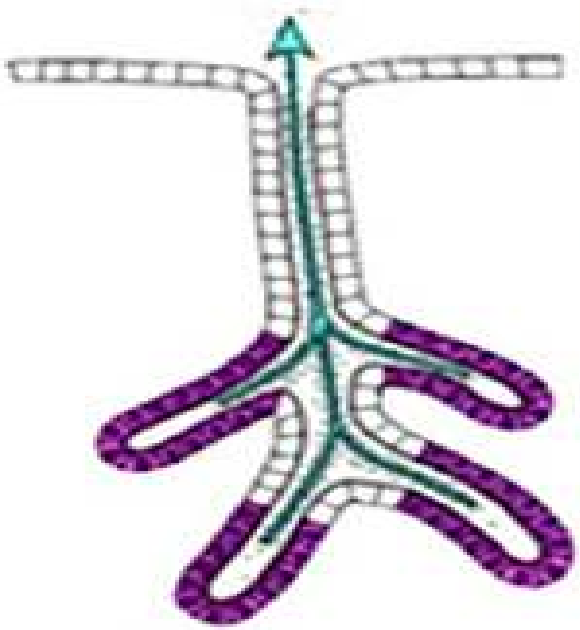
Simple Exocrine Glands

Simple Branched Saccular Gland
Associated with the hair follicle in thin skin.

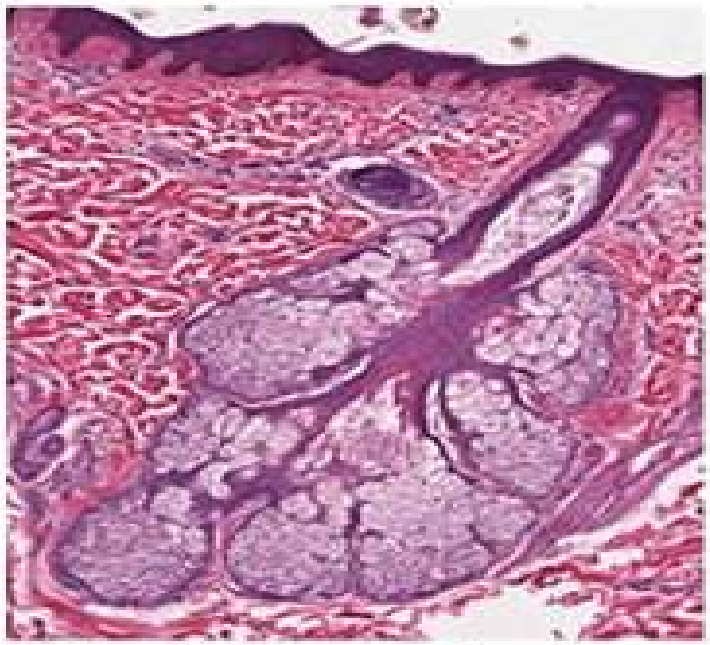
Simple Coiled Tubular Gland
Thick skin.

Simple Straight Tubular Gland
Large intestine. intestinal gland or "crypt of Lieberkuhn"

