

# Glandular tissues

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### Simple squamous

- Lines blood vessels and air sacs of lungs
- Permits exchange of nutrients, wastes, and gases



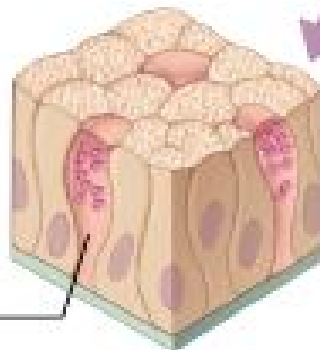
### Simple cuboidal

- Lines kidney tubules and glands
- Secretes and reabsorbs water and small molecules



### Simple columnar

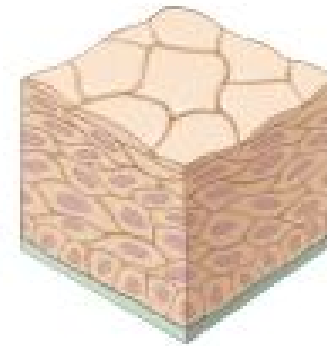
- Lines most digestive organs
- Absorbs nutrients, produces mucus



Goblet cell

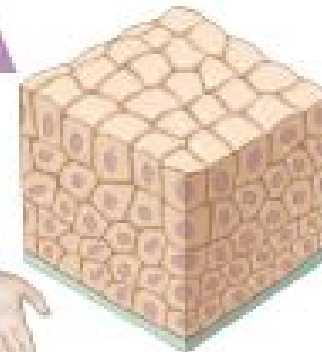
### Stratified squamous

- Outer layer of skin, mouth, vagina
- Protects against abrasion, drying out, infection



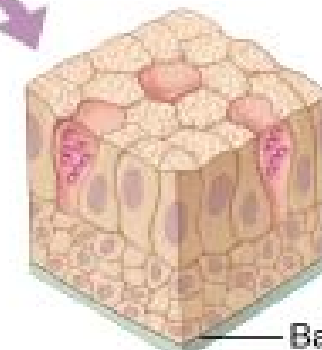
### Stratified cuboidal

- Lines ducts of sweat glands
- Secretes water and ions



### Stratified columnar

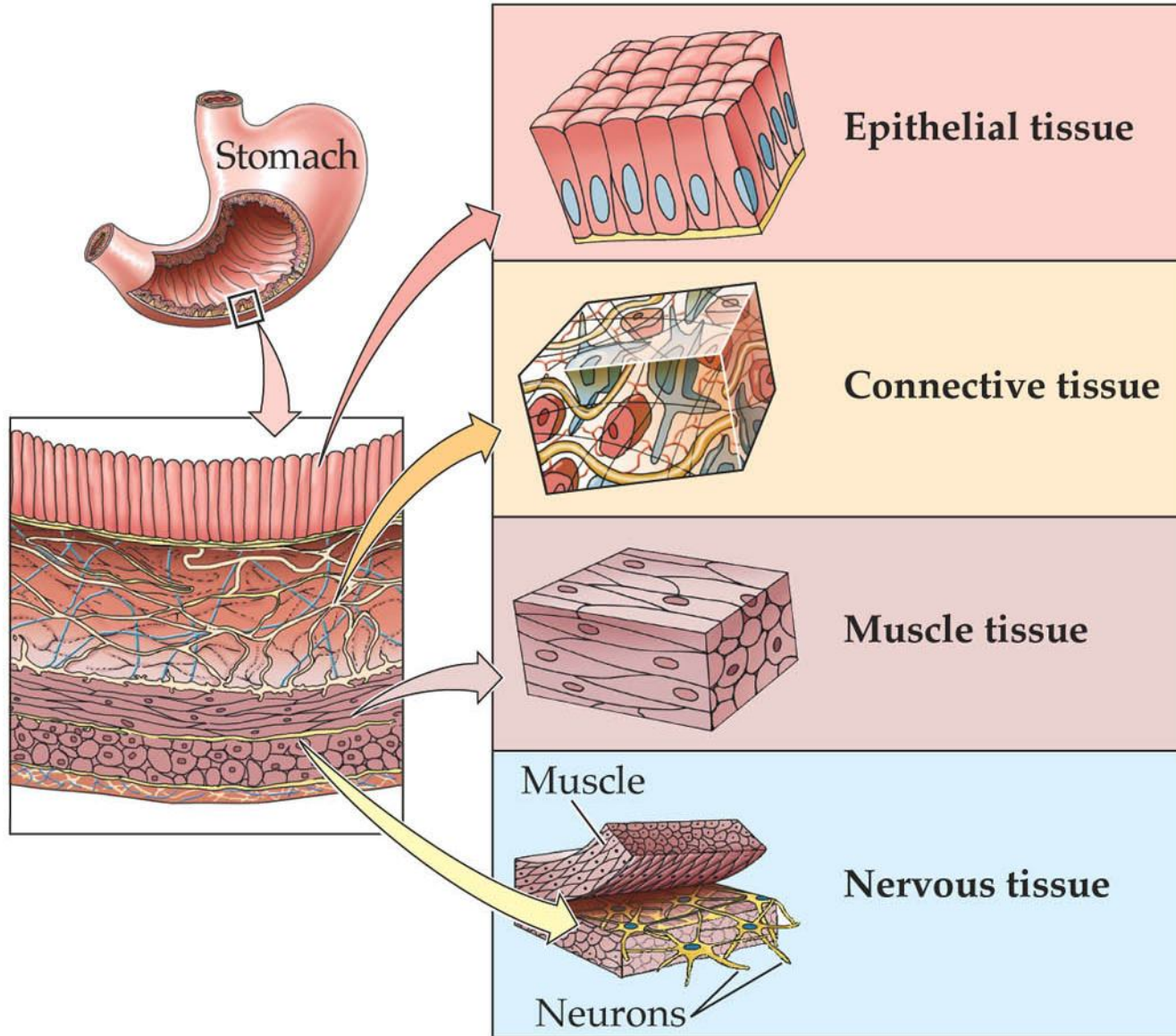
- Lines epididymus, mammary glands, larynx
- Secretes mucus



Basement membrane

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

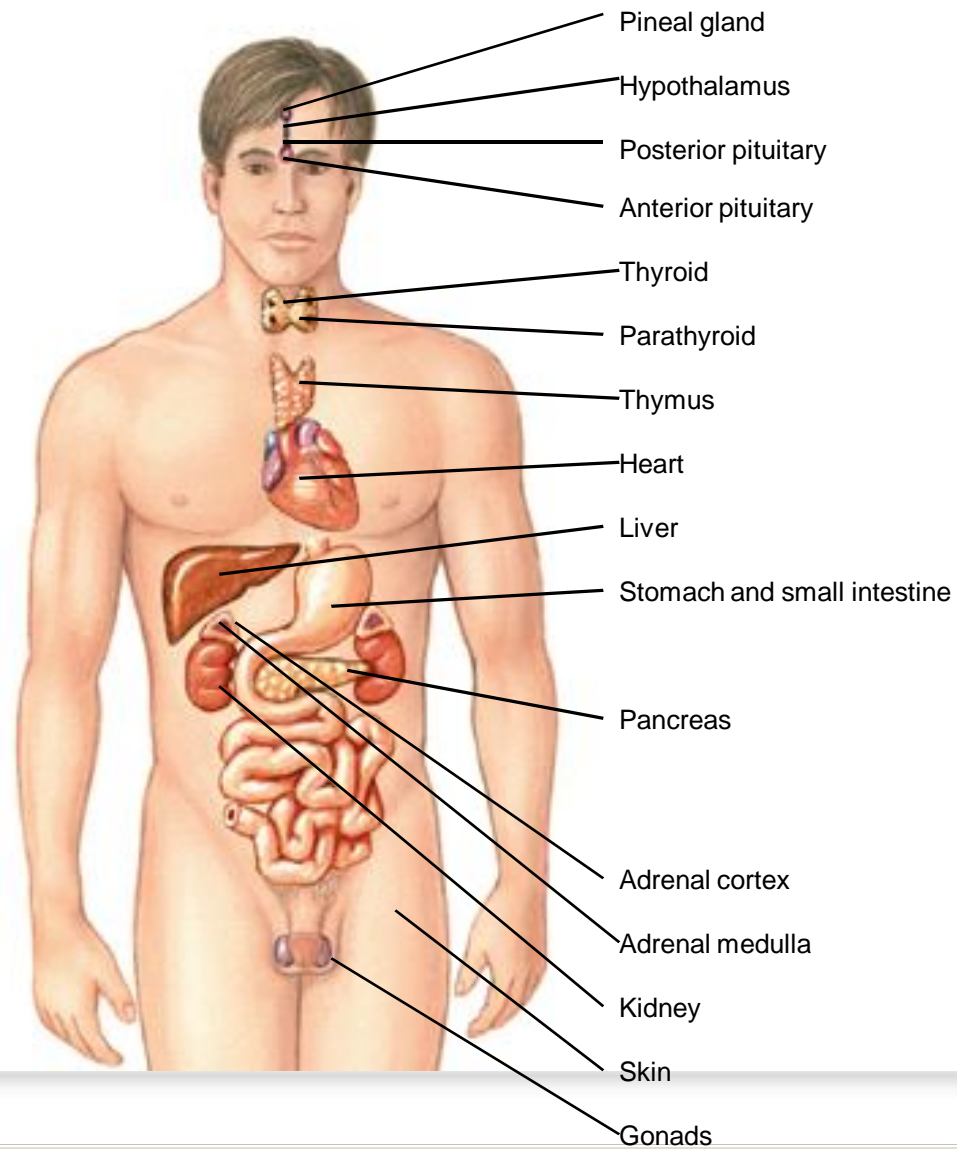
## Tissue type and function



Histologically, glands are described using some standard vocabulary, with which you should be familiar.

