

The module: Tissue of the body

Session 4, Lecture 1

Duration : 1 hr

Glandular Tissues & How Cells Secrete

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Histology Textbooks 'Basic Histology', Junqueira



- **A glandular tissue** :

- is a modified type of epithelial tissue either cell or aggregate of cells specialized for the process of secretion

Secretion:

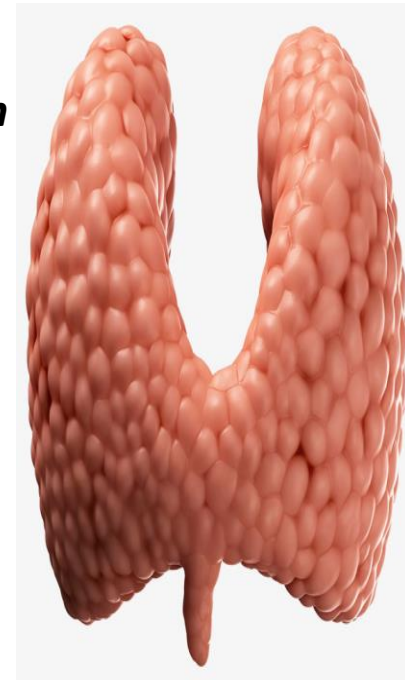
product (secretion) is always a water-based fluid (aqueous) and usually contains proteins .

Secretion is considered an active process.

Glandular cells obtain substances needed from blood and transform them (chemically) into a product that's discharged from the cell.

- **The glandular tissue is classified mainly**

- according to:
 - 1. **Structure**
 - 2. **Nature** of secretion
 - 3. **Method** of discharge





Glandular tissue

Learning Objectives

- Definition of a gland. **L01**
- Classification of glandular tissue. **L02**
- Mechanisms of secretion. **L03**
- Mechanisms of endocytosis. **L04**
- Describe how endocytosis and secretion combine to give trans epithelial transport. **L05**
- Mechanism and importance of the glycosylation of newly synthesised proteins in the Golgi apparatus. **L06**
- Role of secretions in cell functions **L07**
- Mechanisms of control of secretion. **L08**



Criteria of a gland

Lo1

- ❑ Glandular cells are usually **epithelial** in origin.
- ❑ The **Surface** epithelia that have **specialized** modification and fulfil a specific function.
- ❑ Epithelial cells **proliferate** and **leave** the surface from which they developed to **invade the** underlying connective tissue where a **basal lamina** surrounds the **newly** formed gland.
- ❑ **Secretory granules**: vesicles in which the products of a gland are stored.



Classification:

According to Structure:

Include

1- Secretory part:

- a. unicellular or multicellular
- b. acinar (alveolar) or tubular
- c. coiled or branched

2- Duct system:

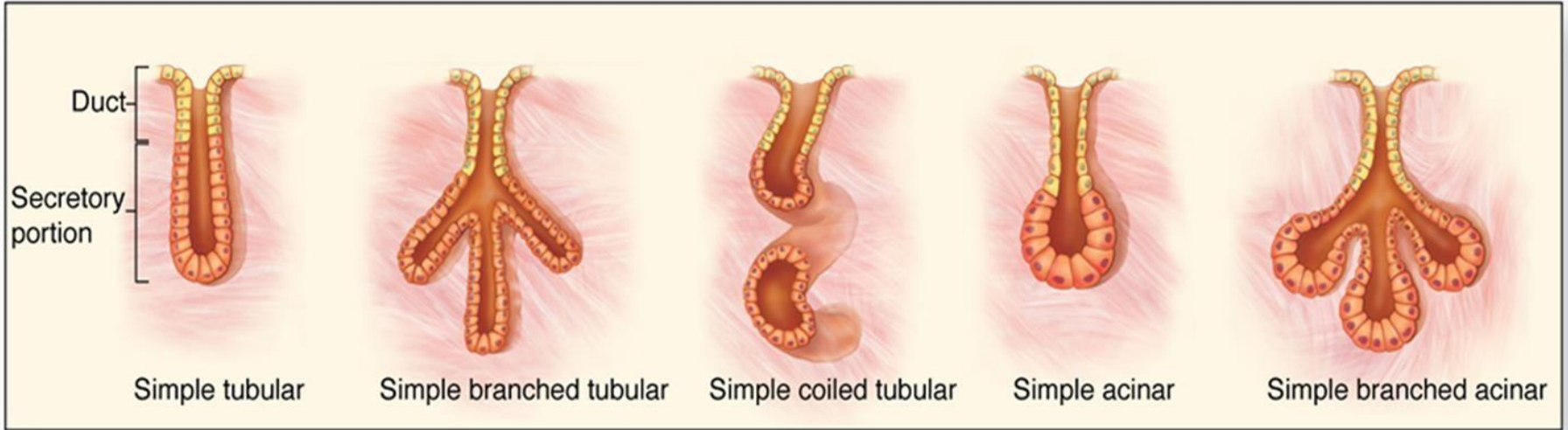
- a. Simple gland = single duct
- b. Compound gland = branched ducts

