Lectures of Histology

(1st Stage)
First Semester 2024-2025

Anatomy and Histology Department

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* Glandular Epithelium

Cuboidal or columnar cells, specialized to produce and secrete chemical substances into ducts or directly into the blood. So, **gland** is a group of cells that are specialized of secretion, although there are single cells that function as independent glandular units.

A distinction must be made between **secretion** and **excretion**, which the first one represents a structural biological process that includes synthesis of substances useful to the organism or its young, such as enzymes, hormones, mucus, and milk, in addition to certain glands produce entire cells such as sex cells produced by gonad. While excretion represents the process of collecting harmful substances from circulatory system and remove, such as bile pigments, urea, and CO_2, as well as, beneficial excess substances are also eliminated through excretion, such as water, salts, glucose sugar, and sex hormones.

* Glands can be classified according to:

1. way of secretion.
2. type of secreted substance (~).
3. how its cells contribute of secretion.
4. number of cells involved in composition of gland.

According to way of secretion, glands can be classified to (Fig.1):

- **Exocrine glands,** secrete their products through the ducts that are connected to a surface, e.g., glands of skin, the alimentary canal.
- **Endocrine glands,** lack a duct system (ductless), so they secrete their products into the bloodstream to reach their target. The products of endocrine glands are called hormones, e.g., thyroid, pituitary, and adrenal glands.
- **Mixed glands,** including exocrine and endocrine secretion, e.g., pancreas.

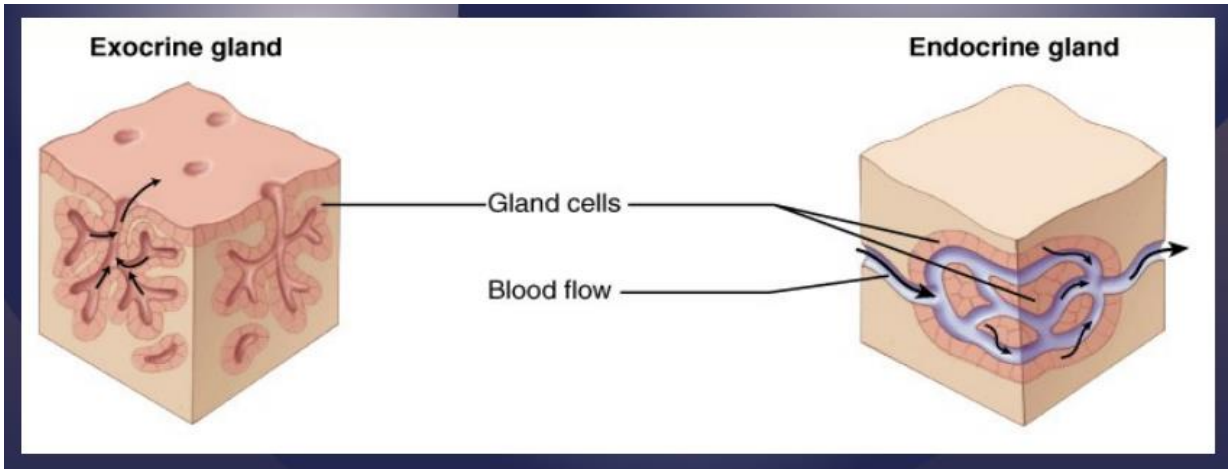


Fig. 1: Exocrine and Endocrine glands.

According to type of secreted substance, glands can be classified to:

- **Serous gland,** secretes a watery fluid containing enzymes, such as parotid salivary gland.
- **Mucous gland,** secretes mucous substances, such as sublingual glands.
- **Seromucous gland or mixed,** secretes a mixture of serous fluid that contains enzymes, and mucous fluid. Gland contains serous and mucosal units, or contains secretory unit composed of both serous and mucous cells, so serous cells aggregation as a crescent shape above mucous cells, termed as serous demilune, such as submandibular salivary gland (Fig.2).