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

# 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:** The two 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.**

- Merocrine ,
- Apocrine ,
- Holocrine secretions

**Mechanism of secretion**

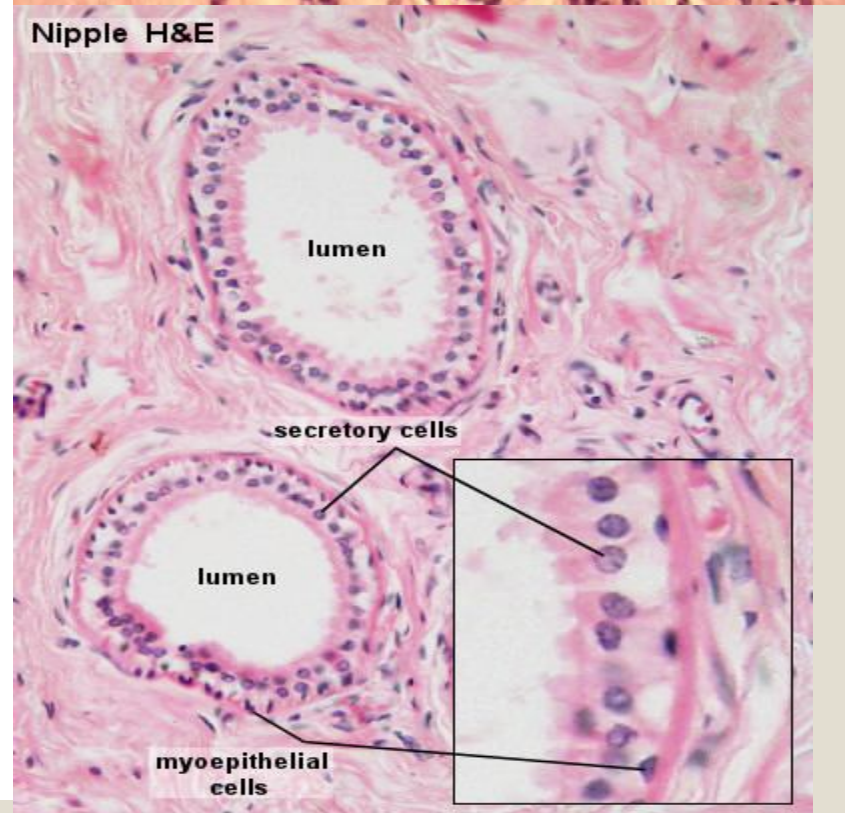


## Merocrine secretion (aka eccrine secretion) -

- 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 (eccrine) secretion:** This common form of secretion involves exocytosis. In merocrine sweat glands, contraction of myoepithelial cells causes the sweat glands to exocytose a hypotonic watery fluid into the excretory segment of the sweat 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.

## 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

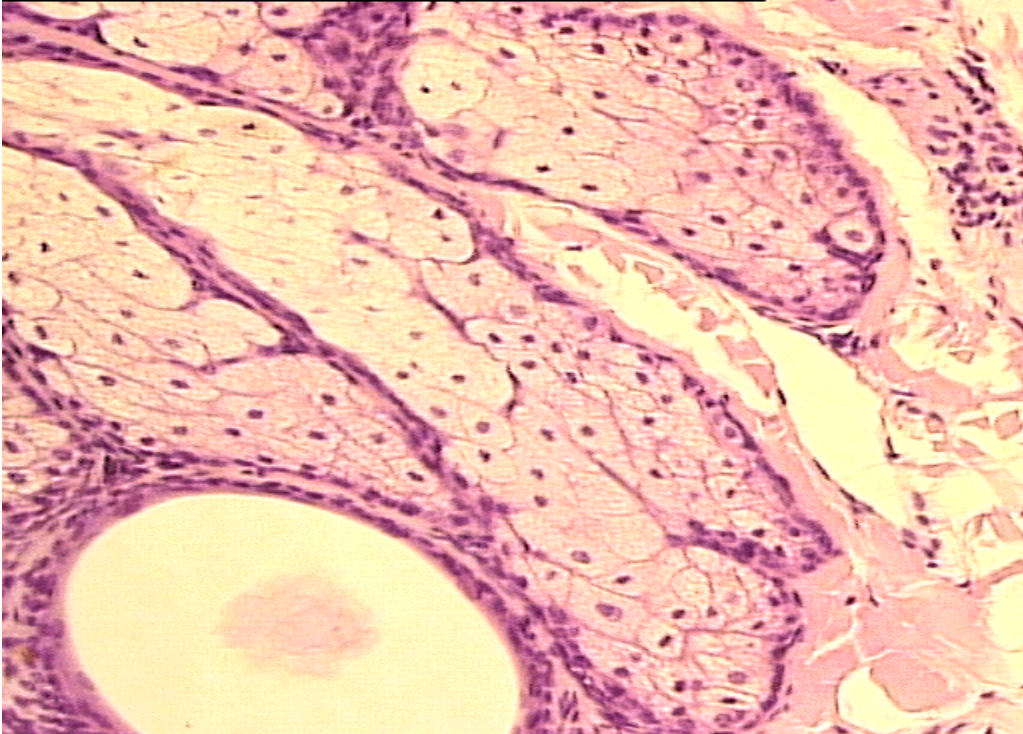
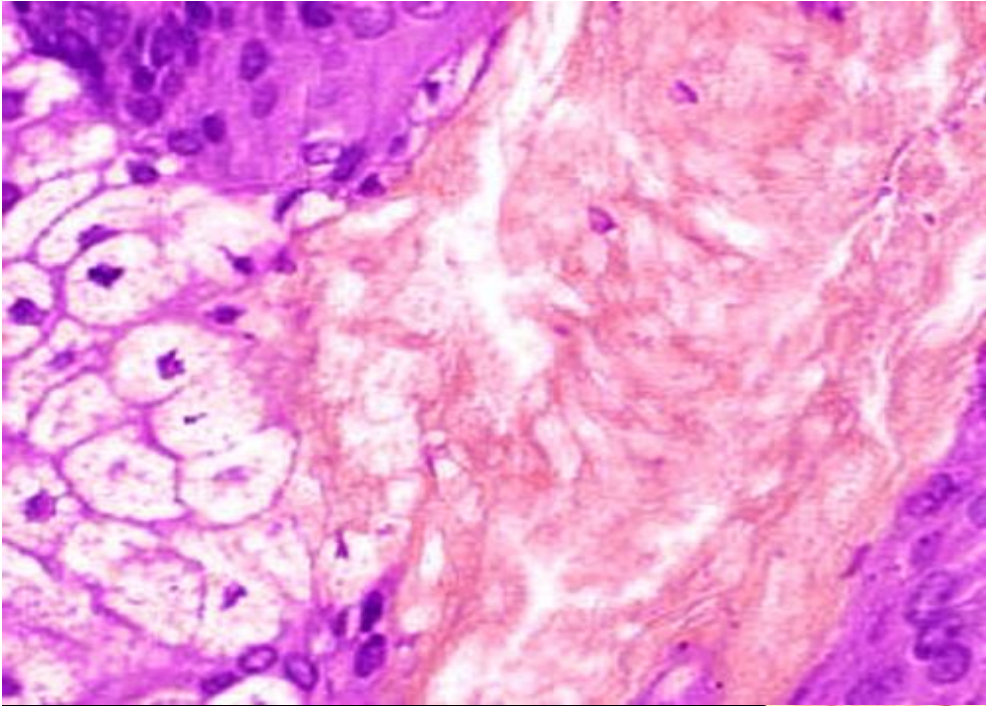
- lactating mammary glands,
- **apocrine glands of skin in the pubic and axilla regions,**
- ciliary (Moll's) glands of the eyelid,
- and the ceruminous glands of the external acoustic meatus.

