# Medical Biology

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## Epithelial Tissues

### 2. Exocrine Glands Classified by Morphology:

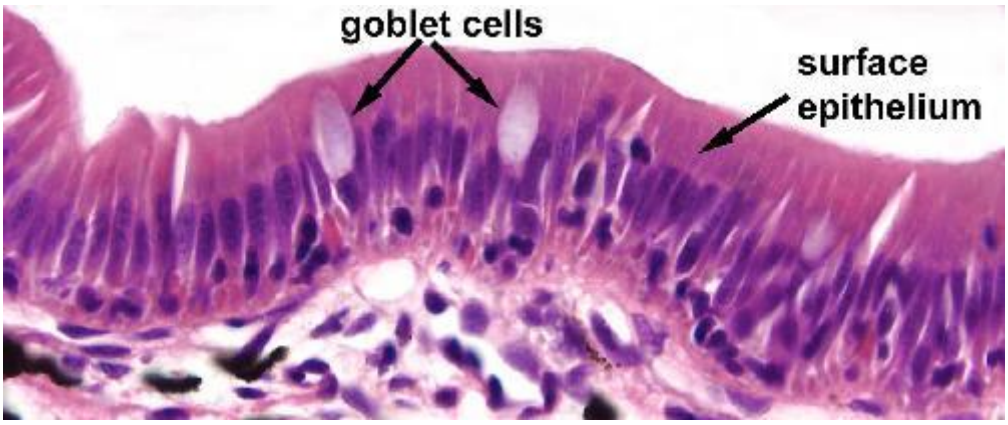
Exocrine glands are classified according to the no. of cells into two groups:

- unicellular glands
- multicellular glands.

### Unicellular exocrine glands:

The main example of a unicellular exocrine gland is the goblet cell. Goblet cells are found scattered in the heterogeneous epithelium of mucous membranes, for example, in the pseudostratified epithelium of the respiratory tract or in the absorptive epithelium of the small and large intestine. These glands synthesize and secrete mucin (the precursor of mucus) to the epithelial surface. This mucoid secretion helps lubricate and maintain the moistness of the epithelium and may also be involved in trapping dust or particulate material and in responding to infection. The nuclei of goblet cells are basally situated and usually are very flattened.

The secretory contents of goblet cells are stained weakly acidophilic (pink staining after H&E) and are stained intensely by the PAS technique owing to their proteoglycan (polysaccharide) content.



**Multicellular exocrine glands:**

**Classification of glandular epithelium**

**It is classified according to morphology**

**1. Unicellular glands**

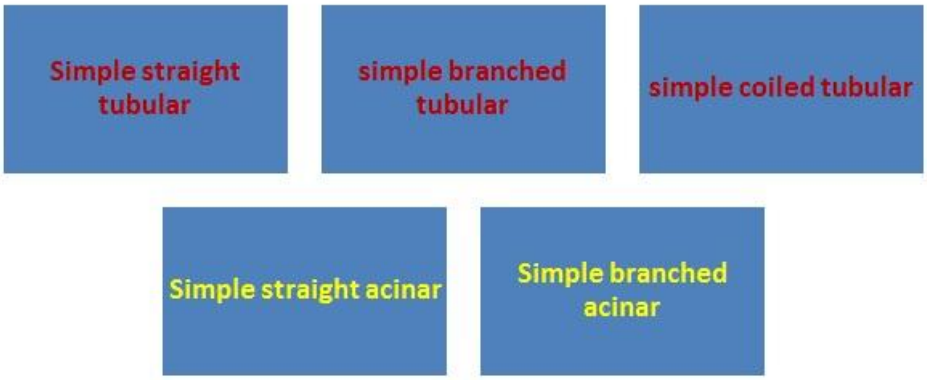
**2. Multicellular glands: they are classified according to the following:**

| Organization of the duct system | Organization of the secretory portion | Shape of the secretory portion |
|---|---|---|
| simple | straight | tubular |
| compound | branched | acinar |
| | coiled | Tubule-acinar |

Multicellular exocrine glands develop by proliferation and invagination of epithelial cells into the underlying connective tissue. The initial portions develop into the secretory duct, whereas the terminal portions develop into the secretory units. In cases where the gland develops from simple epithelium, the duct and secretory units are also single layered (e.g. the exocrine glands of the small and large intestine). In cases where the gland develops from stratified epithelium, the duct and secretory units usually have more than one layer of cells.