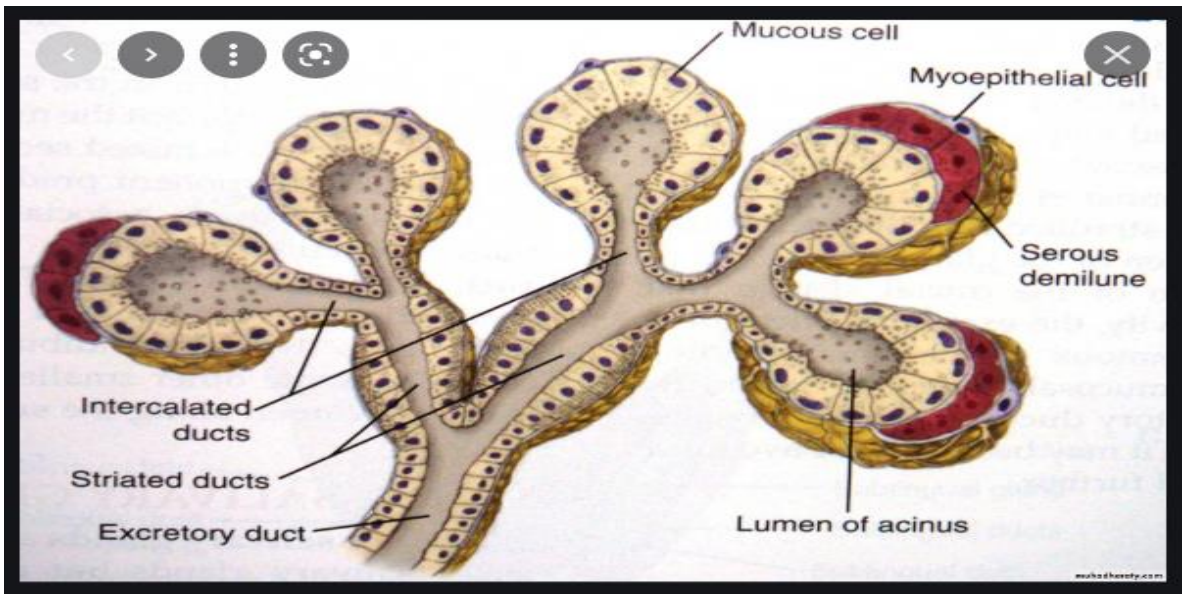


Fig. 2: Seromucous gland or Mixed.

According to how its cells contribute of secretion, glands can be classified to (Fig.3):

- **Merocrine gland,** secretes substances through cell membrane without rupturing it and without losing any part of cytoplasm, such as salivary gland and pancreas.
- **Apocrine gland,** secreted substances collect in the upper part of cell, then that part form a small bulge and separates, containing the secreted substances. Thus, cell loses part of its cytoplasm with the secreted substances, such as mammary.
- **Holocrine gland,** cell is filled with secreted substances, and then all of them are destroyed. Thus, the secreted substance represents the cell itself with substances it contains, such as sebaceous gland.