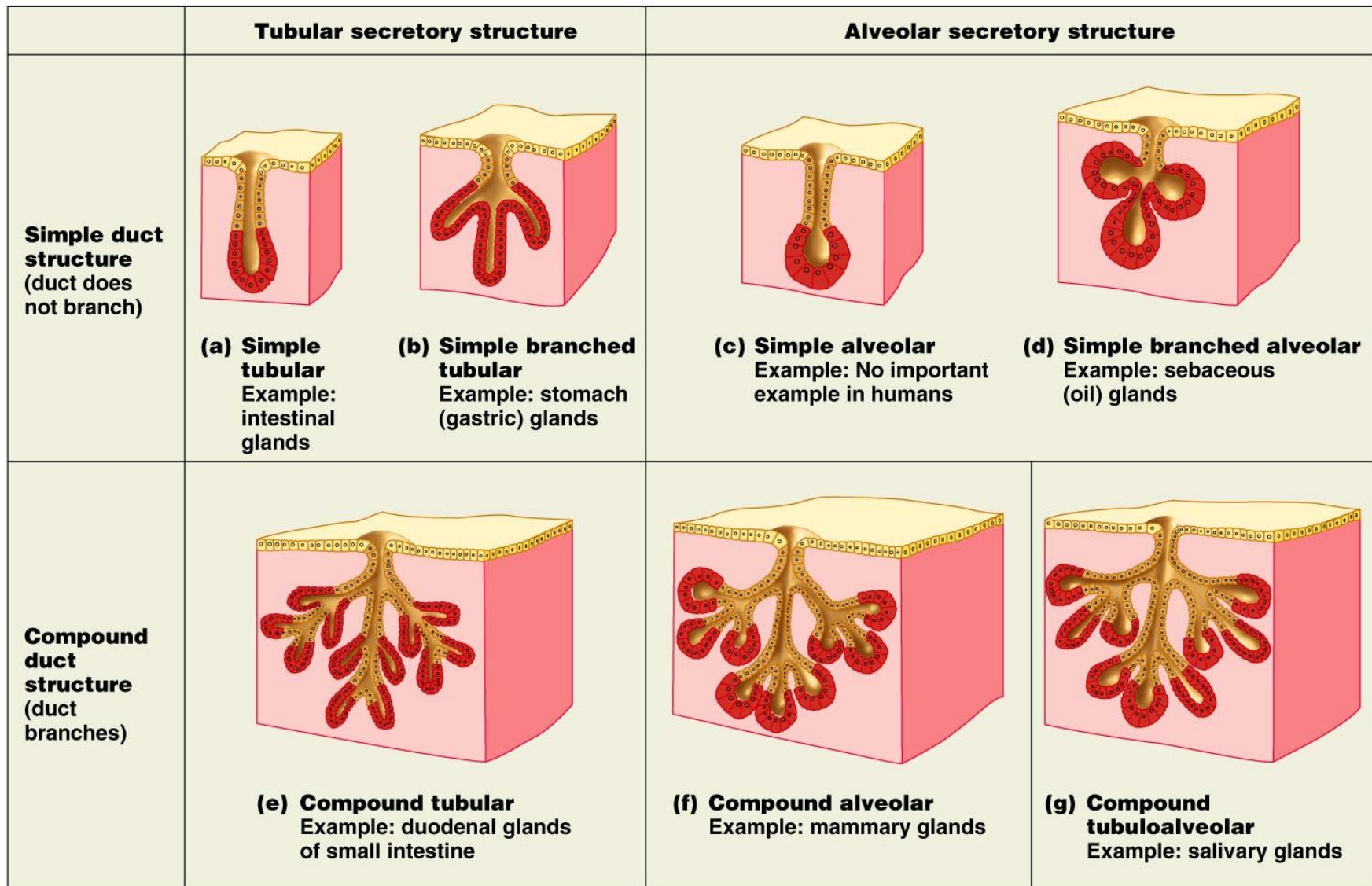
## Apocrine Sweat Gland



## 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.



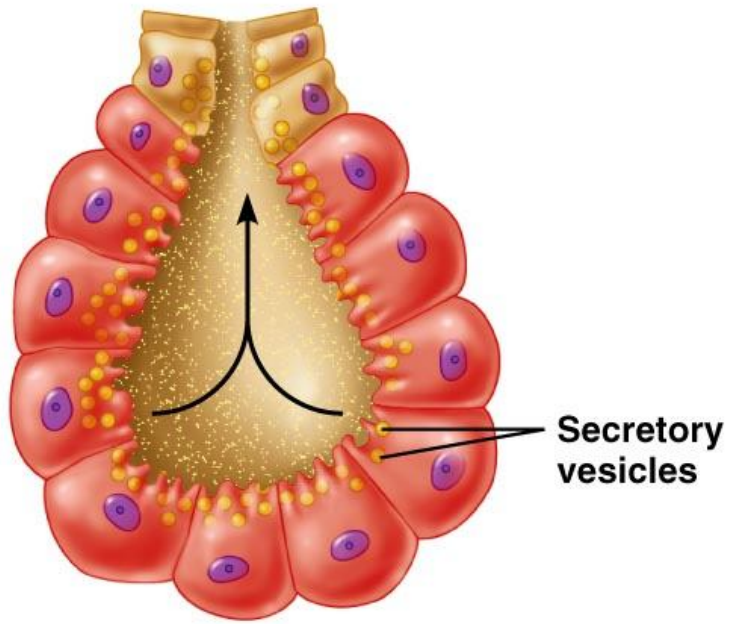


**Key:**  = Surface epithelium  = Duct  = Secretory epithelium

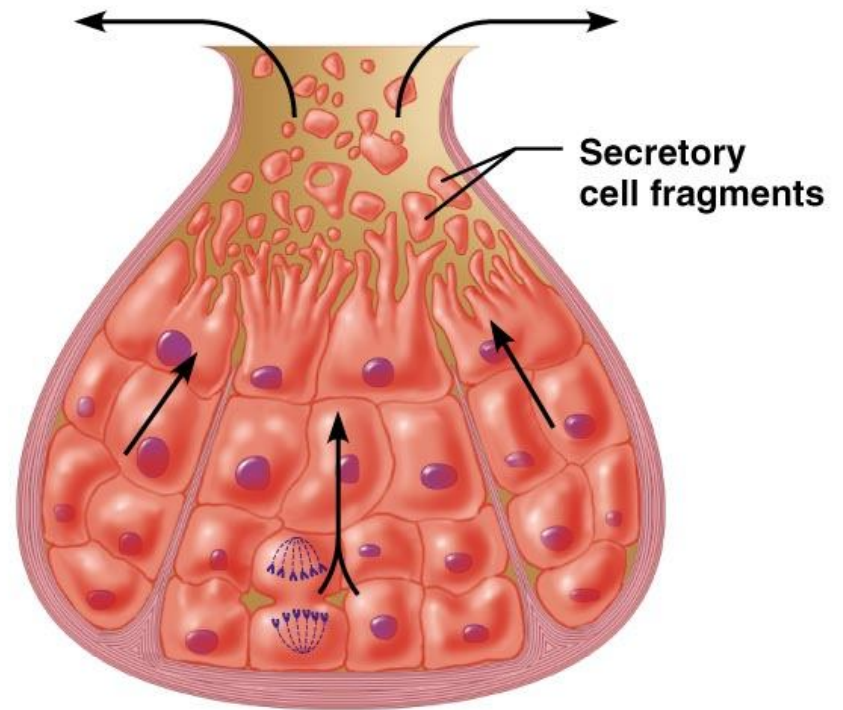
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Figure 4.4