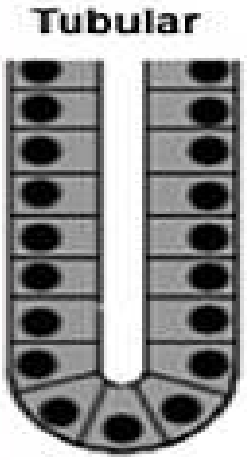

Tubular gland
endometrial glands
myometrium
spiral artery
endometrial stroma

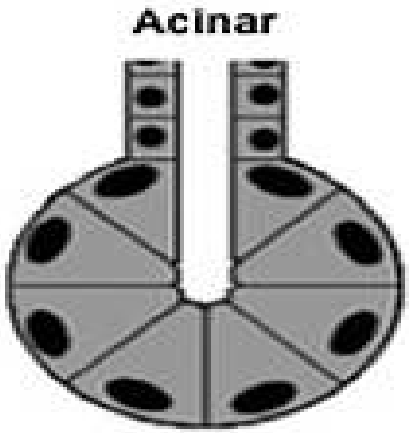


Simple branched tubular

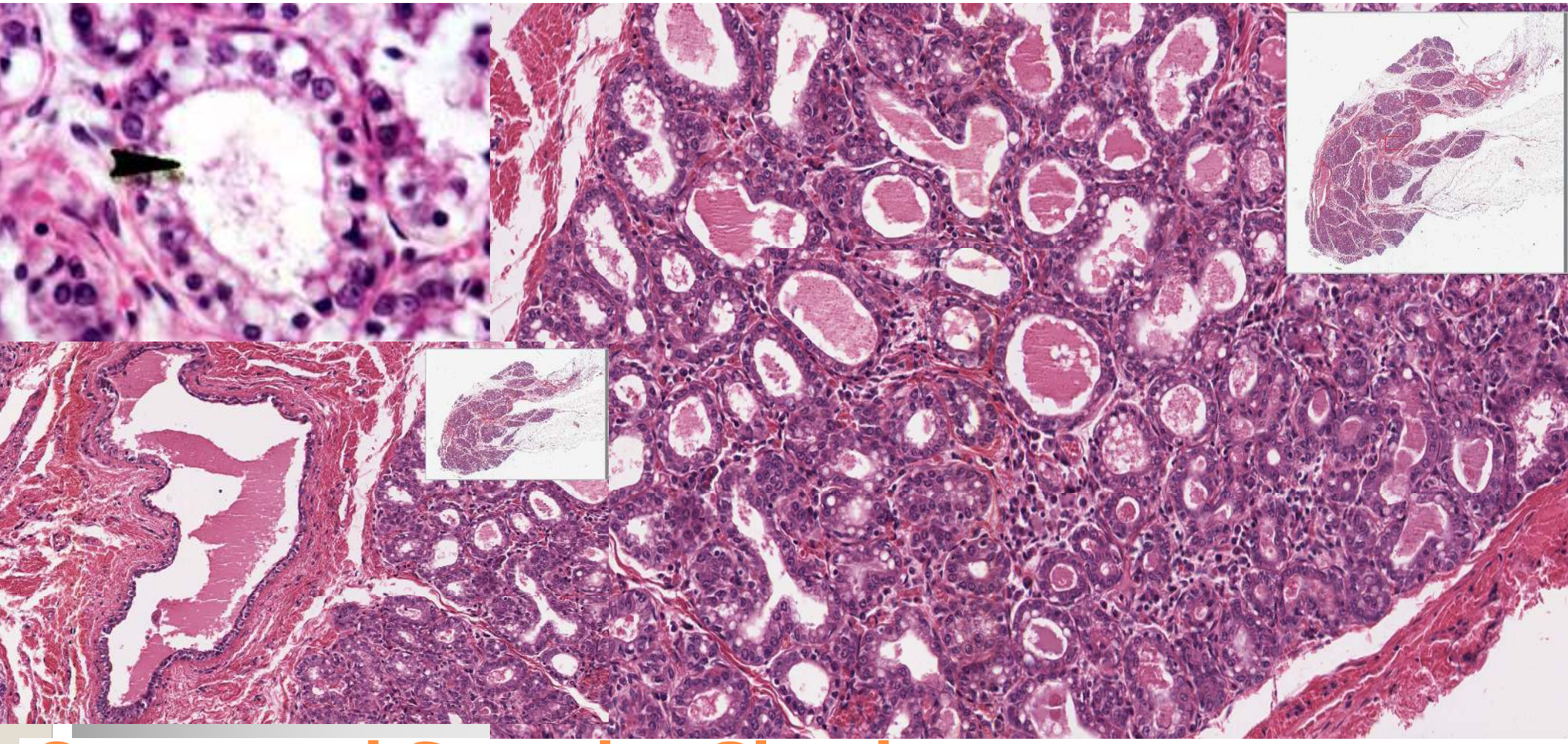


Simple branched acinar





Class of gland	Example
Simple, tubular	Lining of large intestine
Simple, coiled tubular	Sweat glands of skin,
Simple branched acinar	Sebaceous glands of skin,
Compound, acinar	Exocrine pancreas
Compound, tubuloacinar	Submandibular salivary gland,



Compound Saccular Gland
Active mammary gland.

Serous and mucous glands

- Both types of exocrine glands, meaning they release secretions through ducts onto an epithelial surface.
- However, **they differ in the type of secretion they produce and the structure of their cells**

Serous glands

•Secretion:

- •Serous glands secrete a thin, **watery fluid rich in enzymes.**
- •These enzymes help break down carbohydrates, proteins, and fats.

•Cells:

- •Serous glands are composed of serous cells, which are typically pyramidal or cuboidal in shape.
- •The cytoplasm of serous cells contains numerous **zymogen granules**, which store inactive enzymes (enzymes precursors).
- • Upon stimulation, these enzymes are released into the duct and become active.