3. Branching ducts:

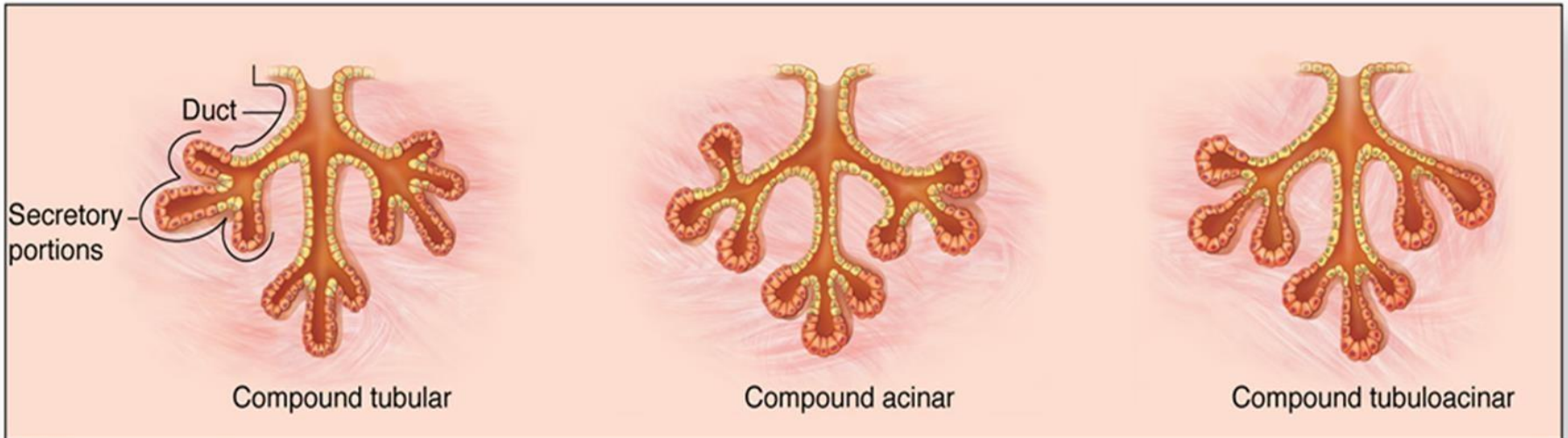
Main duct ► interlobular ► Intralobular ► Intercalary