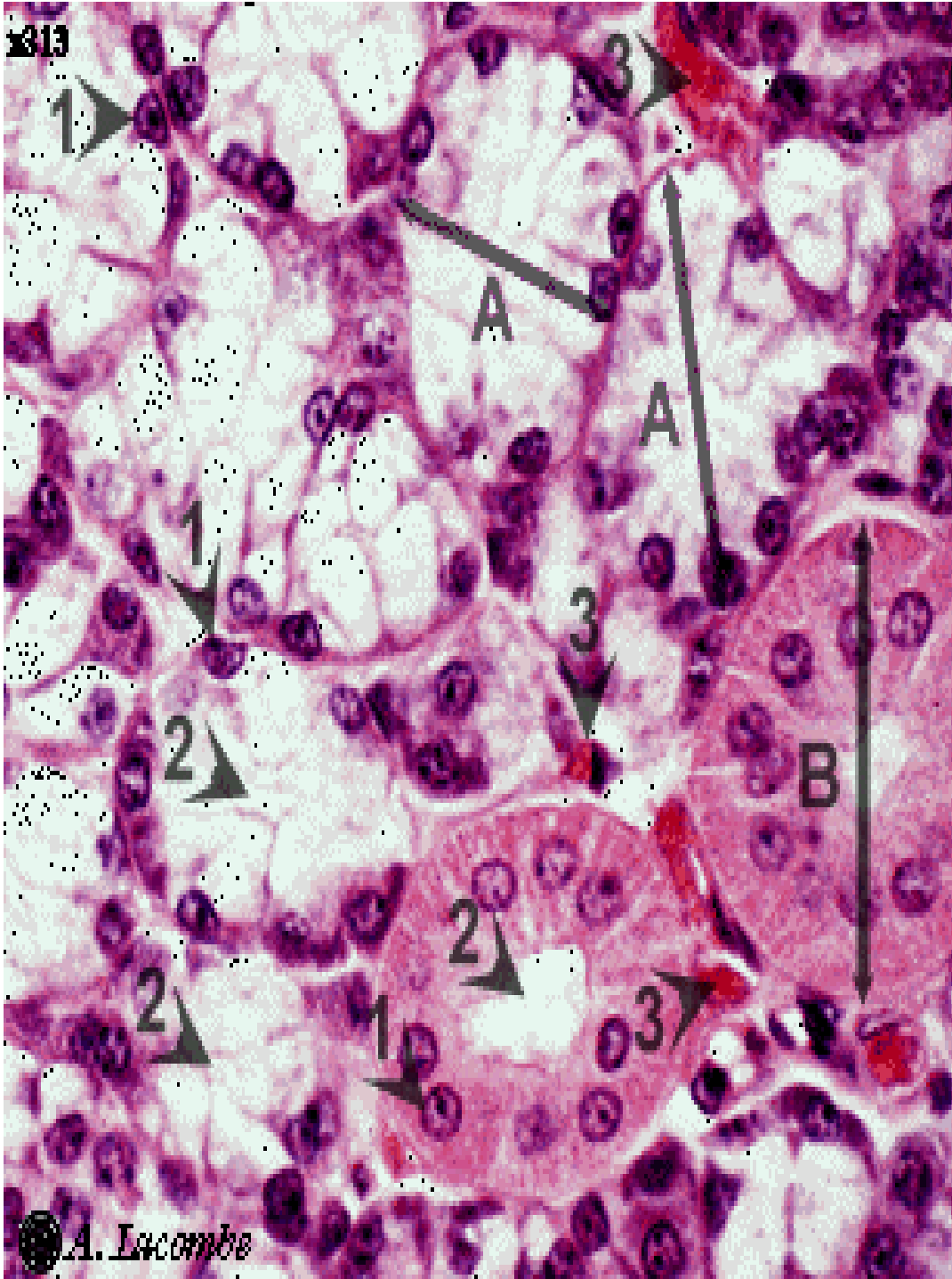
**(a)**



**(b)**

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Figure 4.5



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

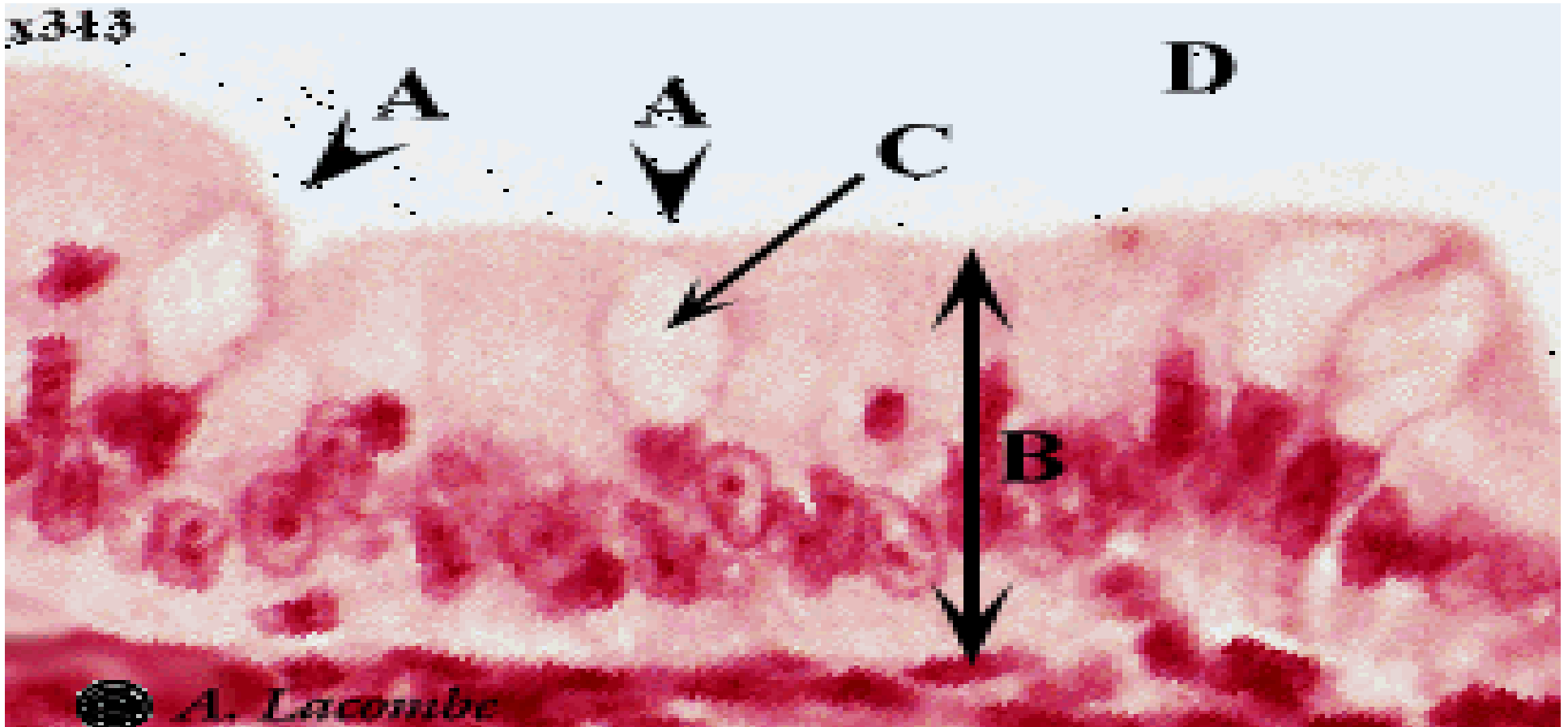
**B: duct of the gland (the nuclei of the duct cells are round --> simple cuboidal epithelium)**

**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)**

x343

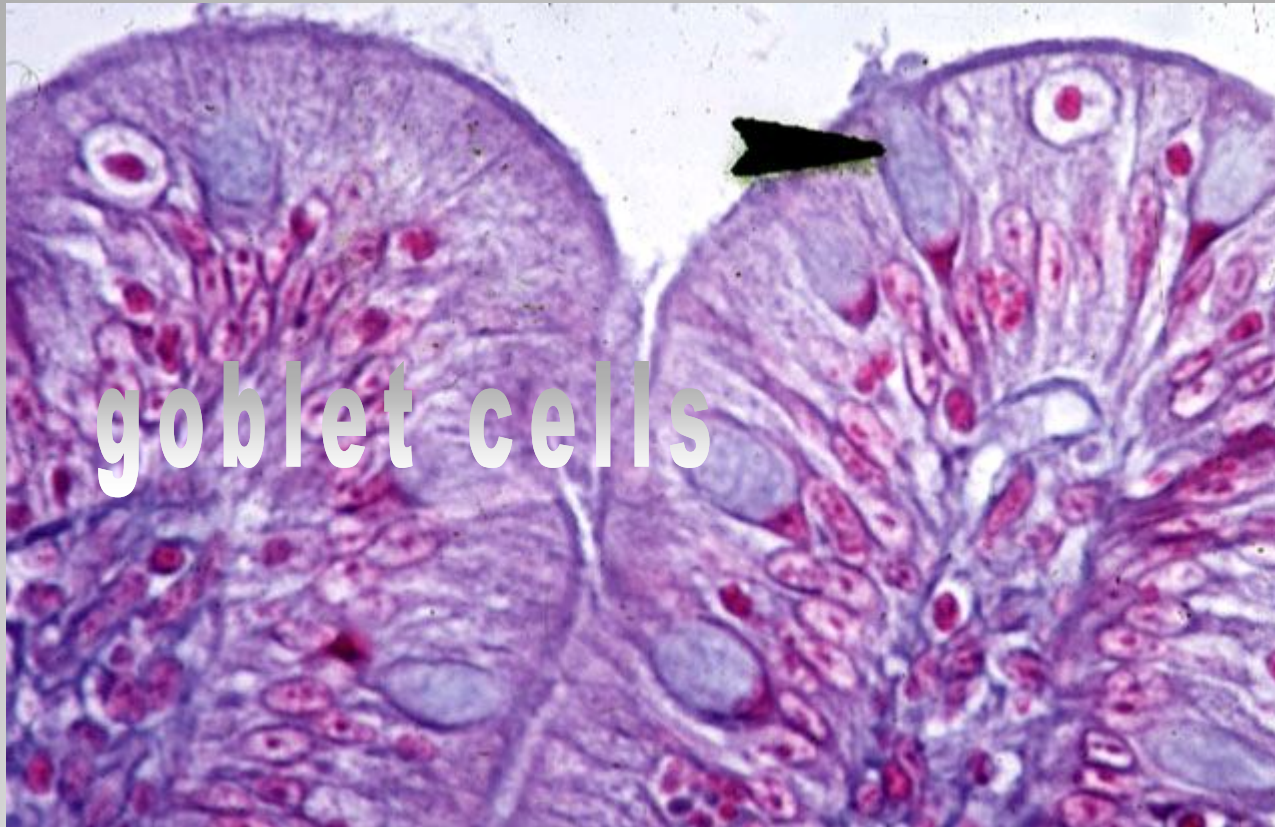


### **UNICELLULAR EXOCRINE GLANDS**

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.

