

The Objectives

- 1- Distinguish endocrine from exocrine glands**
- 2- Distinguish unicellular and multicellular glands**
- 3- Recognize that multicellular glands are classified as either simple (single unit) or compound (multiple, branched units).**
- 4- What are the types of secretory products?**
- 5- Explain the mechanisms of secretion in glands?**

Epithelial Secretion/Glands

Glandular epithelial cells are specialized cells that synthesize, store, and secrete various substances. These substances include:

- * **Proteins** (e.g., pancreas)
- ** **Lipids** (e.g., adrenal glands, sebaceous glands)
- *** **Complexes** of carbohydrates and proteins (e.g., salivary glands)

Some glands, like **mammary glands**, can secrete all three types of substances.

Other glands, such as sweat glands, have low synthesizing activity and primarily secrete substances transferred from the blood.

Glands: Organs primarily composed of these secretory epithelial cells.

Development: Glands develop during fetal life from covering epithelia through cell proliferation, invasion of underlying connective tissue, and subsequent differentiation.

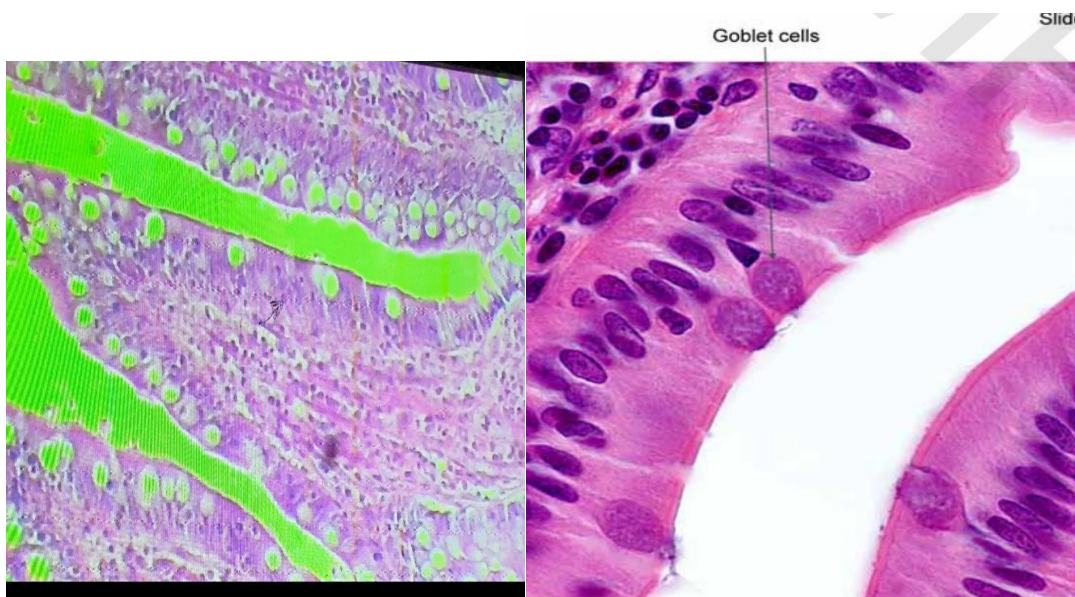
Classification: Glands are classified into two types on the basis of the [site of secretion](#). Exocrine glands secrete into a duct or onto a surface. Endocrine glands secrete into the bloodstream.

1. Exocrine glands

a. Unicellular glands: are composed of a single cell (e.g., goblet cells in tracheal epithelium). Goblet cells are specialized epithelial cells that have a unique, goblet or cup-like shape. This distinctive morphology arises from the large mucin-containing granules in their apical cytoplasm, which push the nucleus and other organelles towards the base of the cell. Goblet cells are essential components of the mucosal linings of various organs, playing a critical role in protection, lubrication, and increasingly recognized as active participants in immune regulation.