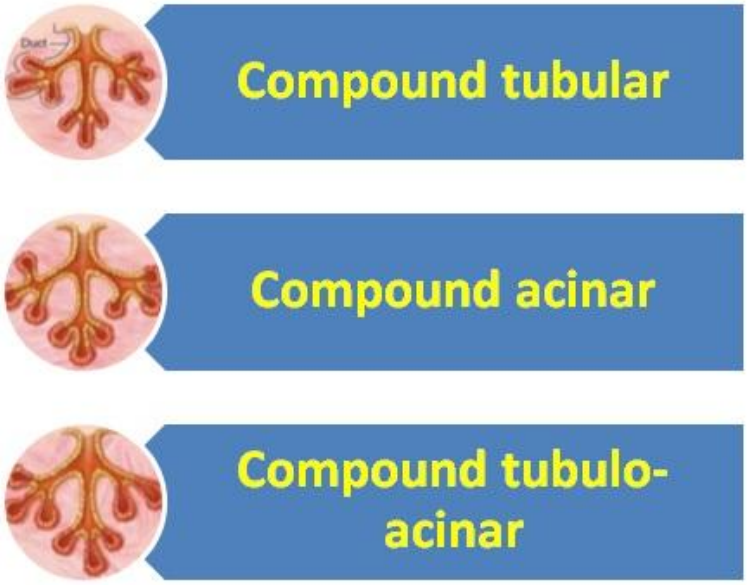
The cells of the secretory ducts are typically less poorly differentiated than the cells of the secretory units. All the epithelial cells of both the ducts and secretory units show marked polarity.

## Simple




## Compound

**(only classified according to organization of duct system and shape of secretory portion)**




Multicellular exocrine glands are classified according to the organization of their duct components into simple or compound glands.

- Simple exocrine glands have unbranched secretory ducts.
- Compound exocrine glands have branched secretory ducts. The branching is often complex and like that of branches of a tree.

Multicellular exocrine glands are classified according to the organization of their secretory components into straight, branched and coiled:

- Straight exocrine glands when the terminal portion of the secretory unit is straight.
- Branched exocrine glands when the terminal portion of the secretory unit bifurcate into 2 or more branches.
- Coiled exocrine glands when the terminal portion of the secretory unit is coiled.

Multicellular exocrine glands are classified according to the shape of secretory units in both simple and compound glands into:

- tubular
- alveolar (acinar)
- tubule-acinar(alveolar)

**Simple Glands**

**1. simple tubular glands:**

***a. simple straight tubular glands:*** there is no secretory duct or a very short one and the terminal portion is straight tubule that opens directly onto the epithelial surface (e.g. the intestinal glands (crypts of Lieberkuhn)).

***b. simple branched tubular glands:*** the tubules of the terminal portion bifurcate into 2 or more branches; an excretory duct may be absent as in the glands of stomach and uterus or there may be a short excretory duct as in some of the glands of the oral cavity.

***c. simple coiled tubular glands:*** the terminal portion is a long-coiled tubule connected to the surface by an unbranched excretory duct (e.g. sweat gland).

**2. simple acinar glands (simple alveolar)**

The terminal portion is expanded to form a spherical or elongated sac.

***a. simple straight acinar glands:*** there is one acinous associated with one excretory duct, this type is present in the small mucous glands along the urethra.

***b. simple branched acinar glands:*** the acinus is subdivided by partition into several smaller compartments (e.g. the sebaceous glands of the skin).