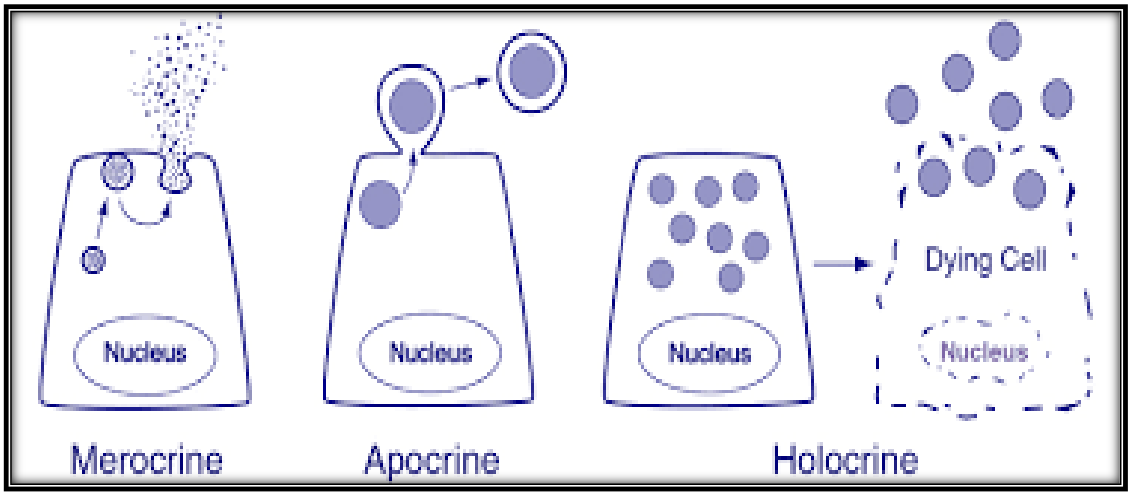


Fig. 3: Merocrine, Apocrine, Holocrine glands.

According to number of cells involved in composition of gland, glands can be classified to:

- **Unicellular gland,** such as goblet cell which secretes mucin (dense, protective carbohydrate protein). Life span of this cell may be long, and it