•Location:

- •Examples of serous glands include **the parotid glands (salivary glands), the exocrine pancreas, and Brunner's glands in the duodenum (small intestine**).

Mucous glands

•Secretion:

- •Mucous glands **secrete mucus**, a thick, sticky **substance that traps dust, debris, and pathogens.**
- •Mucus also helps **lubricate and protect surfaces**.

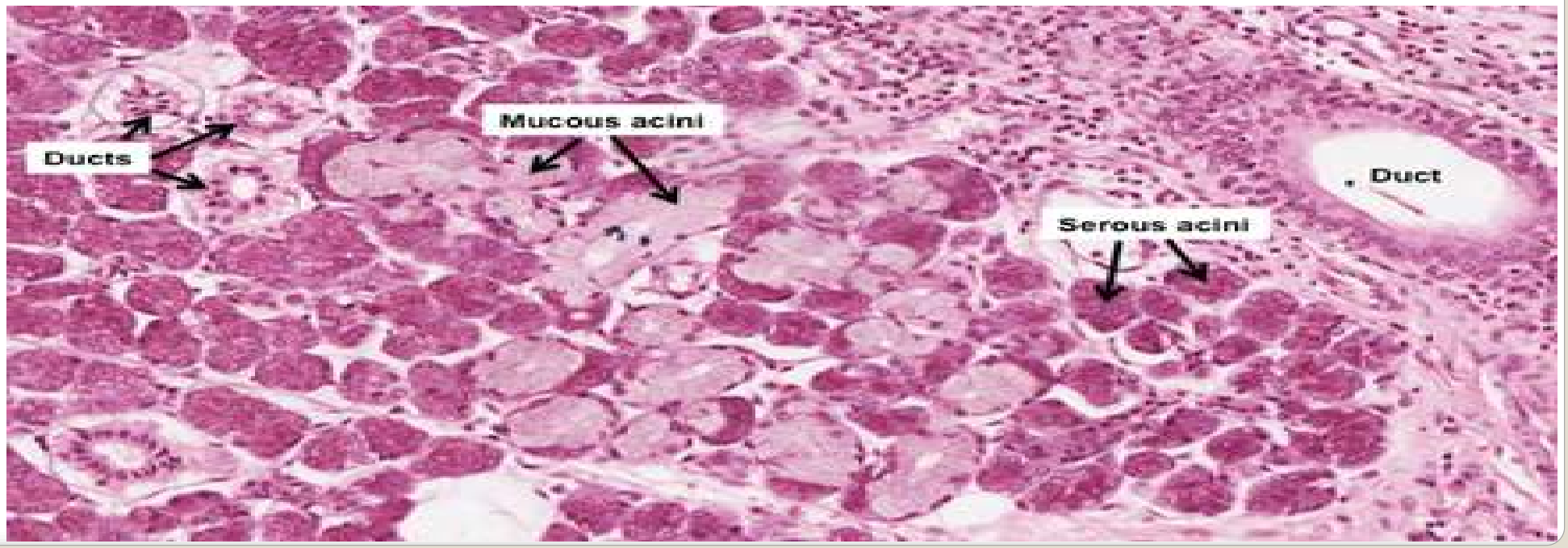
•Cells:

- •Mucous glands are composed of mucous cells, which are **typically columnar in shape**.
- •The cytoplasm of mucous cells is filled with mucinogen granules, which contain mucins, the major component of mucus.