Clinical Significance:

Dysfunction or changes in the number of goblet cells are associated with several diseases such as *respiratory diseases, Inflammatory bowel disease (IBD), mucinous carcinoma and goblet cell carcinoids*



b. Multicellular glands

(1) Multicellular glands are classified according to **duct branching** as (a) *simple glands* (duct does not branch) or *compound glands* (duct branches).

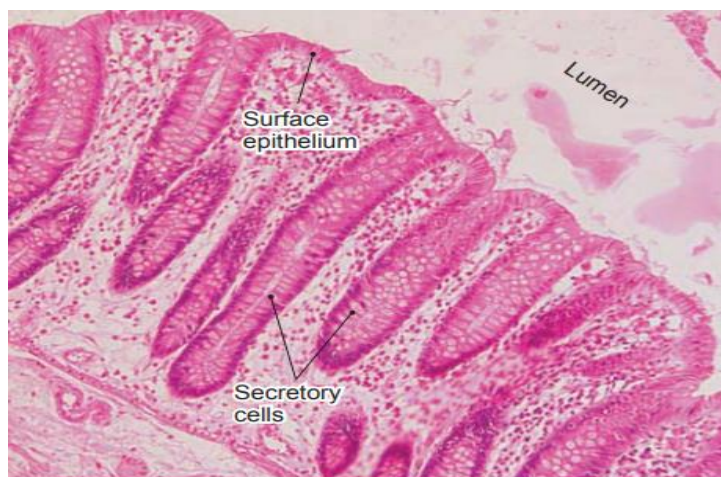
(b) They are further classified *according to the shape of the secretory unit* as :

Simple exocrine glands

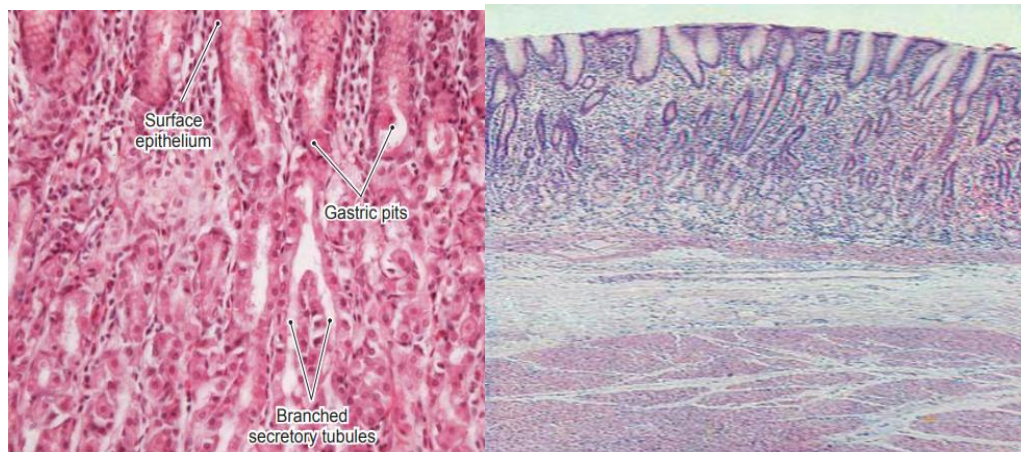
(1) **Simple tubular glands** have no ducts. The secretory cells are arranged in straight tubules such as :

* **Intestinal Glands** (Crypts of Lieberkühn) : found lining the small and large intestines, these glands secrete enzymes and mucus that aid in digestion and lubrication