repeats its secretory cycle a few times, after which it dies and is compensated by neighboring cells that specialization to take the form and function of a goblet cell, or the duration of its life is a few days, as in the lining of intestine (Fig.4).

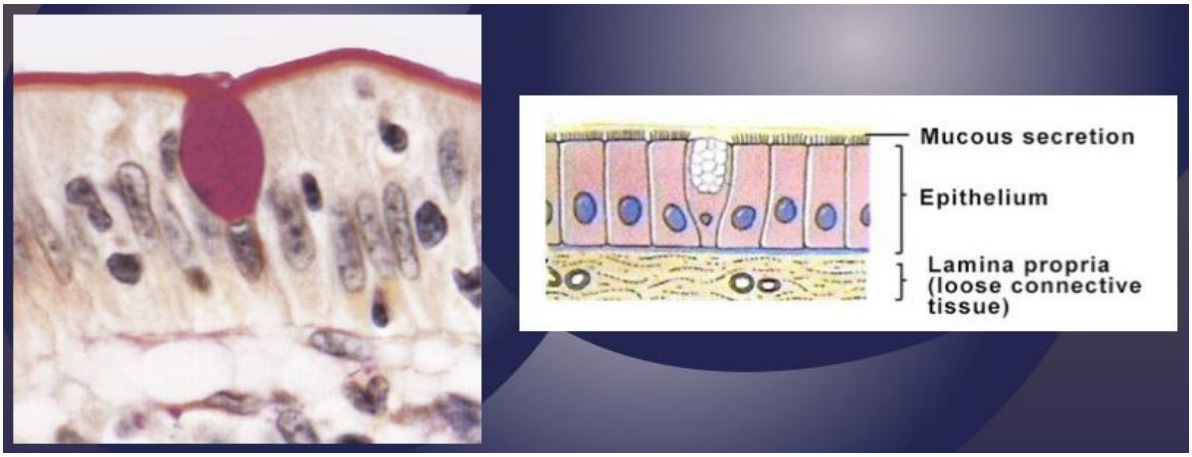
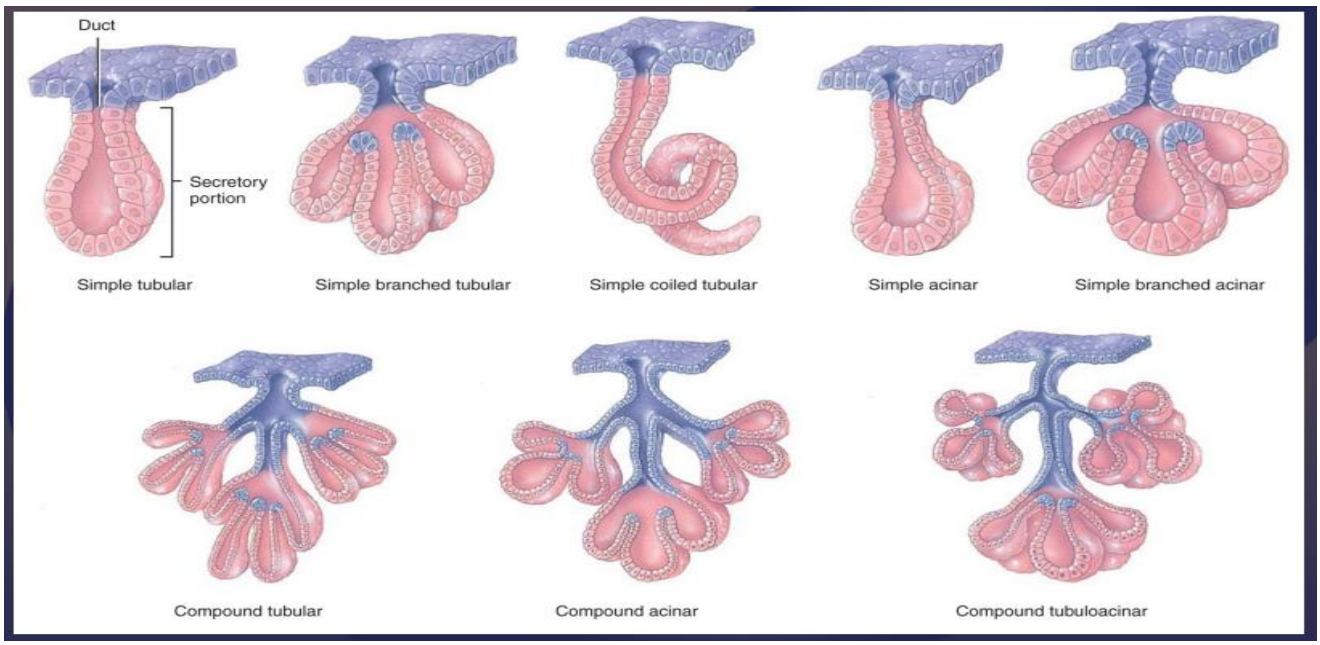