**Compound Glands**

**2. compound multicellular exocrine glands:**

The duct of the compound multicellular exocrine gland is branched repeatedly. It is classified according to the shape of terminal portions of secretory part into:

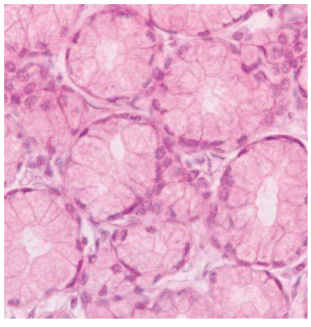
***a. compound tubular glands:*** the terminal portions of the smallest lobules are more or less coiled tubules, usually branching (e.g. submucosal mucous glands (of Brunner) in the duodenum).

***b. compound acinar or alveolar glands:*** the terminal portions appear in the form of spherical shaped units (e.g. the mammary gland).

***c. compound tubuloacinar (tubuloalveolar):*** the secretory parts are tubular and alveolar (e.g. the salivary glands).

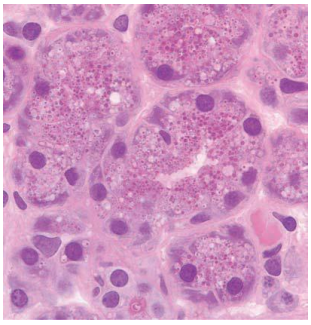
**3. Exocrine Glands Classified by Product:**

The secretory cells (of secretory units) of exocrine glands are classified into three histological categories based on their secretory product characteristics:



**1. Mucous cells:** These are rounded acidophilic or empty cells (typically with basal flattened nuclei), that are rich in glycoproteins and produce a mucoid secretion.

**2. Serous cells:** These are basophilic cells that are pyramidal. The serous cells synthesize and secrete polypeptides or proteins. Their nuclei are oval or rounded centrally located, and the secretory granules may be visible



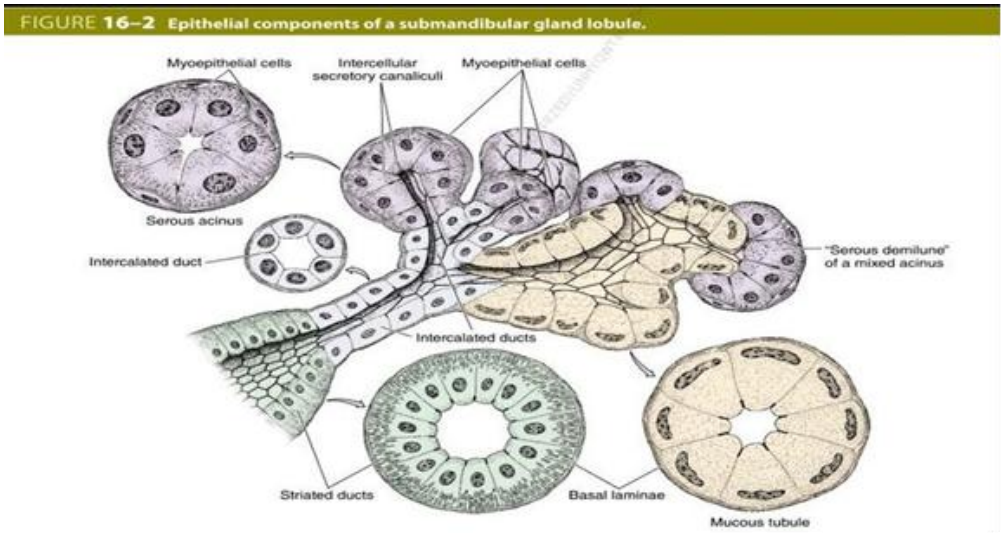
in the apical portion of the cells. The basal region of the cells has accumulations of rough endoplasmic reticulum (RER) that provide the basophil staining.