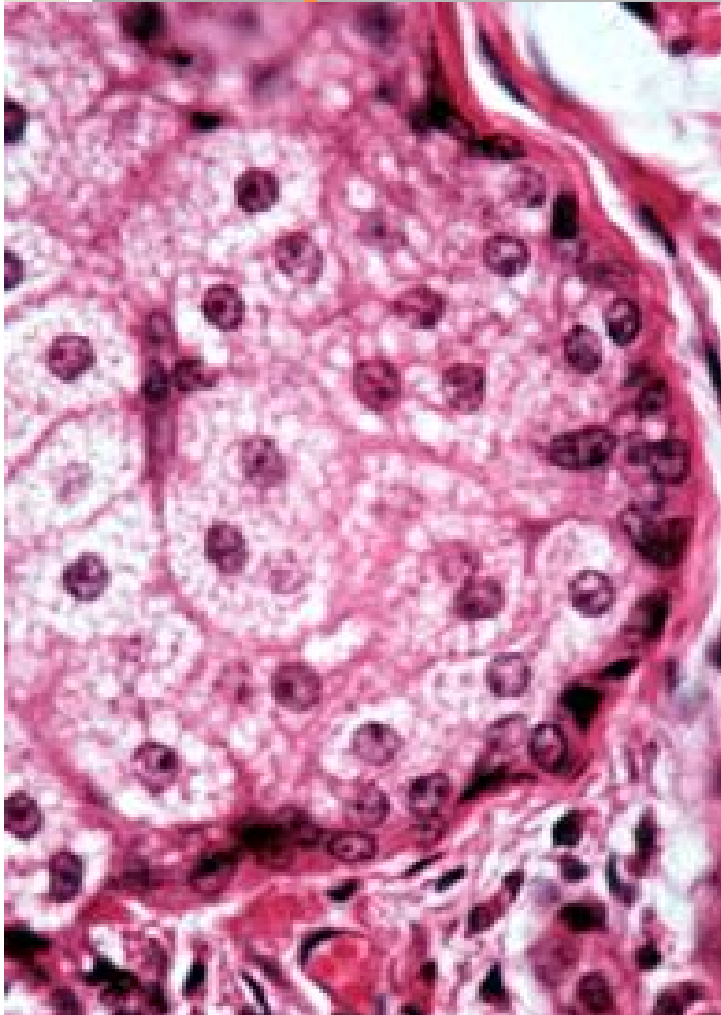


goblet cells

### Unicellular Glands

The glandular epithelial structures are classified into two major categories; namely, the unicellular glands and the multicellular glands. The multicellular glands are further divided into the exocrine glands and the endocrine glands, i.e., those with and those without a duct system.

# Simple Exocrine Glands



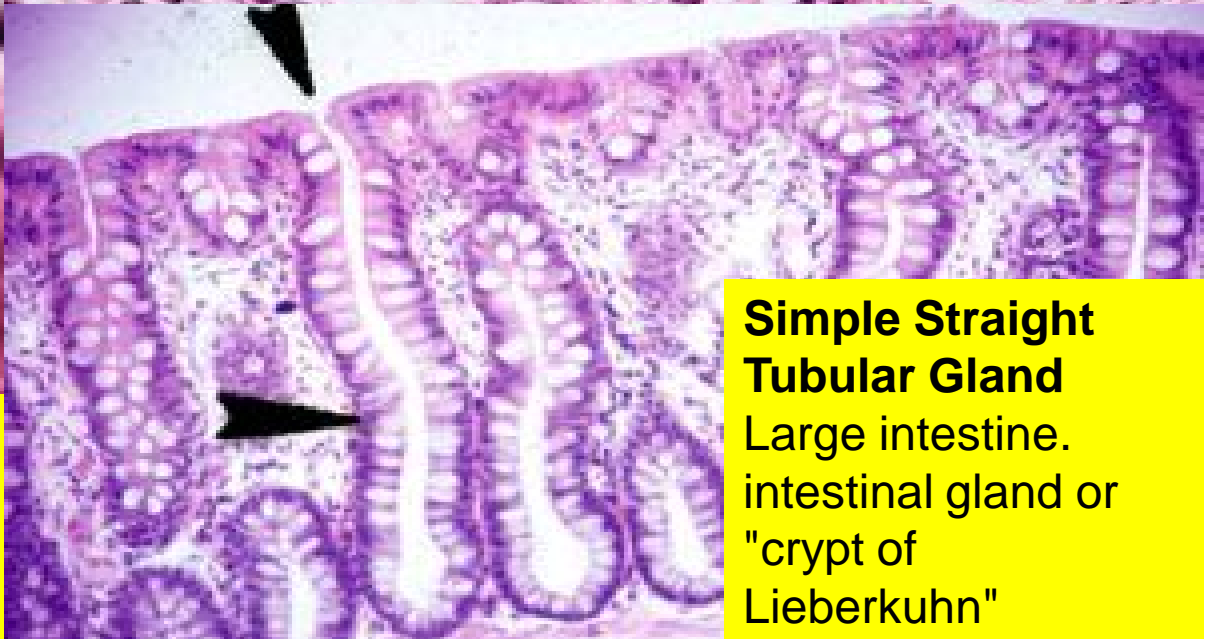
**Simple Branched Saccular Gland**

Associated with the hair follicle in thin skin.



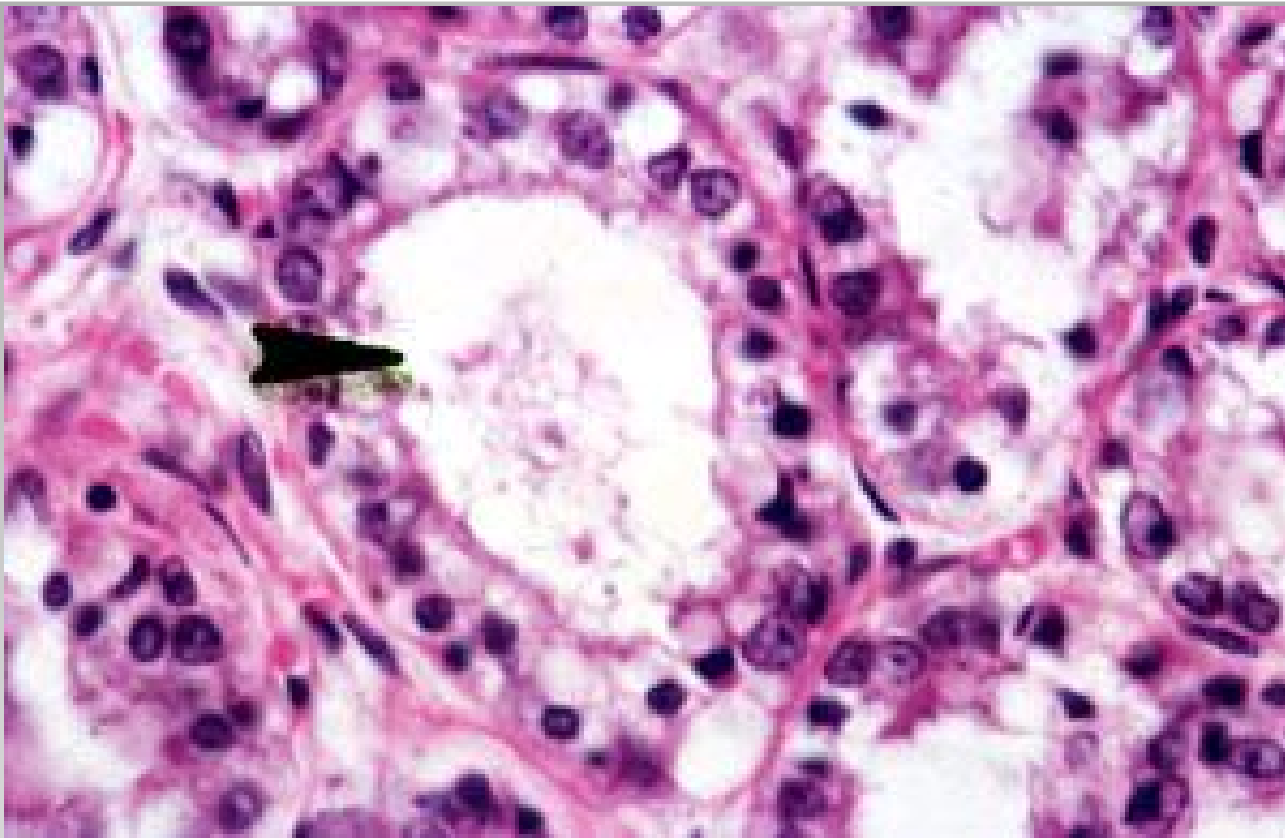
**Simple Coiled Tubular Gland**

Thick skin.