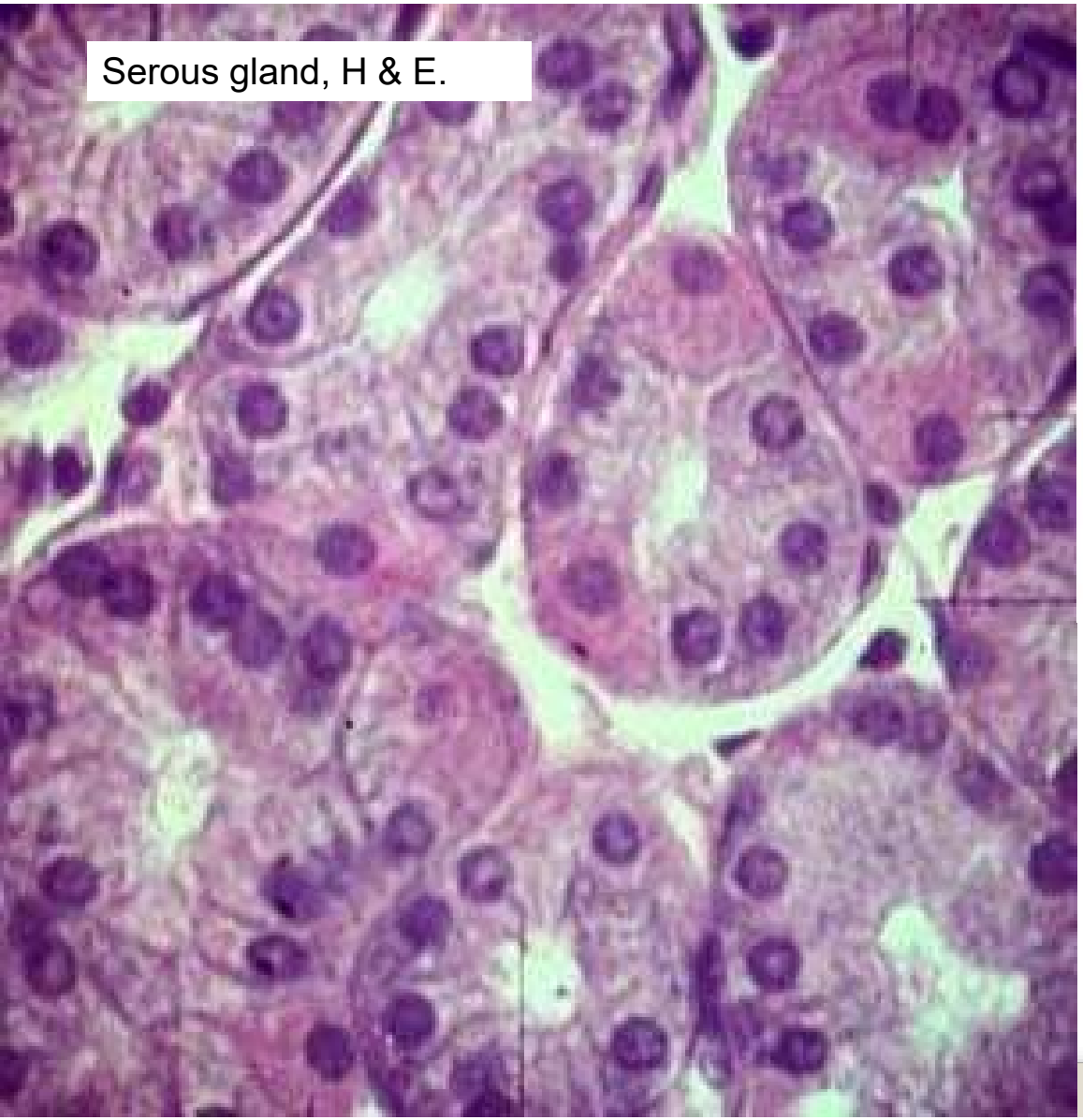
•Location:

- •Examples of mucous glands include **the goblet cells lining the respiratory tract, the sublingual glands (salivary glands), and the lining of the stomach.**

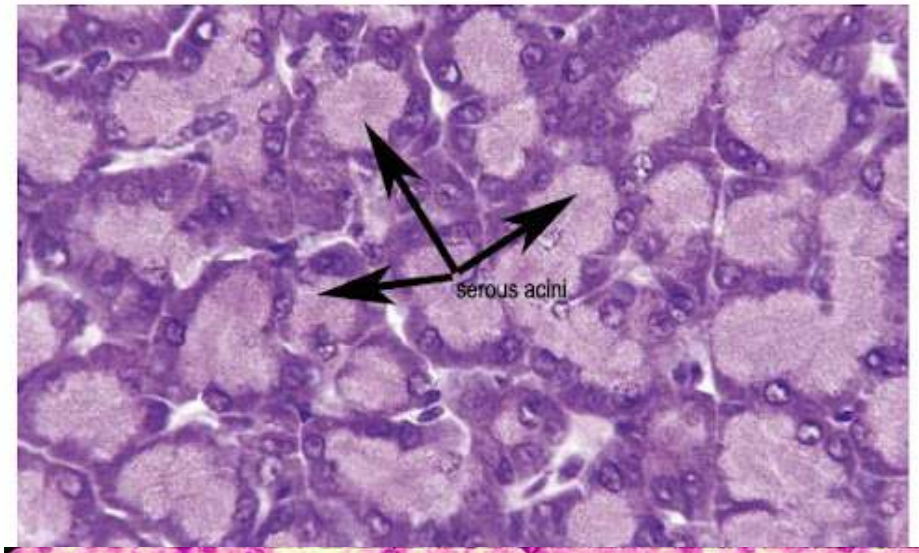
Feature	Serous glands	Mucous glands
Secretion	Thin, watery fluid rich in enzymes	Thick, sticky mucus
Cells	Serous cells (pyramidal or cuboidal)	Mucous cells (columnar)
Cell contents	Zymogen granules (inactive enzymes)	Mucin granules
Location	Parotid glands, pancreas, Brunner's glands	Goblet cells, sublingual glands, stomach lining