**3. Mixed:** These glands have both serous and mucous cells.

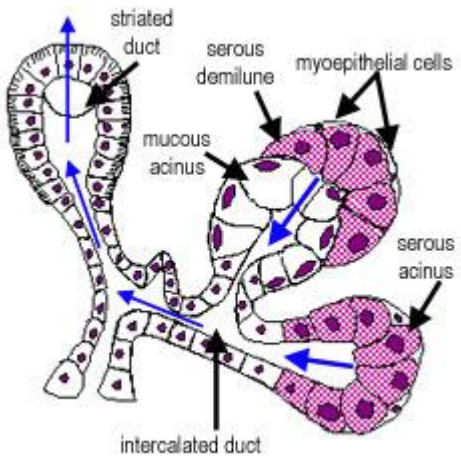
The secretory units of some exocrine glands are entirely serous in nature (e.g. pancreas, parotid gland), whereas other glands may be mixed with both mucous and serous cells (e.g. submandibular gland, glands of the fundus of the stomach).

The mucous cells end in mixed glands is capped by serous cells that secrete between the mucous cells' intercellular space. These serous caps on mucous cells are called serous demilunes. Approximately 10% of submandibular glands contain serous demilunes, but these glands are predominantly serous acini, which constitute 90% of the gland.

The process of synthesis, storage and secretion in serous cells illustrates the structural and functional polarity of the cells. The RER in the basal region synthesizes the polypeptide or protein molecules, which are transported to the Golgi bodies and packaged into membrane-bound granules. These granules accumulate in the apical region of the cells and as a result of the necessary secretory signals are discharged at the apical surface to the external environment by exocytosis.



Several types of multicellular exocrine glands (of ectodermal origin) have an additional cell type known as the myoepithelial cells. These are contractile cells surrounding the secretory units, and when they receive a signal to contract, result in secretory discharge from the secretory cells. Examples of glands with myoepithelial cells include the salivary glands and the mammary glands.




## Difference between Serous & Mucous Acini

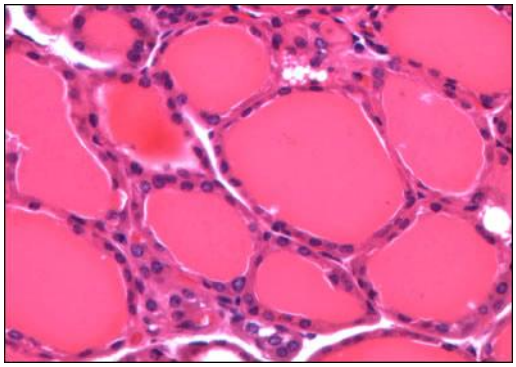
| Serous | Mucous |
|---|---|
| • Thin, watery | • Thick, viscous |
| • Proteinaceous secretion | • Mucopolysaccharides |
| • Zymogen granules in cyto | • Mucigen droplets |
| • Central rounded Nucleus | • Nucleus-flat & peripheral |
| • Small Lumen | • Large Lumen |
| • Indistinct cell bondaries | • Distinct cell boundaries |
| • Darkly stained | • Lighly stained |
| • Enzymatic action | • Protection & lubrication |
| • Parotid Gland | • Sublingual gland |

**Endocrine glands:**

Endocrine glands develop initially in the embryo like the multicellular exocrine glands; however, their ducts degenerate and disappear (ductless glands) and the glands secrete directly into the blood capillaries in the surrounding connective tissue. Endocrine secretions are known as hormones and the endocrine glands form part of a major regulatory system, known as the endocrine system. Endocrine glands, are very variable in histological appearance and owing to their great structural diversity are

hard to classify according to morphology, though the secretory cells may be classified into two major groups:

- ❖ polypeptide (or protein)-secreting cells
- ❖ steroid-secreting cells.

