Glandular Epithelium

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Glands

• “Glandular epithelia are tissues formed by cells specialized to produce secretion.”

• **Secretion**: if substances produced are used elsewhere in the body, they are called secretions.

• **Excretion**: if products are discarded from the body, they are known as excretions.
Glands

- Glandular epithelial cells may synthesize, store, and secrete proteins (e.g. pancreas), lipids (e.g. sebaceous glands), or complexes of carbohydrates and proteins (e.g. salivary glands).

- The mammary glands secrete all 3 substances.

- Some glands have low synthesizing activity (e.g. sweat glands). They secrete mostly substances transferred from the blood to the lumen of the gland.
Exocrine glands

Duct

Secretory portion

Endocrine glands

Capillaries

Secretory portion
Development of glands:

• Glands develop as invaginations of covering epithelia. Epithelial cells proliferate and penetrate connective tissue. They may—or may not—maintain contact with the surface. When contact is maintained, exocrine glands are formed; without contact, endocrine glands are formed.
Classification of glands:

• **Exocrine glands**
  (Gr. Exo, outside, + krinein, to separate) release their products onto an epithelial surface, either directly or through a duct e.g. the salivary glands.

• **Endocrine glands**
  (Gr, endon, within, + krinein) release their products into the blood stream (ductless), e.g. thyroid gland.

• Mixed variety: some glands possess both exocrine and endocrine function e.g. pancreas.
The cells of endocrine glands can be arranged in **cords** (e.g. adrenal, parathyroid, Ant pituitary) or in **follicles** (e.g. thyroid).

The lumens of the follicles accumulate large quantities of secretions; cells of the cords store only small quantities of secretions in their cytoplasm.
Exocrine glands

They can be classified on the basis of:

- Number of cells
- Mode of secretion.
- Morphology of ducts and secreting portions.
- Nature of secretory product.
Exocrine glands are classified according to number of cells into:

A. Unicellular glands

- e.g. Goblet cells which are present in the lining epithelia of intestine and the respiratory tract

B. Multicellular glands

- they form most of the glands of the body
- e.g. salivary gland.
Classification on the basis of the **mode of secretion**

- Depending on their mode of secretion i.e.; the manner in which the secretory product is elaborated, the exocrine glands are classified into the following varieties:
  
1. Merocrine glands
2. Apocrine glands
3. Holocrine glands
Merocrine glands

The secretory product is delivered in membrane-bound vesicles to the apical surface of the cell. Here, vesicles fuse with the plasma membrane and extrude their contents by **exocytosis**

e.g; pancreas, salivary glands
Apocrine glands

In these glands part of the apical cytoplasm is lost along with the secretory material.

e.g; lactating mammary glands, special sweat glands located in axilla and perianal area and the ceruminous glands of the external auditory meatus.
Holocrine glands

In these glands entire cells laden with secretory material disintegrate and all of the cellular contents are discharged from the gland as secretions.

E.g; the sebaceous glands of skin
(a) Merocrine gland

(b) Holocrine gland

(c) Apocrine gland

Disintegrating cells with contents becoming the secretion

Secrents

Nucleus of secretory cell

Cells dividing

Pinching off of apical portion of secretory cell

Secretory vesicles releasing their contents via exocytosis

Secretory vesicle

Secretory contents
Goblet cells

Goblet cell is a glandular simple columnar epithelial cell whose function is to produce and secrete strongly hydrophilic glycoproteins called mucins. When secreted, becomes highly hydrated mucous (an elastic protective lubricating gel).

Scattered among cells of many simple epithelia, especially respiratory & GI tracts.

Mainly use the **merocrine** method of secretion.
Goblet cell

The goblet cell is **highly polarized** with the nucleus and other organelles concentrated at the base of the cell. The remainder of the cell's cytoplasm is occupied by membrane-bound secretory granules containing mucin.

Apical cytoplasm contains numerous secretory granules. Cell base has the nucleus and is rich in rER. Golgi, located above nucleus, exceptionally well-developed.
Multicellular Exocrine Glands

- Have two basic parts
  - Secretory unit
  - Epithelium-walled duct

- Classified by structure of duct
  - Simple
  - Compound

- Categorized by secretory unit
  - Tubular
  - Acinar (Alveolar)
  - Tubuloacinar
The secretory units are supported by a stroma of connective tissue.

**Parenchyma**: composed of the cells responsible for the organ’s specialized functions.

**Stroma**: the cells of which have a supportive role in the organ.
Generally the larger glands have the same structural pattern. Externally a gland is surrounded by a dense layer of connective tissue which forms **capsule** of the gland. From the capsule connective tissue septa extend into the gland, thereby dividing its substance into a number of **lobes**. Thinner septa subdivide each lobe into smaller **lobules**. Blood vessels and nerves pass along the connective tissue septa to reach the secretory elements.
Ducts

secretory acini

Simple cuboidal

Simple columnar

Stratified cuboidal
### SIMPLE Glands (Ducts Do Not Branch)

<table>
<thead>
<tr>
<th>Class</th>
<th>Simple Tubular</th>
<th>Branched Tubular</th>
<th>Coiled Tubular</th>
<th>Acinar (or Alveolar)</th>
<th>Branched Acinar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Elongated secretory portion; duct usually short or absent</td>
<td>Several long secretory parts joining to drain into 1 duct</td>
<td>Secretory portion is very long and coiled</td>
<td>Rounded, saclike secretory portion</td>
<td>Multiple saclike secretory parts entering the same duct</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>Mucous glands of colon; intestinal glands or crypts (of Lieberkühn)</td>
<td>Glands in the uterus and stomach</td>
<td>Sweat glands</td>
<td>Small mucous glands along the urethra</td>
<td>Sebaceous glands of the skin</td>
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</tbody>
</table>
**COMPOUND Glands** (Ducts from Several Secretory Units Converge into Larger Ducts)

<table>
<thead>
<tr>
<th>Class</th>
<th>Tubular</th>
<th>Acinar (Alveolar)</th>
<th>Tubuloacinar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Several <em>elongated</em> coiled secretory units and their ducts converge to form larger ducts</td>
<td>Several <em>saclike</em> secretory units with small ducts converge at a larger duct</td>
<td>Ducts of both tubular and acinar secretory units converge at larger ducts</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>Submucosal mucous glands (of Brunner) in the duodenum</td>
<td>Exocrine pancreas</td>
<td>Salivary glands</td>
</tr>
</tbody>
</table>
Classification on the basis of nature of secretory product:

1. **Mucous glands**: these glands produce a viscid, slimy, carbohydrate-rich secretion which is called mucus, e.g.; the goblet cells, some glands in digestive tube, respiratory tract and genital tract.

2. **Serous glands**: these glands produce a thin, watery, protein-rich secretions, often high in enzymatic activity e.g.; the parotid salivary gland.

3. **Mixed (seromucous) glands**: these glands produce both mucous and serous secretions e.g.; the sublingual and submandibular salivary glands.

4. **Steroid secreting cells**: endocrine cells specialized for synthesizing and secreting steroids with hormonal activity.
Myoepithelial cells

Located between the secretory cells and the basement membrane

Rich in actin and myosin

When these cells contract, they squeeze the ducts, helping to extrude the contents
Each myoepithelial cell has long cytoplasmic processes which wrap around a secretory unit.