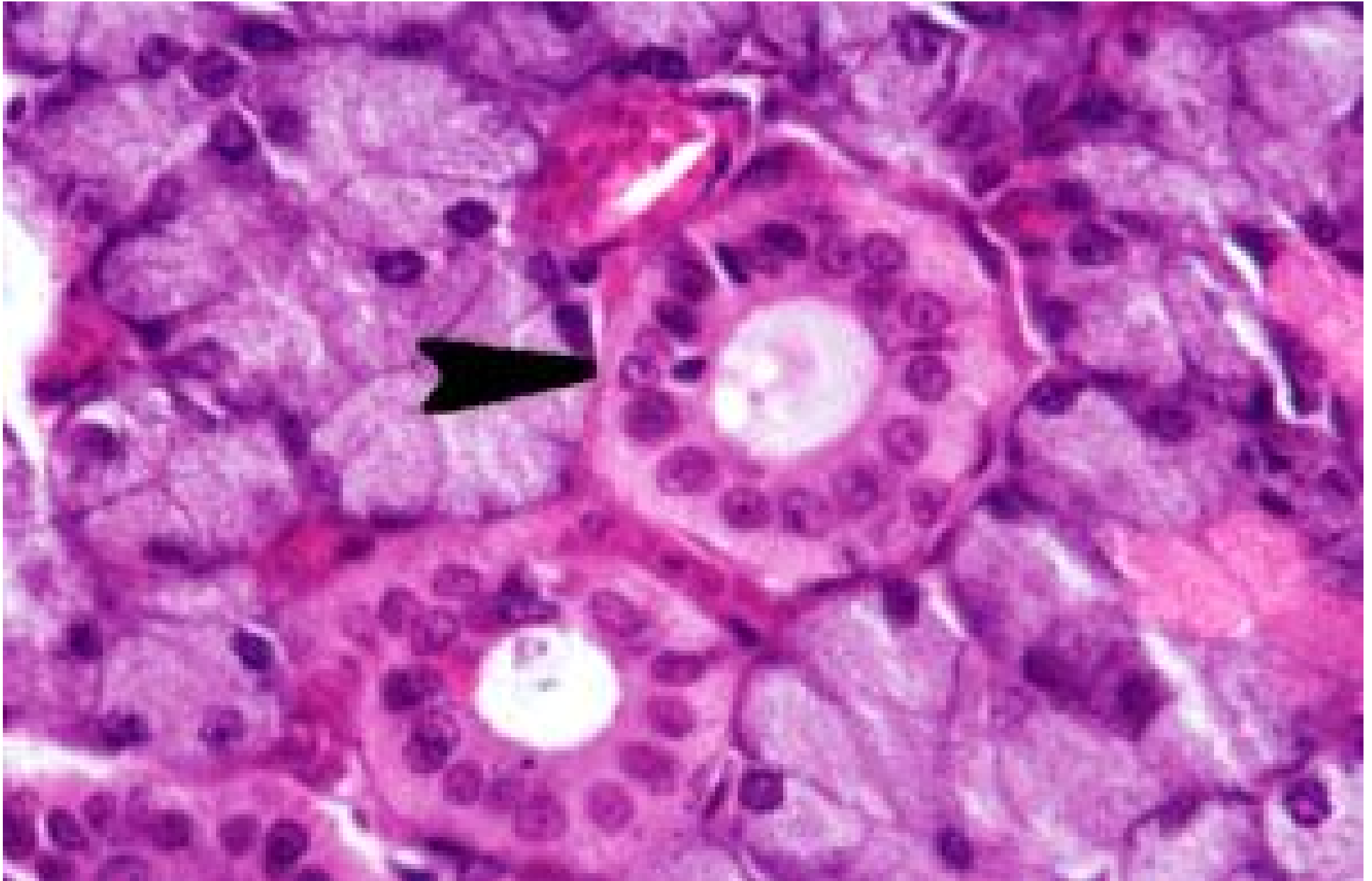


**Simple Straight Tubular Gland**

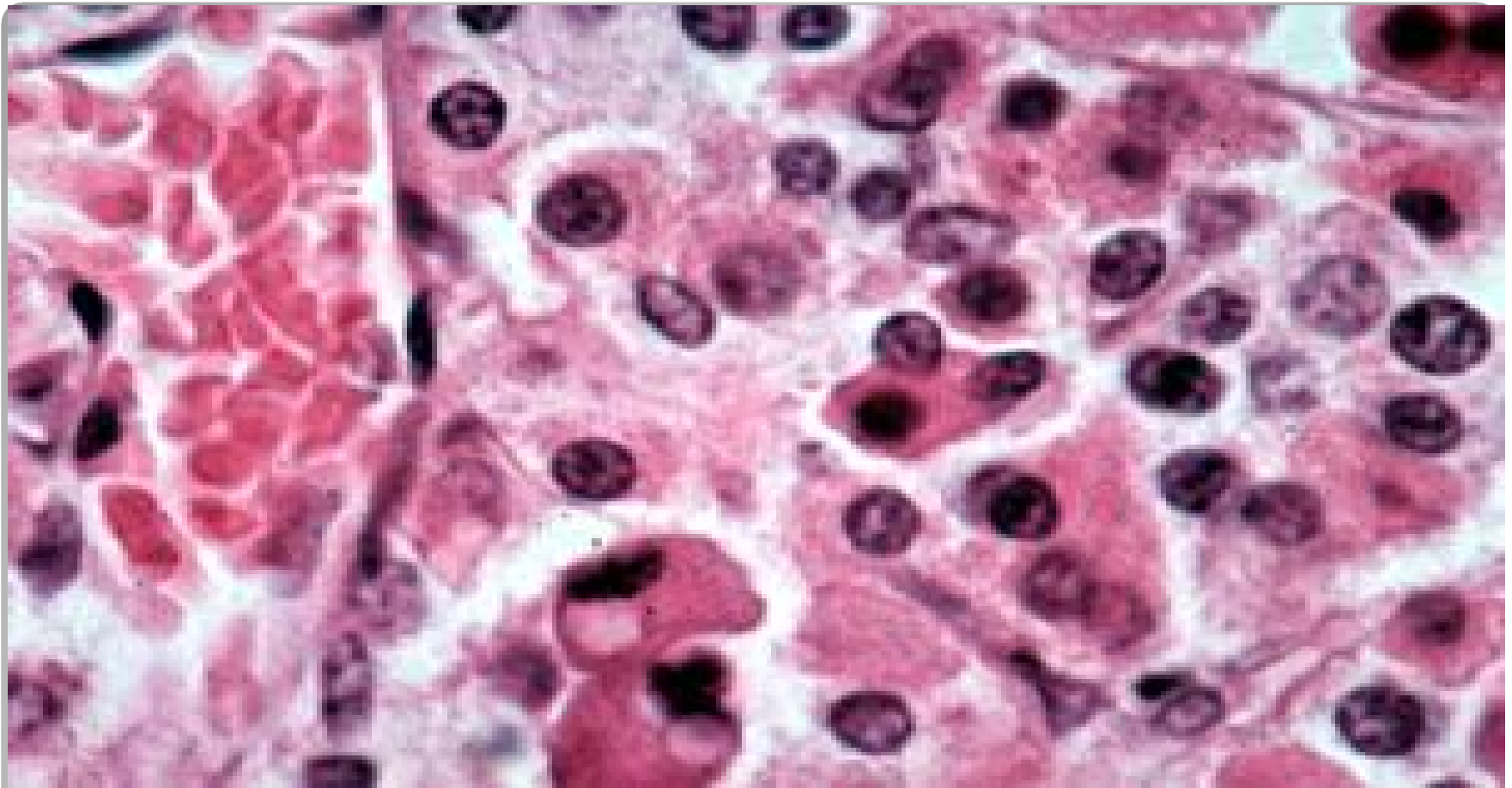
Large intestine. intestinal gland or "crypt of Lieberkuhn"