Fig. 4: Unicellular gland.

- **Multicellular gland,** consists of more than one cells. Composed of excretory duct and secretory unit. This type of glands can be classified according to branching or non-branching **excretory duct** into (Fig.5):

1. Simple glands: classified according to the **shape of secretory unit**:
- Tubular: straight (intestine g.), coiled (sweat g.), branched (pyloric g.).
- Alveolar/acinar: unbranched (poisonous g. in frog) branched (sebaceous g.).

2. Compound glands: classified according to the **shape of secretory unit**:
- Compound tubular gland: duodenal gland.
- Compound alveolar gland: mammary gland.
- Compound tubuloalveolar gland: salivary gland.



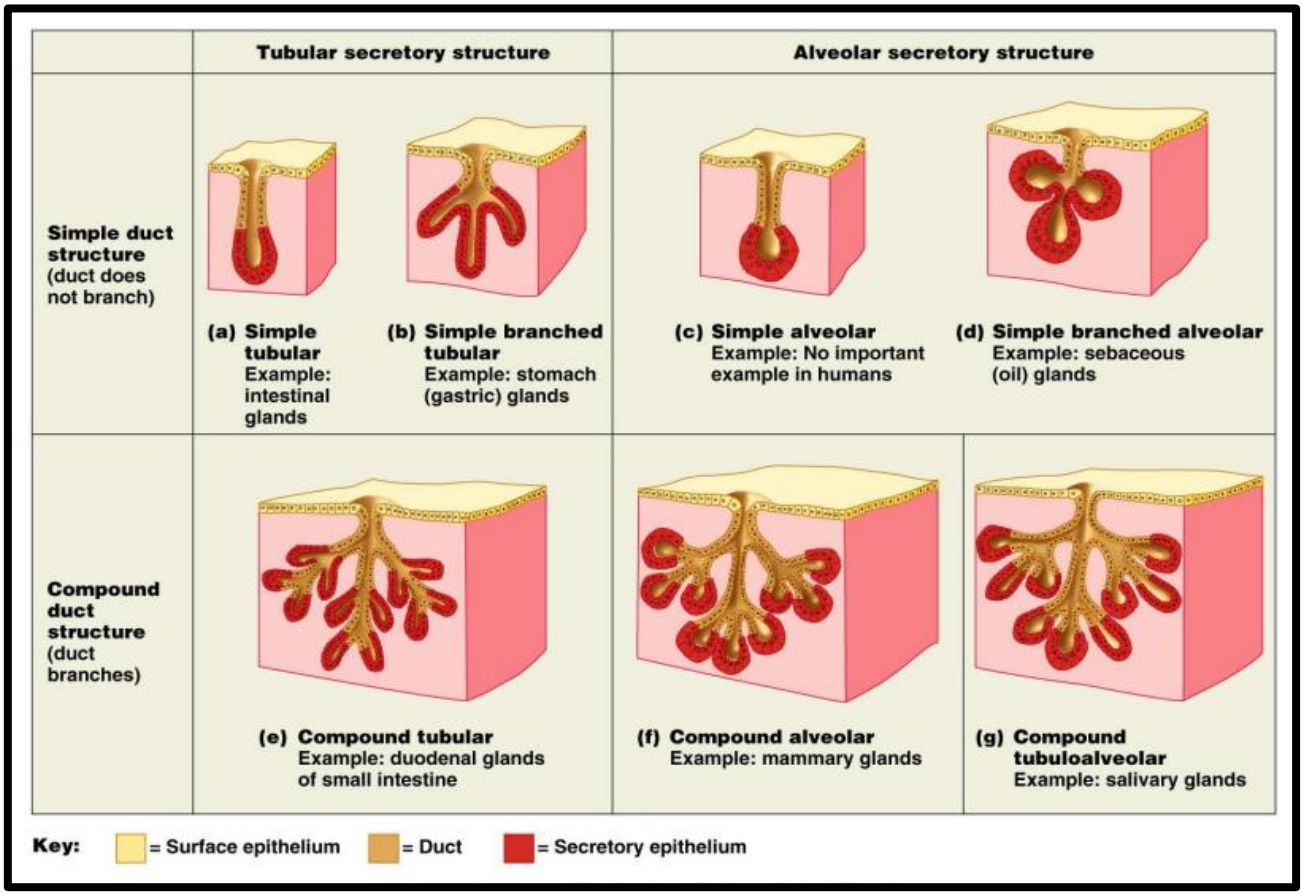


Fig. 5: Multicellular gland.

* Compound gland structure:

1. Surrounded by a capsule of dense connective tissue.

2. Gland is usually divided into **lobes** by connective tissue septa extending from the capsule.

3. Each lobe is divided into smaller units called **lobules** by thin septa composed of connective tissue also supported by interlobar septa.

4. Main duct of the gland divides into branches smaller than it is between the lobes, called **interlobar** ducts, then divide or branch into smaller branches called **intralobar** ducts.

5. These ducts also divide or branch into more smaller branches called **interlobular** ducts, then branches into more and more smaller branches called **intralobular** ducts.

6. These ducts are continuous with very fine ducts called **intercalated** ducts connected to the **lumen of secretory unit** (Fig.6).