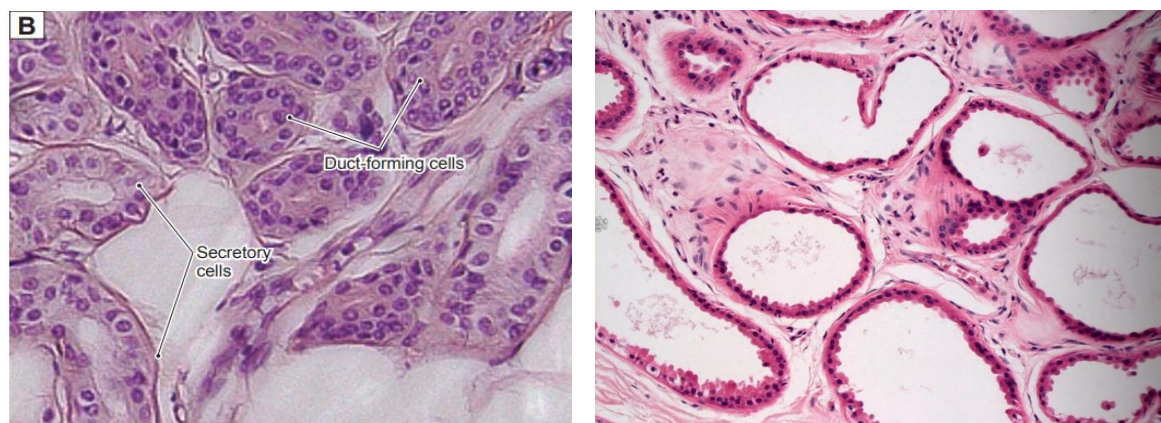
** **Uterine Glands**: Located in the endometrium (lining) of the uterus, these glands secrete a fluid that supports the pre-implantation embryo



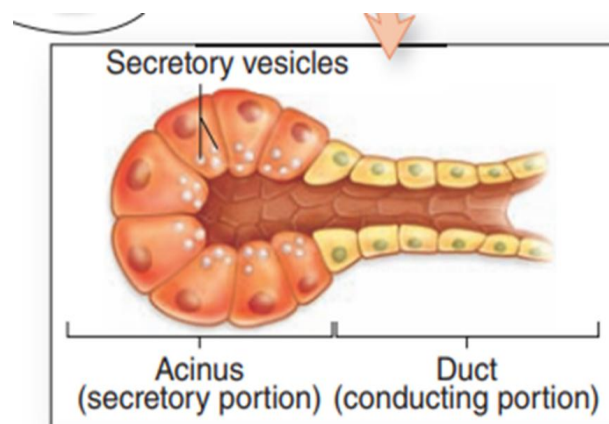
(2) **Simple branched tubular glands** do not have ducts, and their secretory cells are split into two or more tubules. This type of gland can be found in gastric glands in the stomach.



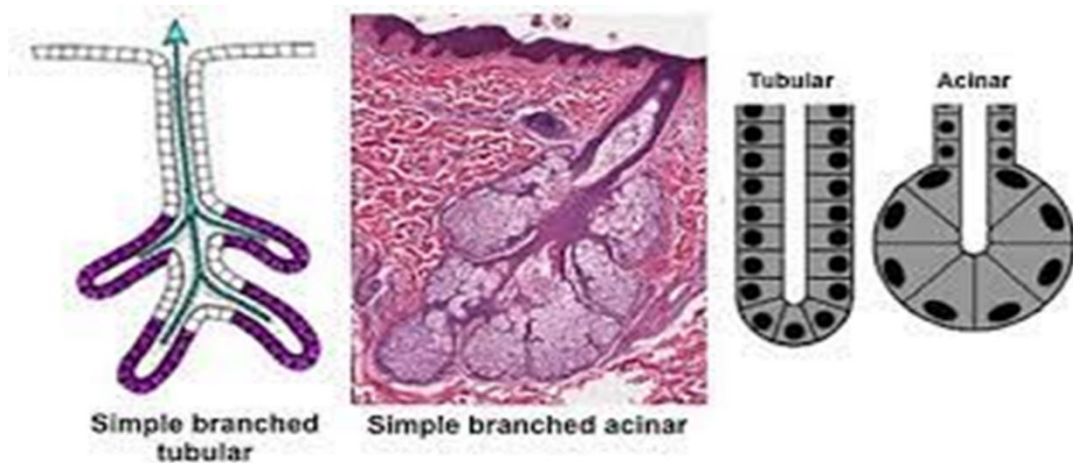
(3) Simple coiled tubular glands have a long duct, and secretory cells are formed by coiled tubules. Sweat glands are examples of this type of gland.