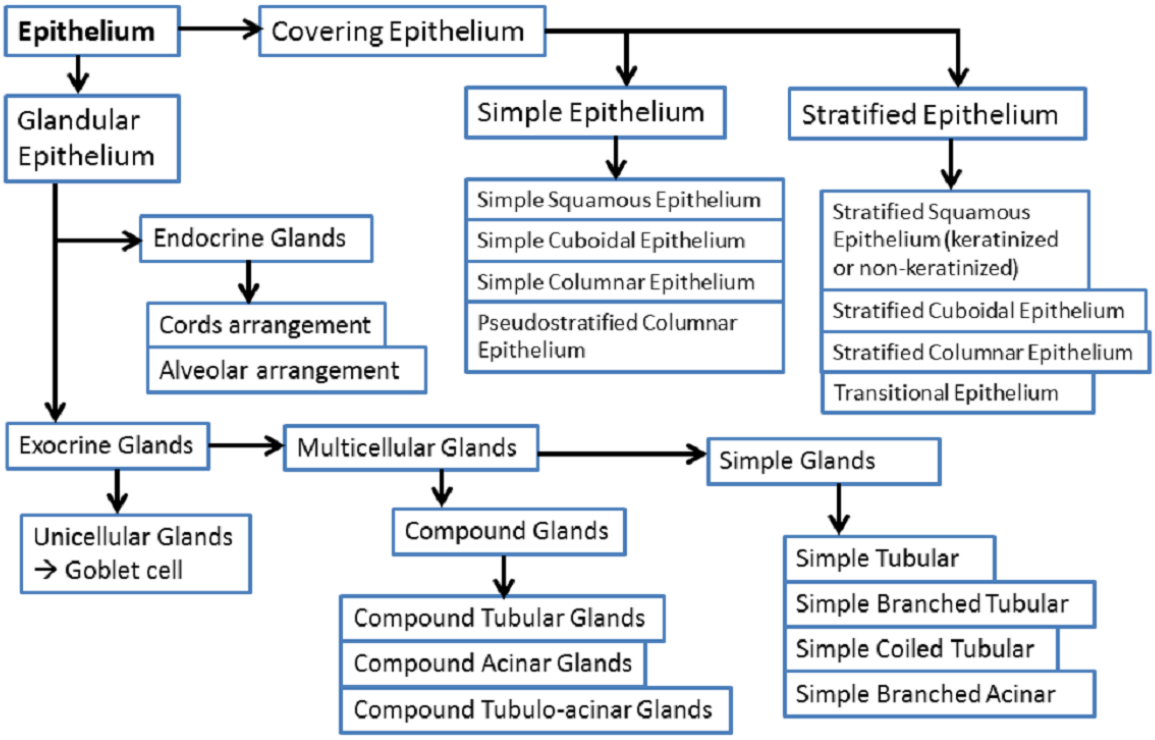


The endocrine polypeptide (or protein)-secreting cells are typically characterized by well-developed RER (rough endoplasmic reticulum), Golgi bodies and membrane-bound secretory granules. These endocrine cells may be isolated or in small groups (the diffuse endocrine system) and include many of the endocrine cells of the intestine.

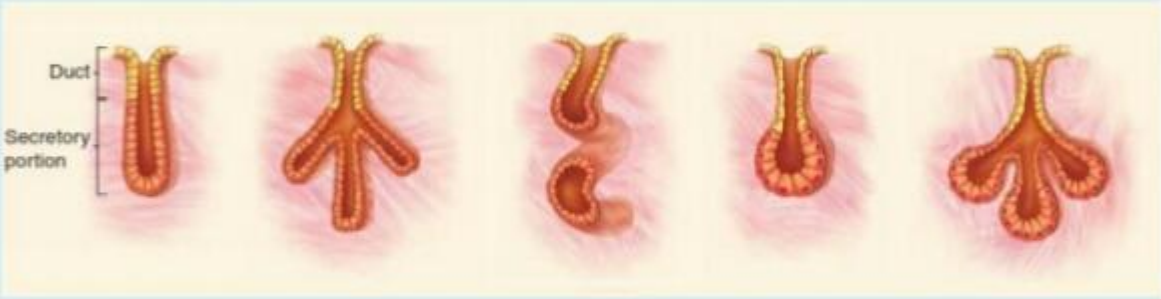
The endocrine steroid-secreting cells (e.g. in the testis, ovary, suprarenal cortex) are characterized by well-developed SER (smooth endoplasmic reticulum) and abundant lipid droplets.