Lo2



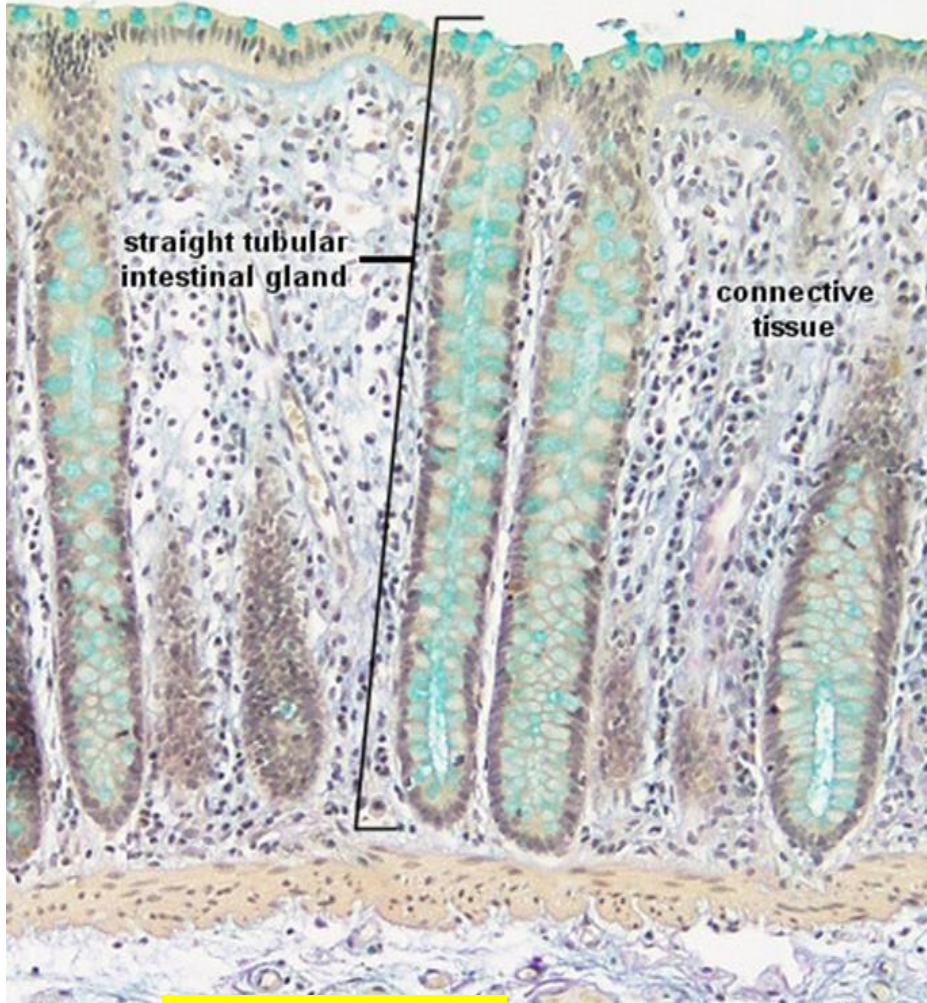


a Simple glands

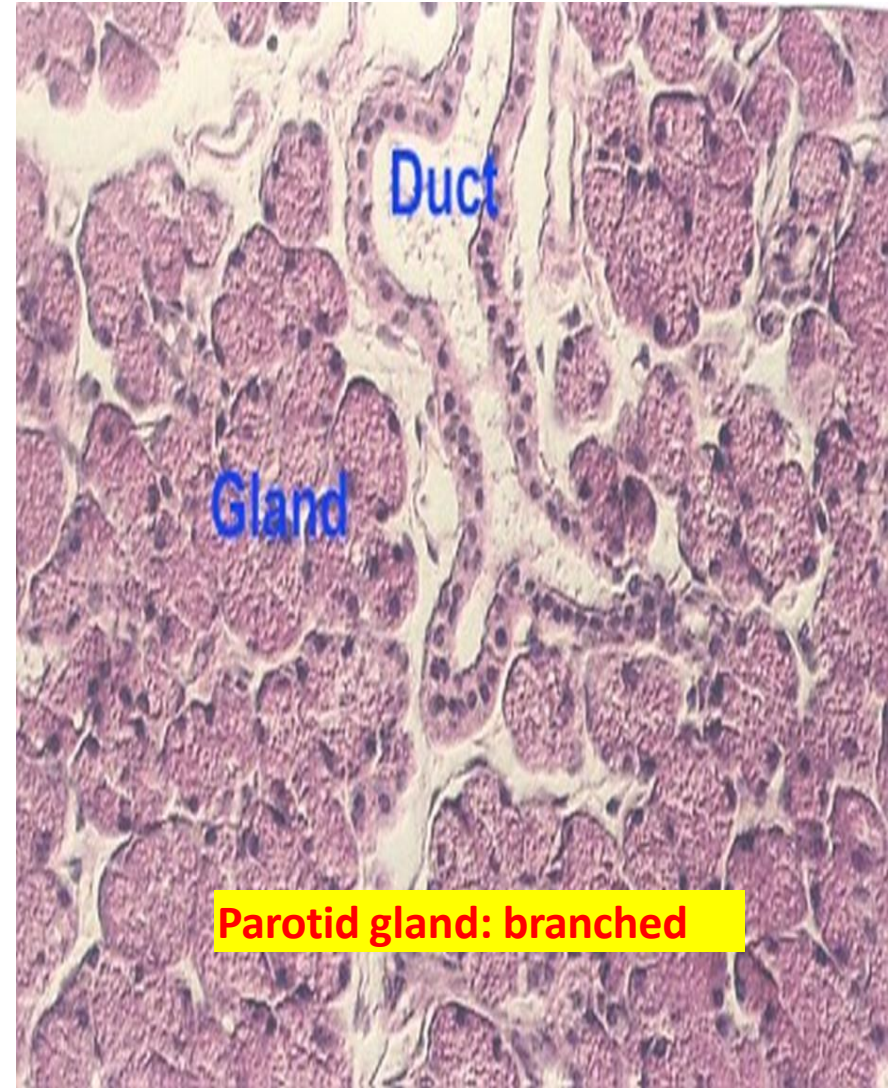


b Compound glands

Colon Alcian blue & van Gieson



Intestinal gland



Parotid gland: branched

Branching ducts:

Main



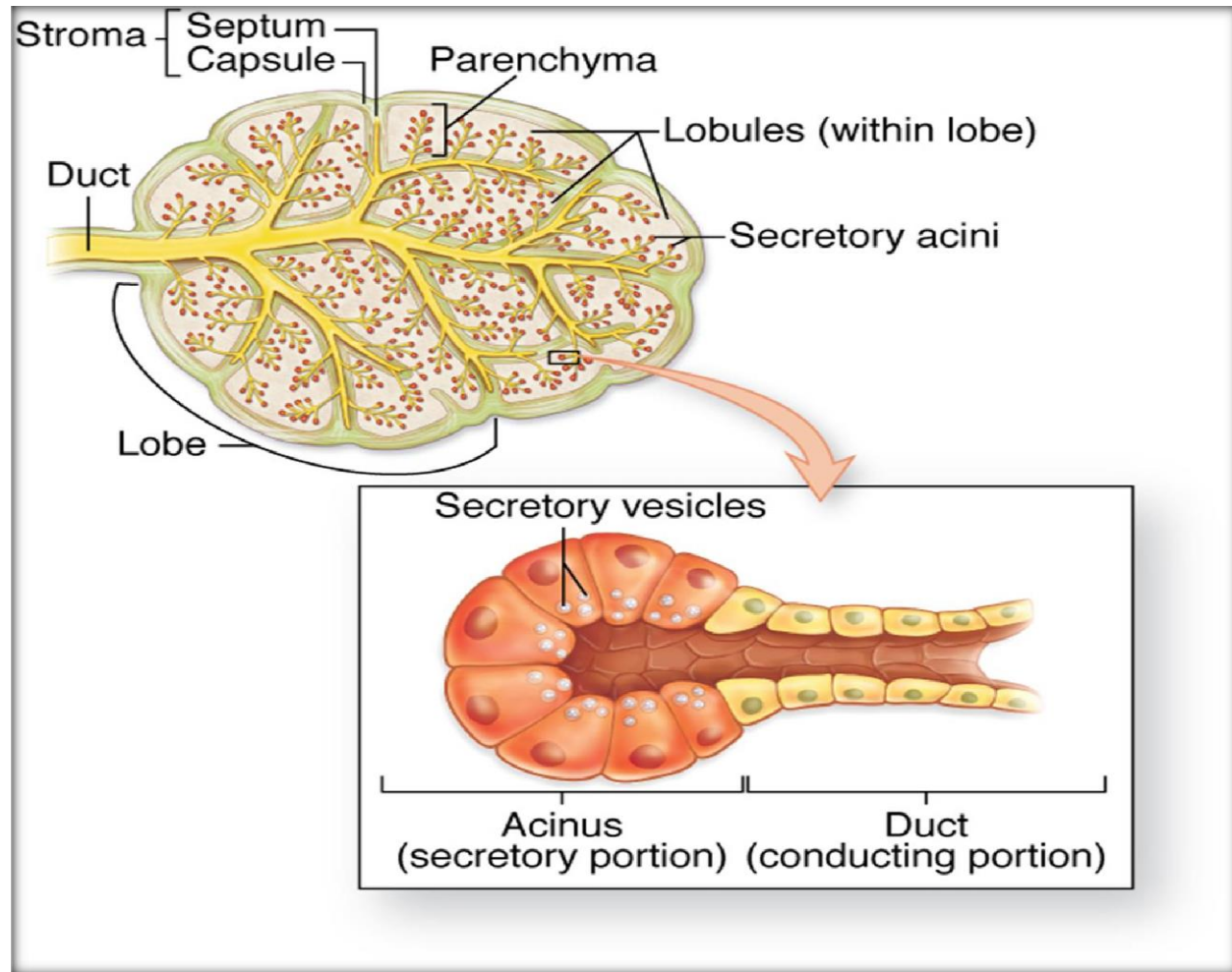
interlobular



Intralobular



Intercalary



According to: **Ductal system**

duct or no duct

Two major groups of gland :

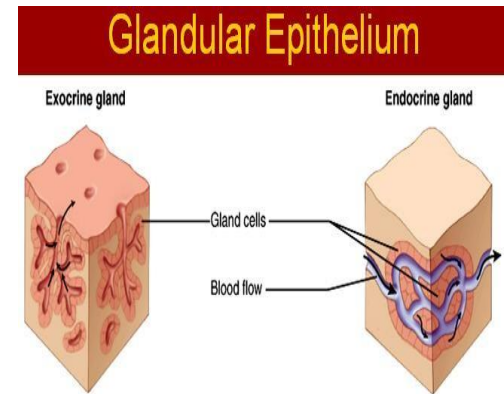
1. Exocrine glands :

- Secrete into **ducts** or **directly** on a free surface.
- Their secretions include mucus, sweat, oil, ear wax and digestive enzymes.
- Examples:
pancreas , stomach , sweat glands , salivary glands , mammary glands , sebaceous glands , etc .