(4) Simple acinar glands have a short, unbranched duct; the secretory cells are arranged in acini form. The mucus-secreting glands in the submucosa of the penile urethra are examples of this type of gland.



(5) Simple branched acinar glands have a short, unbranched duct, and their secretory cells are formed into branched acini. The sebaceous glands of the skin belong to this type. These glands secrete sebum, an oily substance that lubricates the hair and skin.



Compound exocrine glands

(1) Compound tubular glands have branched ducts. Their secretory cells are formed into branched tubules as can be found in the Brunner glands of the duodenum which secrete an alkaline mucus .

(2) Compound acinar glands have branched ducts, and the secretory units are branched acini. The pancreas and mammary glands are examples of this type of gland.

(3) Compound tubuloacinar glands have branched ducts, and the secretory units are formed by both an acinar component and a tubular component. The **salivary glands** (submandibular and sublingual) are excellent examples, secreting saliva that contains both serous (watery,

enzyme-rich) and mucous components.

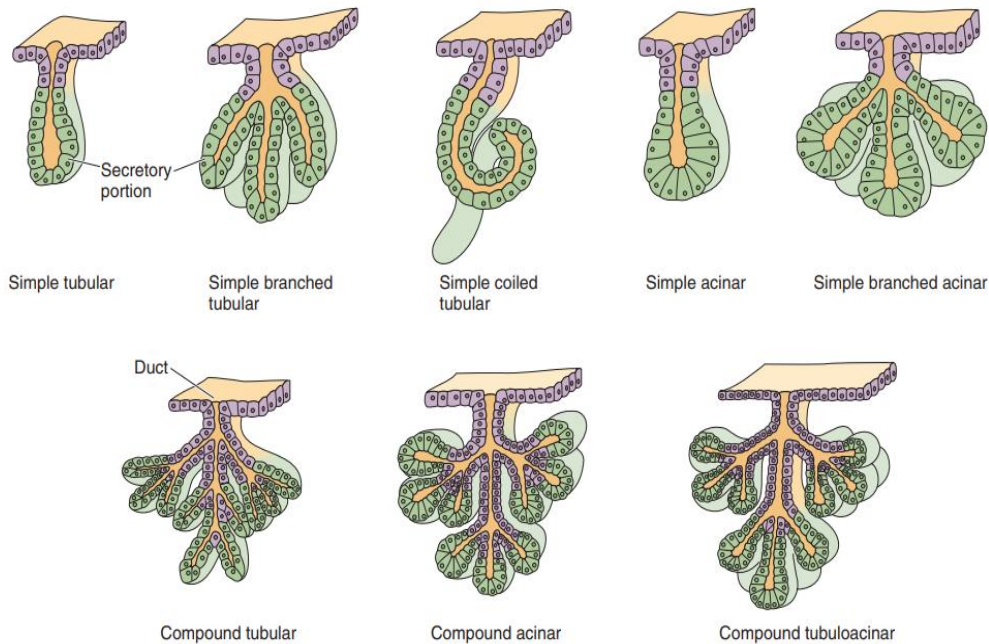


Fig. 1 Types of Exocrine Gland

The type of secretory product of exocrine glands:

A. Serous Glands: produce and secrete a non-viscous, watery fluid, such as sweat, milk, tears, or digestive juices. This fluid carries wastes (sweat) to the surface of the skin, nutrients (milk), to a nursing infant, or digestive enzymes from the pancreas to the lumen of the small intestine.

B. Mucous Glands: secrete mucins, which forms mucus when mixed with water. Found in such places as the roof of the oral cavity and the surface of the tongue.

C. Mixed Glands (seromucous): such as the salivary glands inferior to the oral cavity, contains both serous and mucous cells, and produce a mixture of the two types of secretions.