**Compound Saccular Gland**  
**Active mammary gland.**



**Intralobular Duct**  
Parotid gland



**Endocrine Gland**  
**Anterior pituitary**



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

## Endocrine Glands

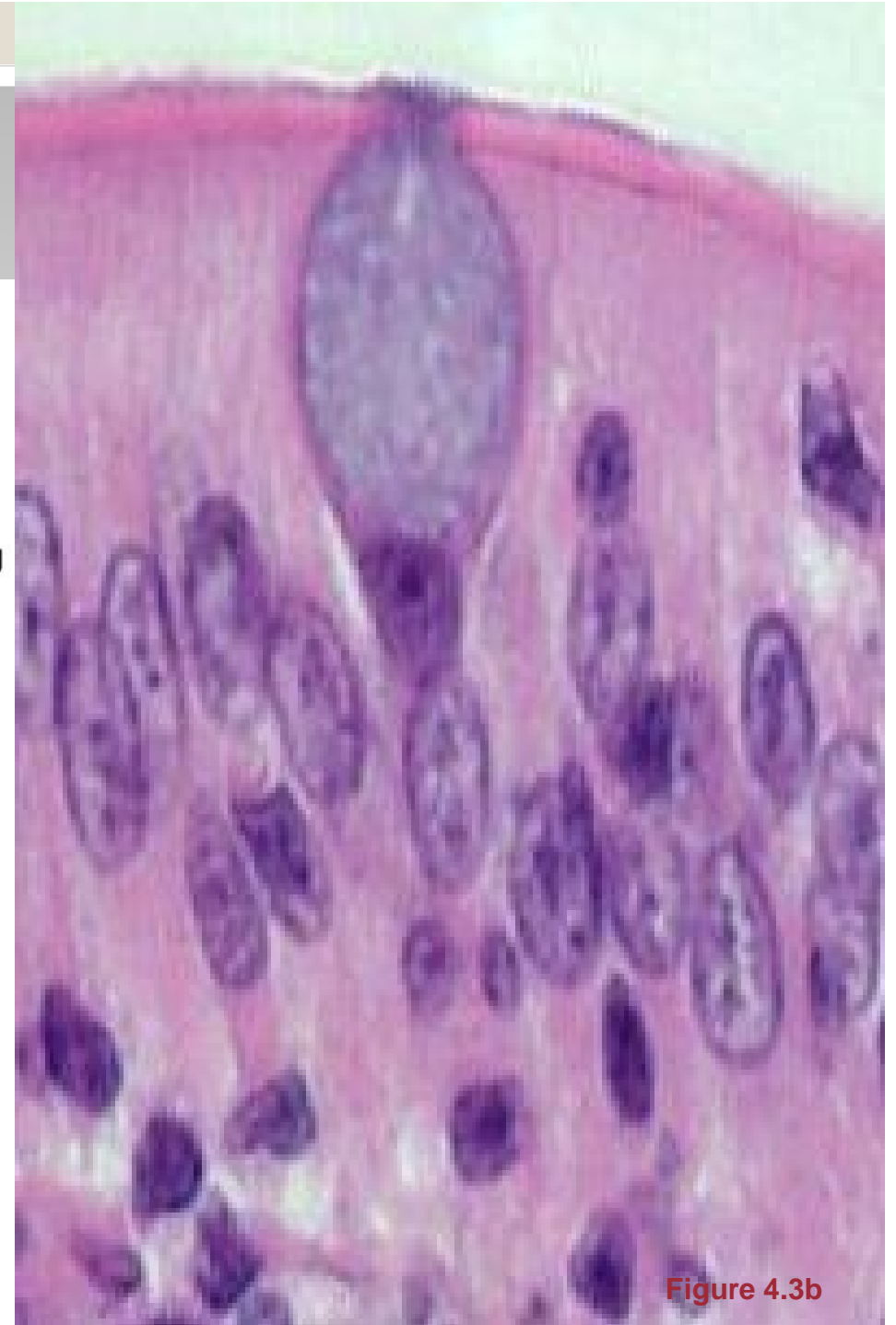
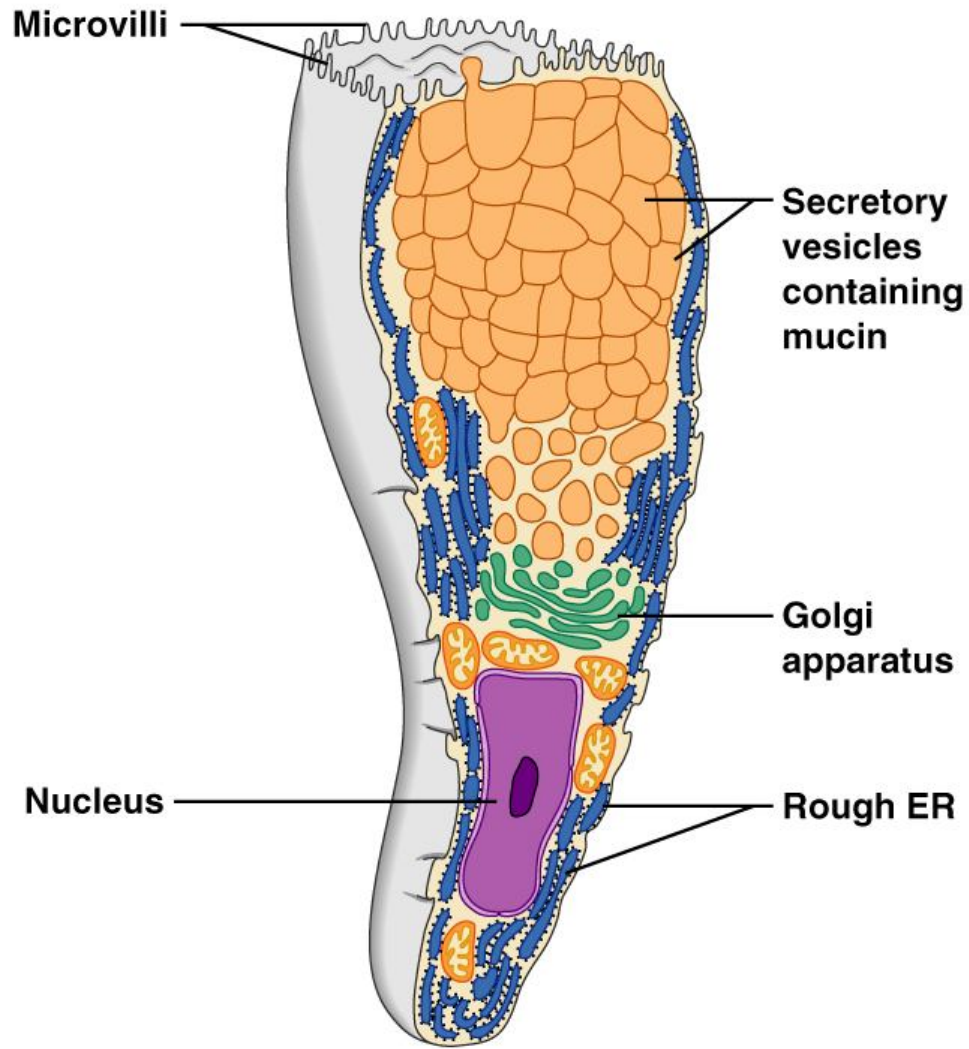
- More numerous than endocrine glands
- **Secrete their products onto body surfaces (skin) or into body cavities**
- **Examples include mucous, sweat, oil, and salivary glands**
- **The only important unicellular gland is the goblet cell**
- **Multicellular exocrine glands are composed of a duct and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

## **Exocrine Glands**

- Classified according to:
  - **Simple or compound duct type**
  - Structure of their secretory units

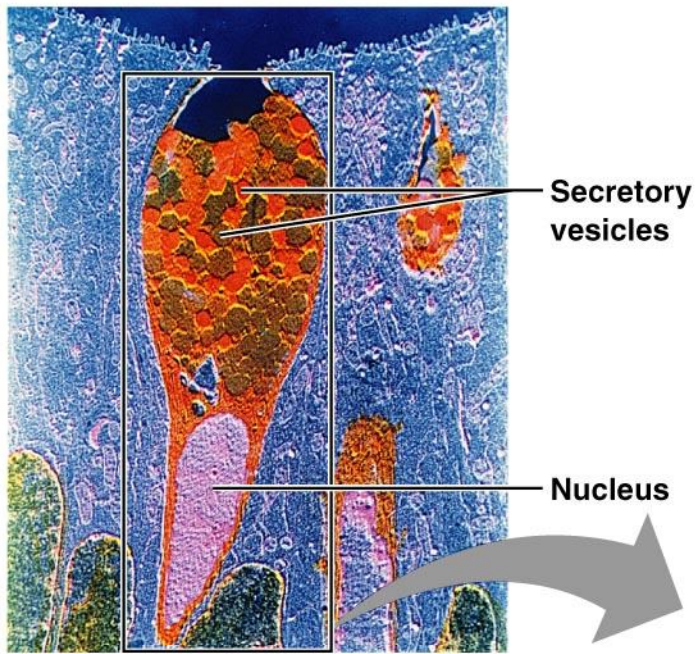
## Multicellular Exocrine Glands

# Goblet Cell

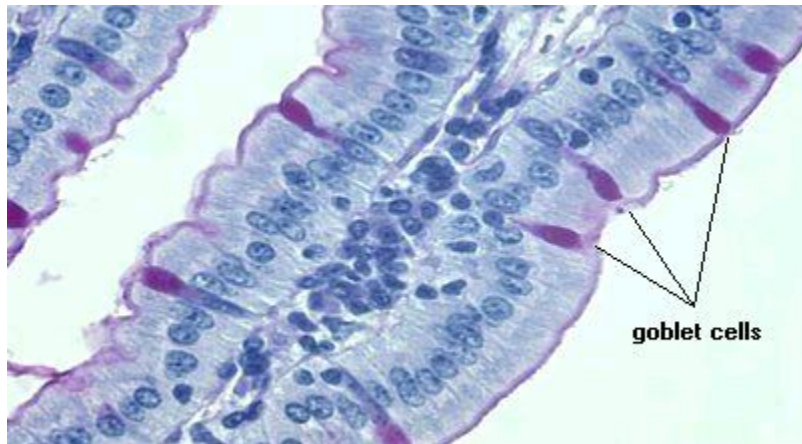


(b)

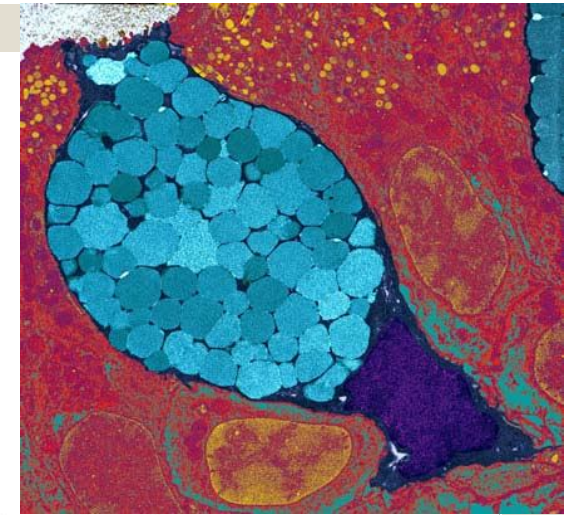
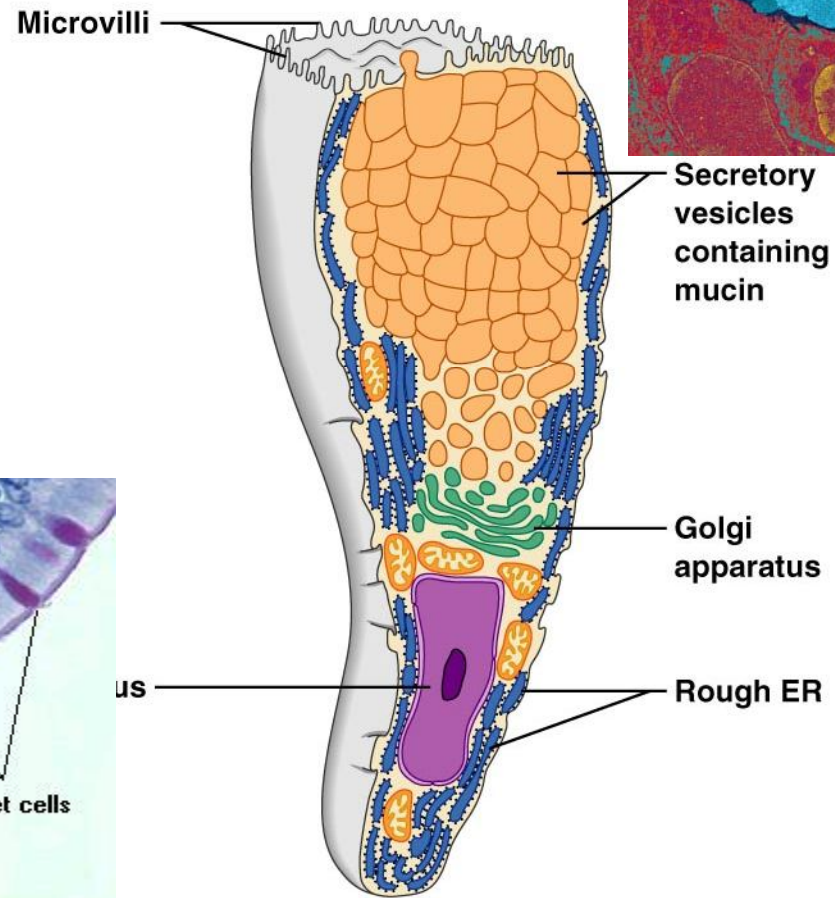
Figure 4.3b