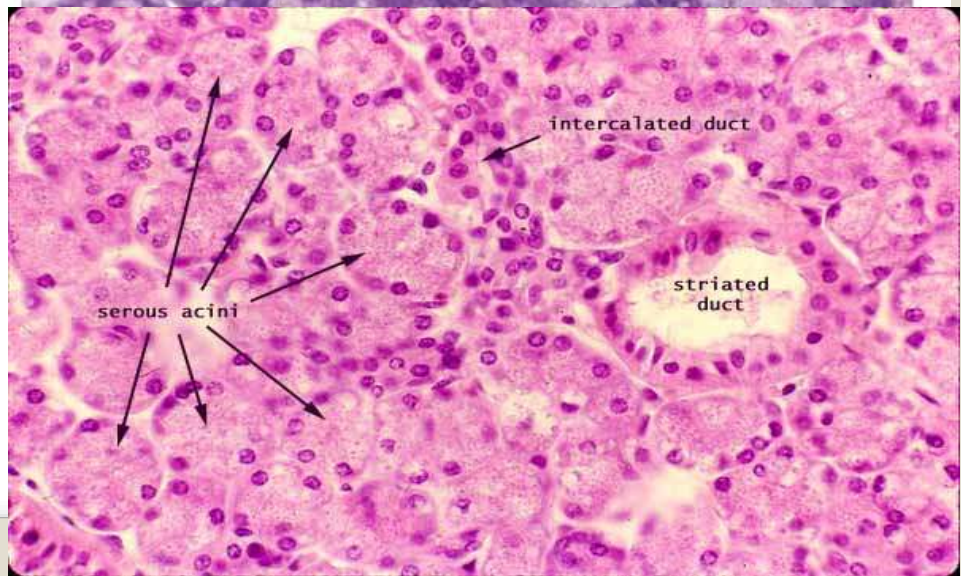


Serous gland, H & E.