**Medical notes:**

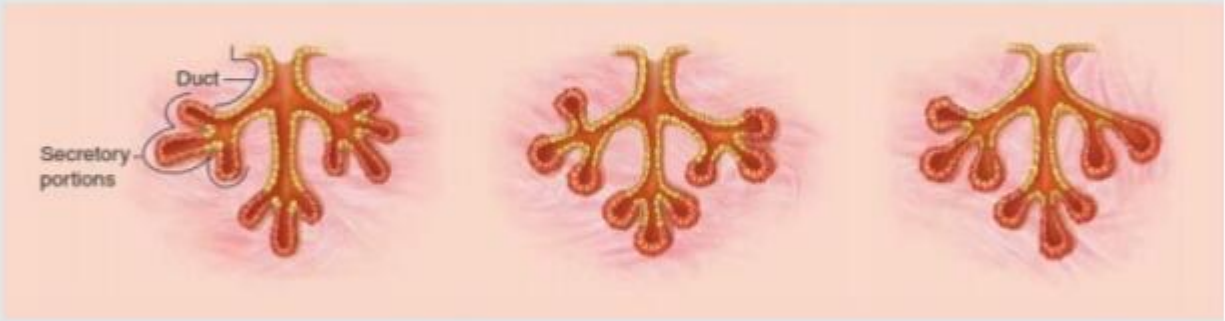
Both benign and malignant tumours can arise from most types of epithelial cells. Malignant tumours of epithelial origin are called carcinomas. Malignant tumours derived from glandular epithelial tissue are called adenocarcinomas which are mostly common tumours in adults after age 45.


Epithelium
Covering Epithelium
Glandular Epithelium
Simple Epithelium
Stratified Epithelium
Simple Squamous Epithelium
Simple Cuboidal Epithelium
Simple Columnar Epithelium
Pseudostratified Columnar Epithelium
Stratified Squamous Epithelium (keratinized or non-keratinized)
Stratified Cuboidal Epithelium
Stratified Columnar Epithelium
Transitional Epithelium
Endocrine Glands
Cords arrangement
Alveolar arrangement
Exocrine Glands
Multicellular Glands
Simple Glands
Unicellular Glands
→ Goblet cell
Compound Glands
Compound Tubular Glands
Compound Acinar Glands
Compound Tubulo-acinar Glands
Simple Tubular
Simple Branched Tubular
Simple Coiled Tubular
Simple Branched Acinar

# Simple (ducts do not branch)

| Class | Simple Tubular | Branched Tubular | Coiled Tubular | Acinar (or Alveolar) | Branched Acinar |
|---|---|---|---|---|---|
| |  | | | | |
| Features | Elongated secretory portion; duct usually short or absent | Several long secretory parts joining to drain into 1 duct | Secretory portion is very long and coiled | Rounded, saclike secretory portion | Multiple saclike secretory parts entering the same duct |
| Examples | Mucous glands of colon; intestinal glands or crypts (of Lieberkühn) | Glands in the uterus and stomach | Sweat glands | Small mucous glands along the urethra | Sebaceous glands of the skin |

# Compound (Ducts from Several Secretory Units Converge into Larger Ducts)

| Class | Tubular | Acinar (Alveolar) | Tubuloacinar |
|---|---|---|---|
| |  | | |
| Features | Several *elongated*, coiled secretory units and their ducts converge to form larger ducts | Several *saclike* secretory units with small ducts converge at a larger duct | Ducts of both tubular and acinar secretory units converge at larger ducts |
| Examples | Submucosal mucous glands (of Brunner) in the duodenum | Exocrine pancreas<br>Mammary gland | Salivary glands |