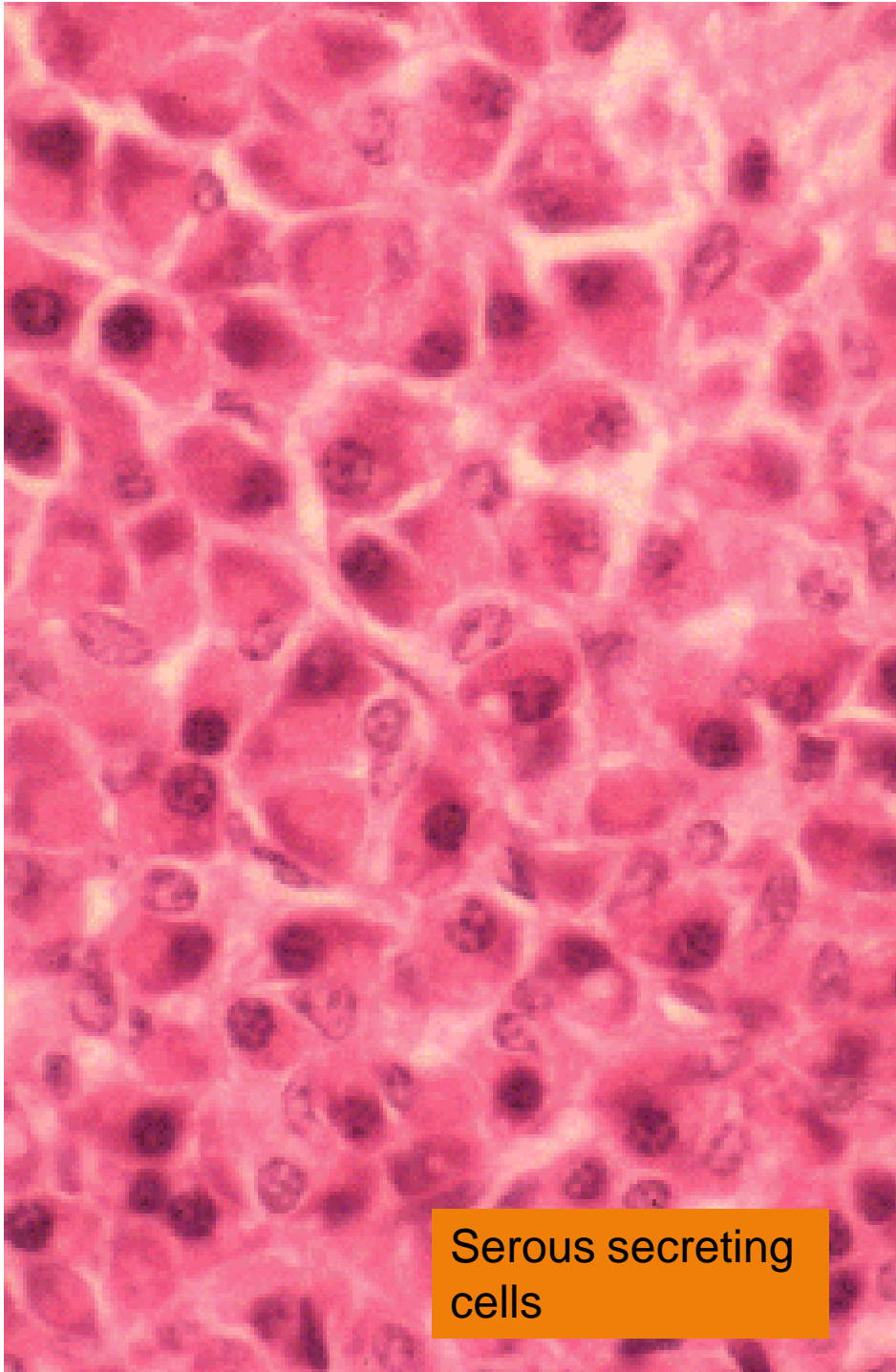


**(a)**

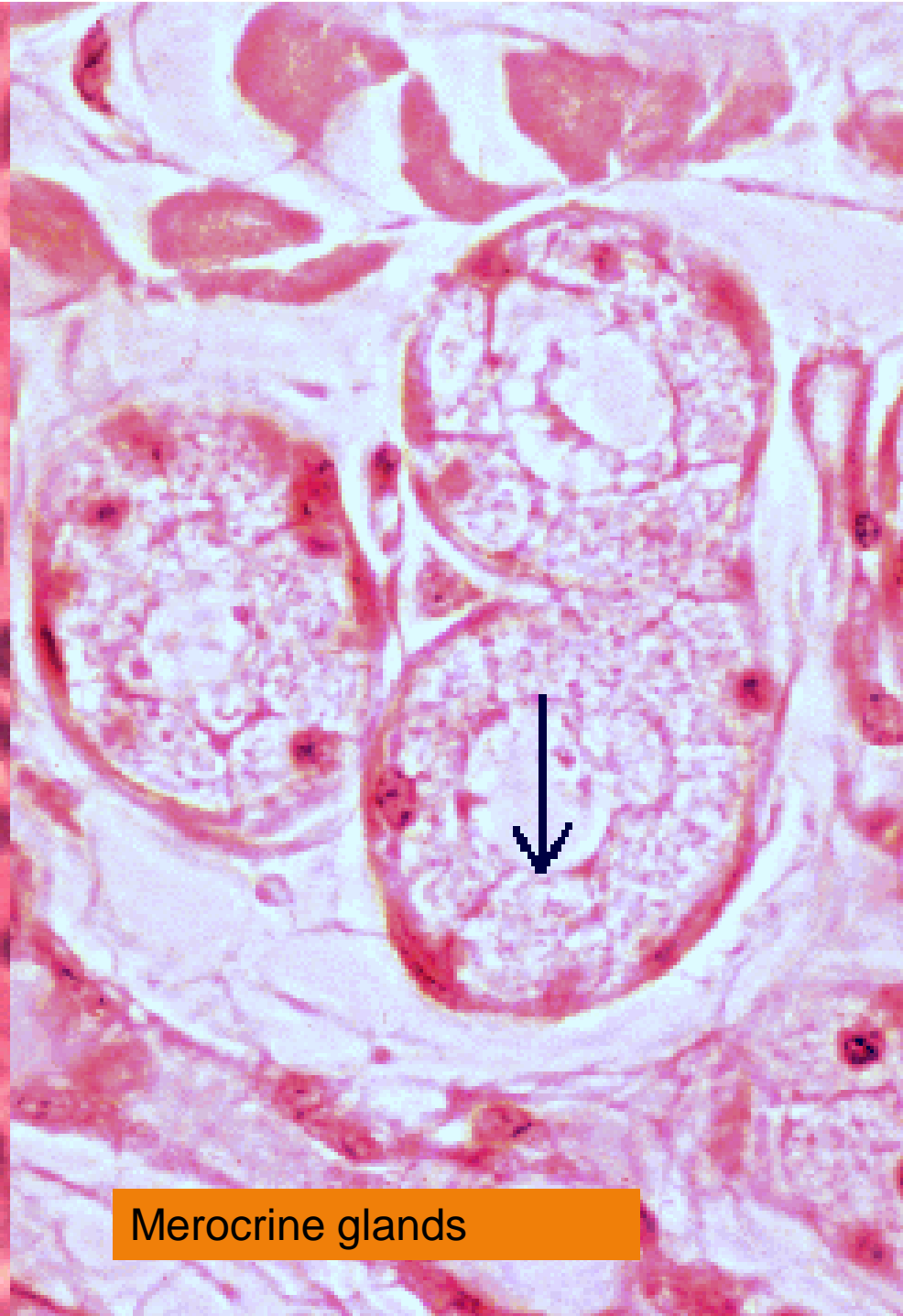


**(b)**





Serous secreting cells



Merocrine glands