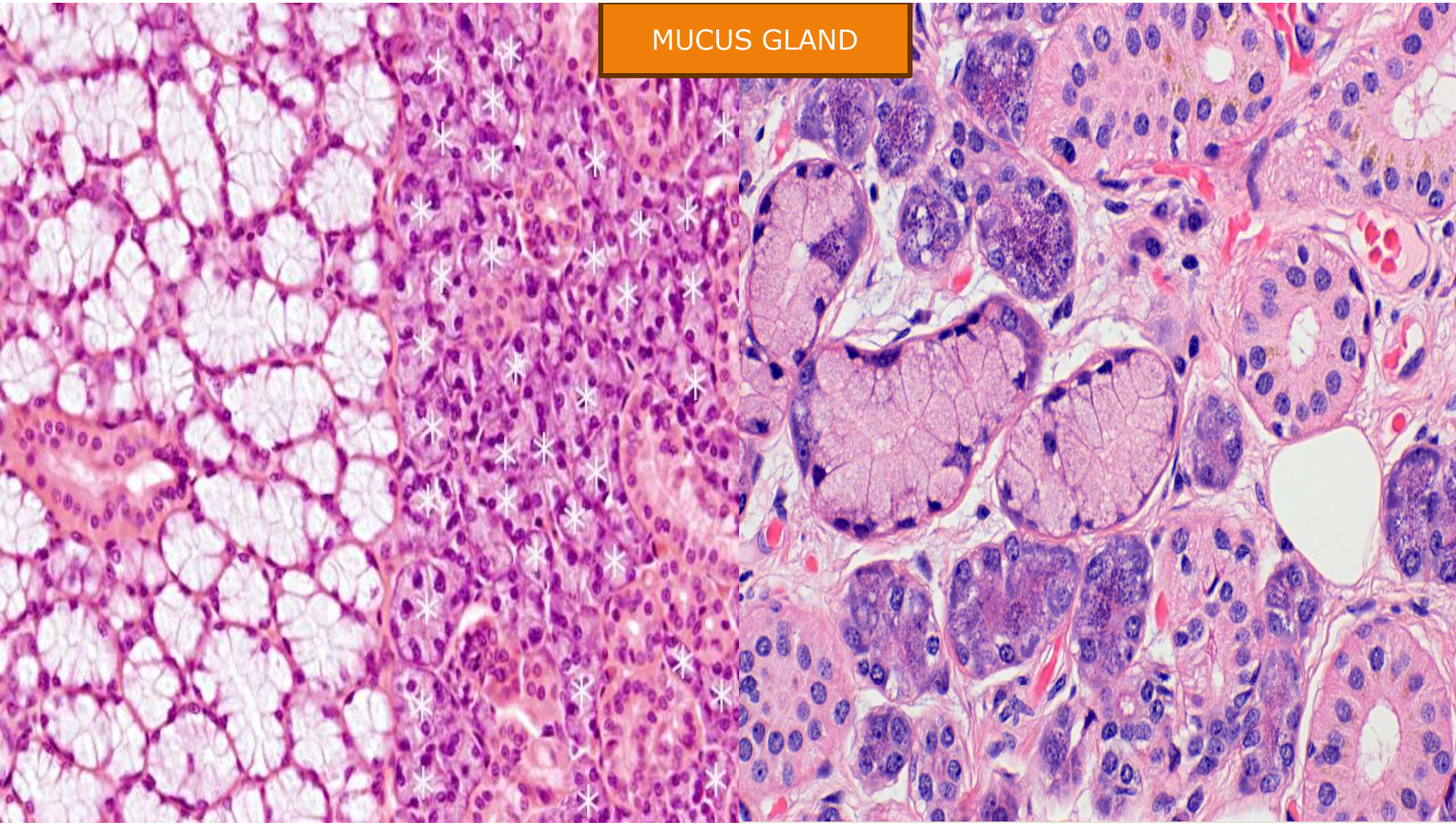


SEROUS GLAND



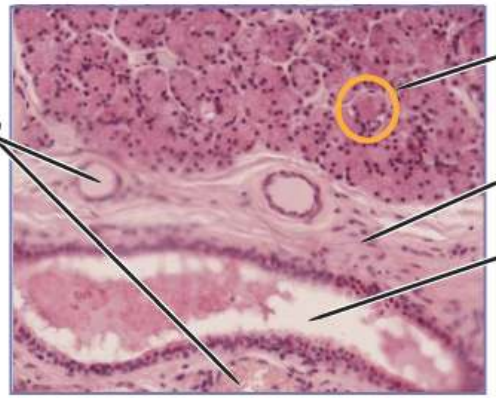


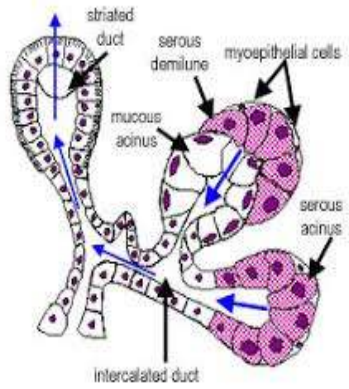
MUCUS GLAND



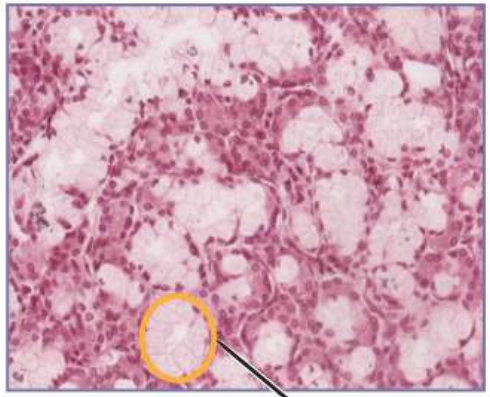
Salivary Glands

Parotid

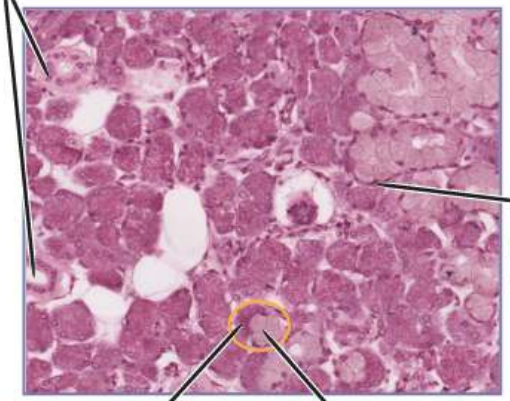


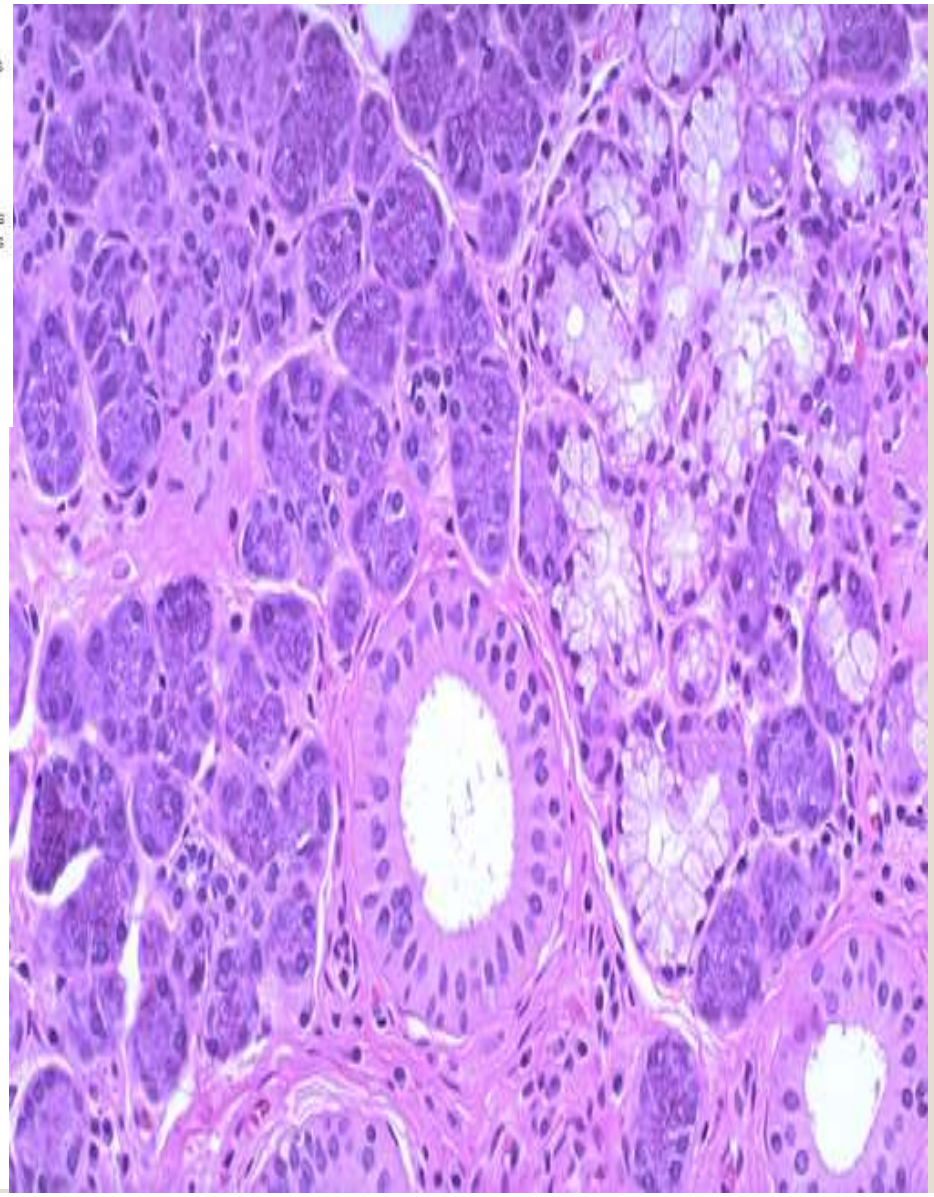


Sublingual

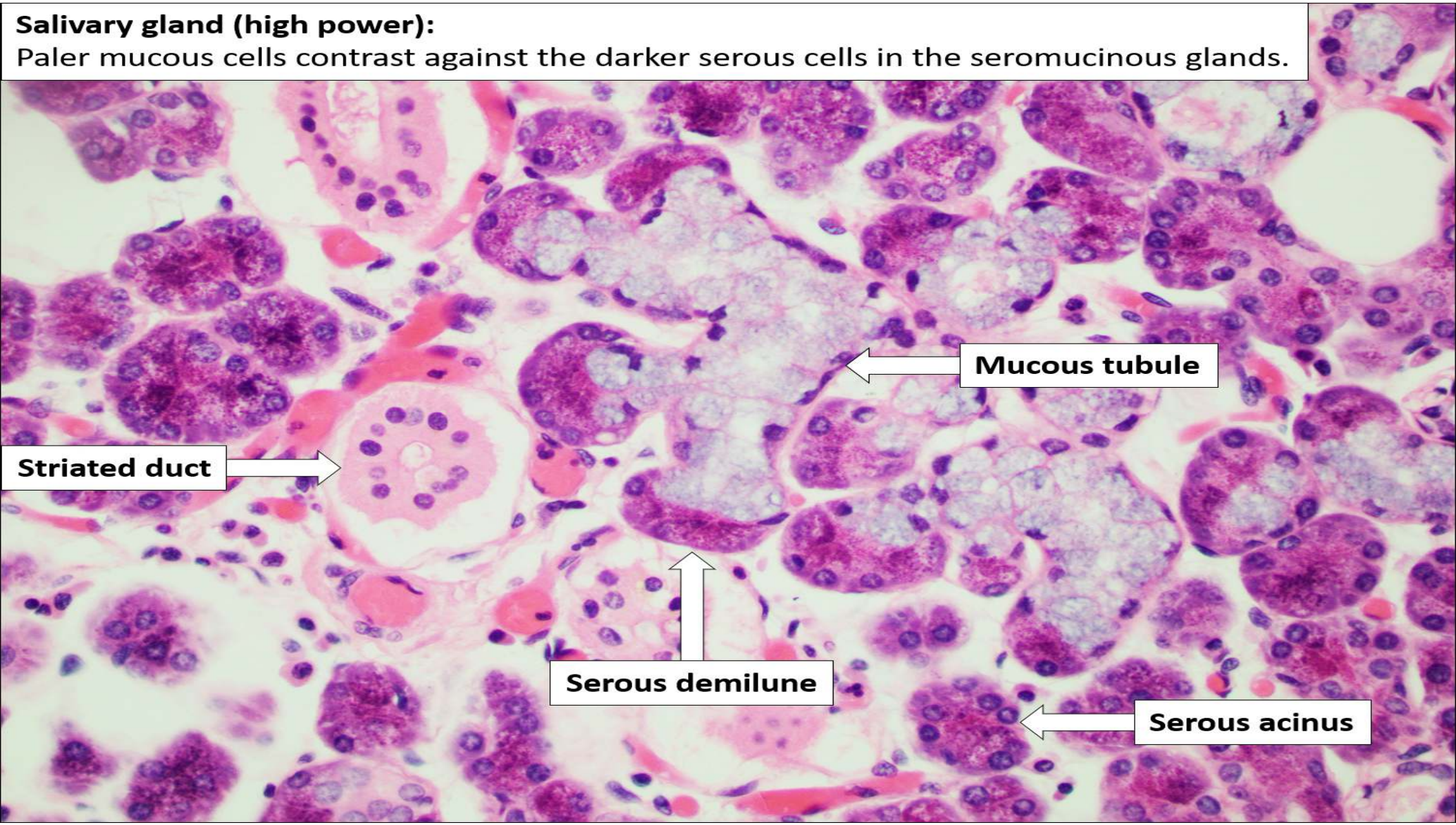


Submandibular





Salivary gland (high power):
Paler mucous cells contrast against the darker serous cells in the seromucinous glands.



Mixed glands

- Many glands in the body are actually mixed glands, containing both serous and mucous cells.
- This allows them to secrete a combination of enzymes and mucus, providing a more versatile function.
- For example,
  - the submandibular glands (salivary glands) contain both serous and mucous cells, allowing them to secrete a saliva that is both watery (to dissolve food) and thick (to lubricate food passage).


Serous secreting cells


Merocrine glands

https://www.youtube.com/watch?app=desktop&v=iIdEKUC62ME&ab_channel=LecturioMedical

https://www.youtube.com/watch?v=09IsSmngM9g

https://www.youtube.com/watch?v=reoEVXvoUmI

https://www.youtube.com/watch?v=umgio0gqKPc

https://www.youtube.com/watch?v=A3An8mGcC-I