Mechanisms of secretion :

(A) Holocrine glands : Formed from cells that accumulate a product and then the entire cell disintegrates. Thus, a holocrine secretion is a mixture of cell fragments and the product the cell synthesized prior to its destruction. • The ruptured dead cells are continuously replaced by other epithelial cells undergoing mitosis. The oil-producing glands (sebaceous glands) in the skin are an example of holocrine glands.

(B) Merocrine glands :the secretory cells release their contents by exocytosis. They package their secretions in structures called secretory vesicles. • The secretory vesicles travel to the apical surface of the glandular cells, and leave the cell by exocytosis with no loss of other cellular material. • Lacrimal(tear) glands, salivary glands, some sweat glands, the exocrine glands of the pancreas, goblet cell , and the gastric glands of the stomach are examples of merocrine glands.

(C) Apocrine glands: Composed of cells that accumulates their secretory products within the apical portion of their cytoplasm. The secretion follows as this apical portion decapitates. So, their mode of secretion is a decapitation. The apical portion of the cytoplasm begins to pinch off into the lumen of the gland for the secretory product to be transported to the skin surface. Mammary glands and ceruminous glands (special types of sweat glands) are apocrine glands.

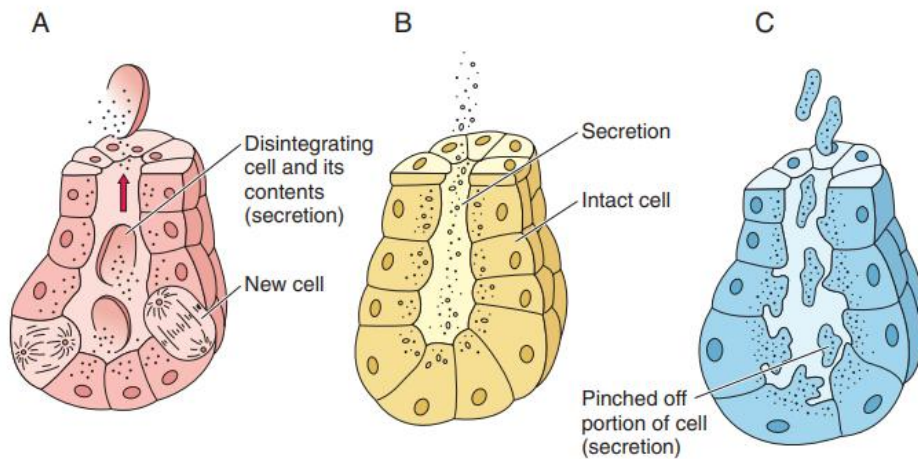


Figure 5-19 Schematic diagram of modes of secretion. **A**, Holocrine; **B**, merocrine; **C**, apocrine.

2. Endocrine glands may be unicellular (e.g., individual endocrine cells in gastrointestinal and respiratory epithelia) or multicellular (e.g., adrenal gland), and they lack a duct system. These glands that secrete their products through the basal lamina into the blood stream and lack a duct system. These glands often secrete hormones.

MEDICAL APPLICATION

Diagnosis and treatment of :

- **Thyroid Gland:** hypothyroidism, hyperthyroidism, thyroid nodules, and thyroid cancer.
- **Pancreas:** diabetes mellitus, pancreatitis, and pancreatic cancer.
- **Adrenal Glands:** adrenal insufficiency, Cushing's syndrome, and adrenal tumors.
- **Pituitary Gland:** growth hormone disorders, prolactinomas, and other pituitary tumors.
- **Salivary Glands:** sialadenitis, salivary stones, and salivary gland tumors.
- **Mammary Glands:** breast cancer, as well as management of benign breast conditions.

- **Prostate Gland:** benign prostatic hyperplasia (BPH), prostatitis, and prostate cancer.
- **Lymph Nodes:** infections, inflammation, and cancers (lymphoma, metastasis)

Both benign and malignant tumors can arise from most types of epithelial cells. Malignant tumors of epithelial origin are called carcinomas.

Malignant tumors derived from glandular epithelial tissue are called adenocarcinomas.