





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

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A **gland** is an organ that synthesizes a substance for release of substances such

•as hormones

• breast milk,

often into the bloodstream (endocrine gland)
into cavities inside the body or its outer surface (exocrine gland).

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.



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

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

The endocrine system of humans



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



Multicellular Exocrine Glands

Endocrine Glands

No duct system

Secretions directed into the extracellular fluid (basal side), move into vascular system

Exocrine Glands

Ducts to release products

Secretions released to the apical cell surface, move out of ducts to outside environment

 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

<u>Major Types of Glands</u>: 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.

<u>Paracrine Glands</u> – These glands are similar to endocrine glands, but their secretions <u>reach target cells</u> by diffusion through the extracellular space or immediately subjacent connective tissue. <u>These secretory products are not</u> <u>delivered to their target tissue via ducts or the bloodstream</u>.

Exocrine glands — secrete their products through a duct or directly onto the apical surface, the glands in this group can be divided into three groups:

•Merocrine glands — cells secrete their substances by exocytosis (e.g., mucous and serous glands). Also called "eccrine".

•Apocrine glands — a portion of the secreting cell's body is lost during secretion. *Apocrine gland* is often used to refer to the apocrine sweat glands, however it is thought that apocrine sweat glands may not be true apocrine glands as they may not use the apocrine method of secretion.

•Holocrine glands — the entire cell disintegrates to secrete its substances (e.g., sebaceous glands)

- Merocrine ,
- Apocrine ,
- Holocrine secretions



Mechanism of secretion

Merocrine secretion (aka eccrine secretion)

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

• 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.



The term **eccrine** is specifically used to designate merocrine secretions from

•sweat glands (eccrine sweat glands)

- •Salivary glands
- •Pancreatic glands
- •Certain sweat glands (eccrine and apocrine)



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.

•<u>Protection.</u> 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,

•The ceruminous glands of the external acoustic meatus.

•Scrotum



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 <u>sebaceous glands within the skin, but</u> also in the tarsal (Meibomian) glands of the eyelid.





Mechanism of Secretion

Merocrine	Apocrine	Holocrine
Expelled by exocytosis	Uses membrane vesicles	Entire secretory cell lost, as plasma membrane breaks to release product
Only secretory product is lost	Secretory product and some membrane lost	Sebaceous glands use this method

Ways of Secretion and exocrine type







(a)



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)



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.



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 Branched Saccular Gland

Associated with the hair follicle in thin 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







The type of secretory product of an Exocrine gland may also be one of three categories:

Serous glands — secrete a watery, often proteinrich product.

Mucous glands — secrete a viscous product, rich in carbohydrates (e.g., glycoproteins).

Sebaceous glands — secrete a lipid product. These glands are also known as oil glands.

Type of Secretion

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Mucous

Thin, watery protein-rich secretion

Viscous secretion with lubricating or protective function

Mixed Serous-Mucous

Serous demilunes (cells) secrete into space between mucous cells



Unicellular Glands

Multicellular Glands

Made of only one glandular epithelium cell; called intraepithelial cells

Goblet cells are the only human example

Multiple cells make up one gland; called extraepithelial cells

Many examples, including secretory sheets in the human stomach