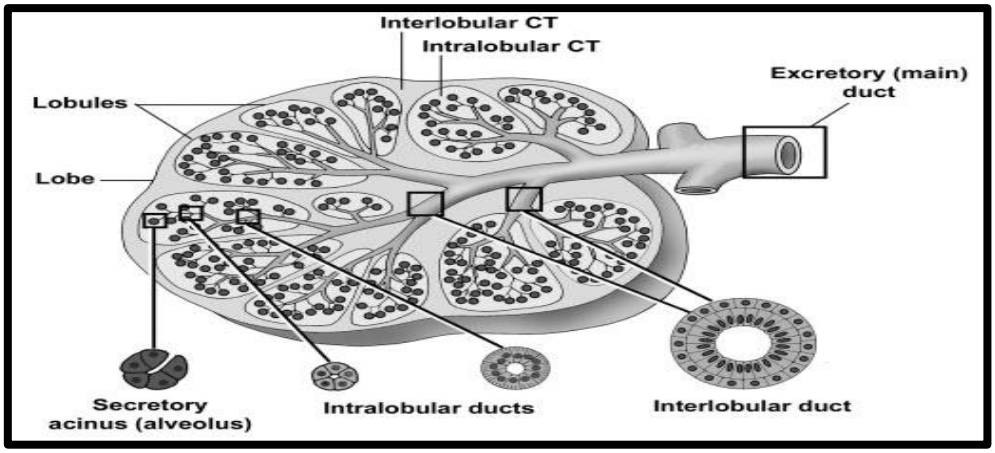


Fig. 6: Compound gland structure.

* Glands formation

1. Both types (exocrine and endocrine glands) arise in form of a non-hollow protrusion of epithelial tissue cells because of their repeated divisions (Fig.7).
2. Growth of protrusion increase and extends into connective tissue adjacent to the original epithelial tissue in form of a cell cord.
3. Then this cord hollows because of degeneration of the cells that occupy center of cord.
4. Final section of this structure is specialized to the secretory portion and the remainder of it forms gland duct.
5. In case of endocrine glands, epithelial cells that connect the end part of cord to the epithelial tissue (arise from it) decay and disappear, leaving the end part to turn into a gland composed of a mass of epithelial cells surrounded and permeated by connective tissue and blood vessels that transfer their secretions to the blood directly.

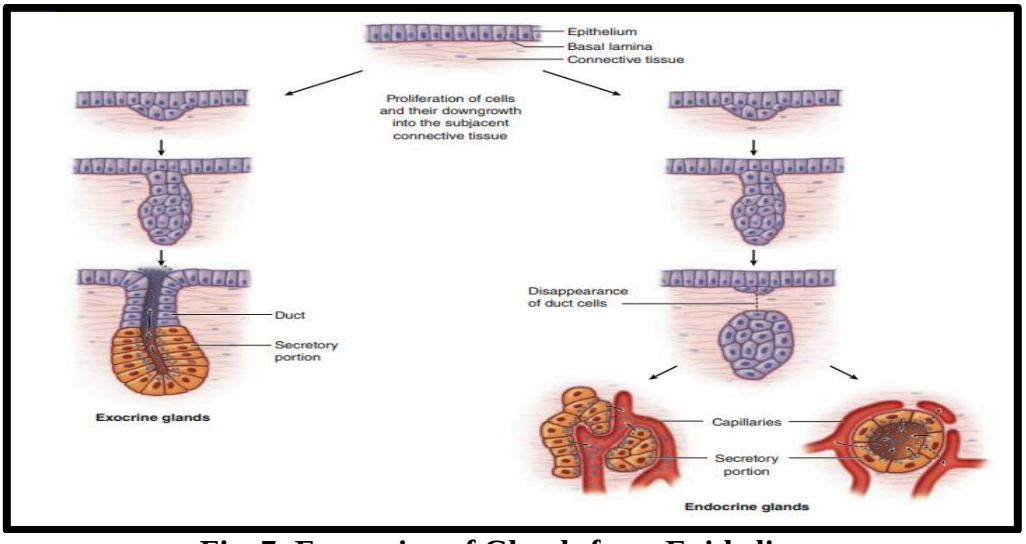


Fig. 7: Formation of Glands from Epithelium.