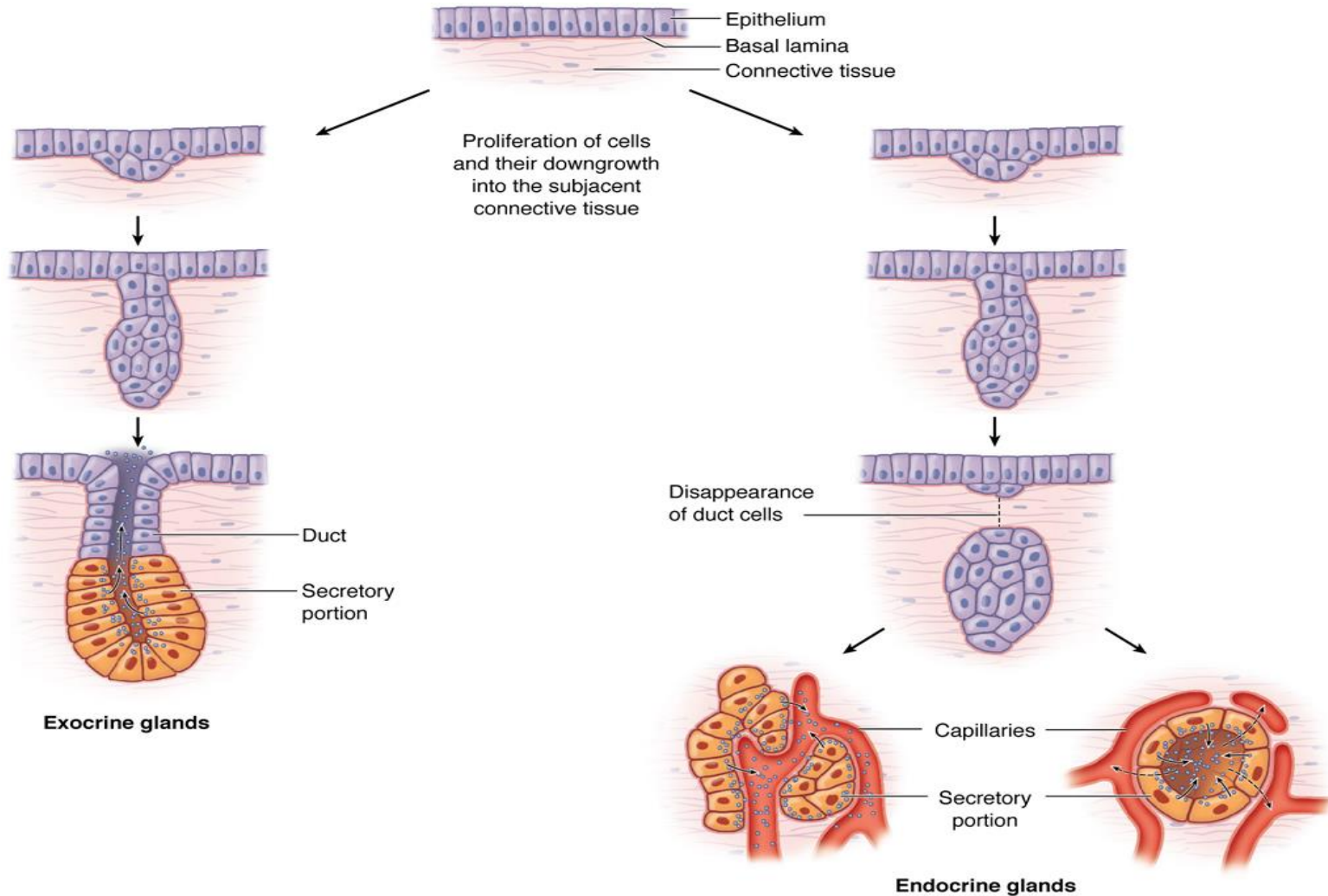
2. Endocrine glands

- ductless, secrete directly into blood or lymphatic vessels.
- These secretions are hormones, or chemical messengers, which regulate many body functions.

Example: pancreas, thyroid, adrenals, etc.



N: Majority of glands are derivatives of epithelial tissue



Endocrine glands

Lo2

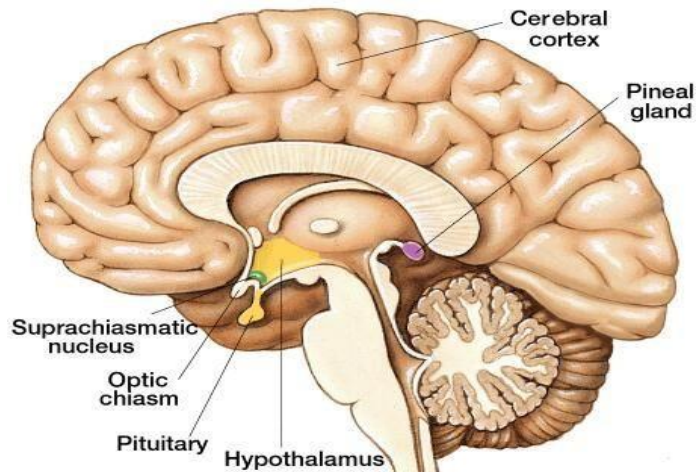
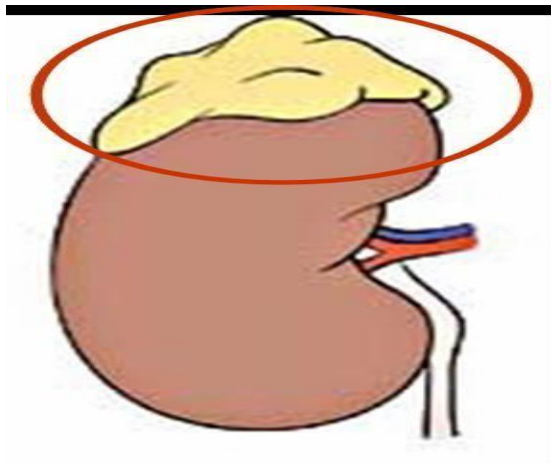
have no ducts and the secretion pass directly to the blood

e.g.

Thyroid gland .

Pituitary gland.

Adrenal gland .

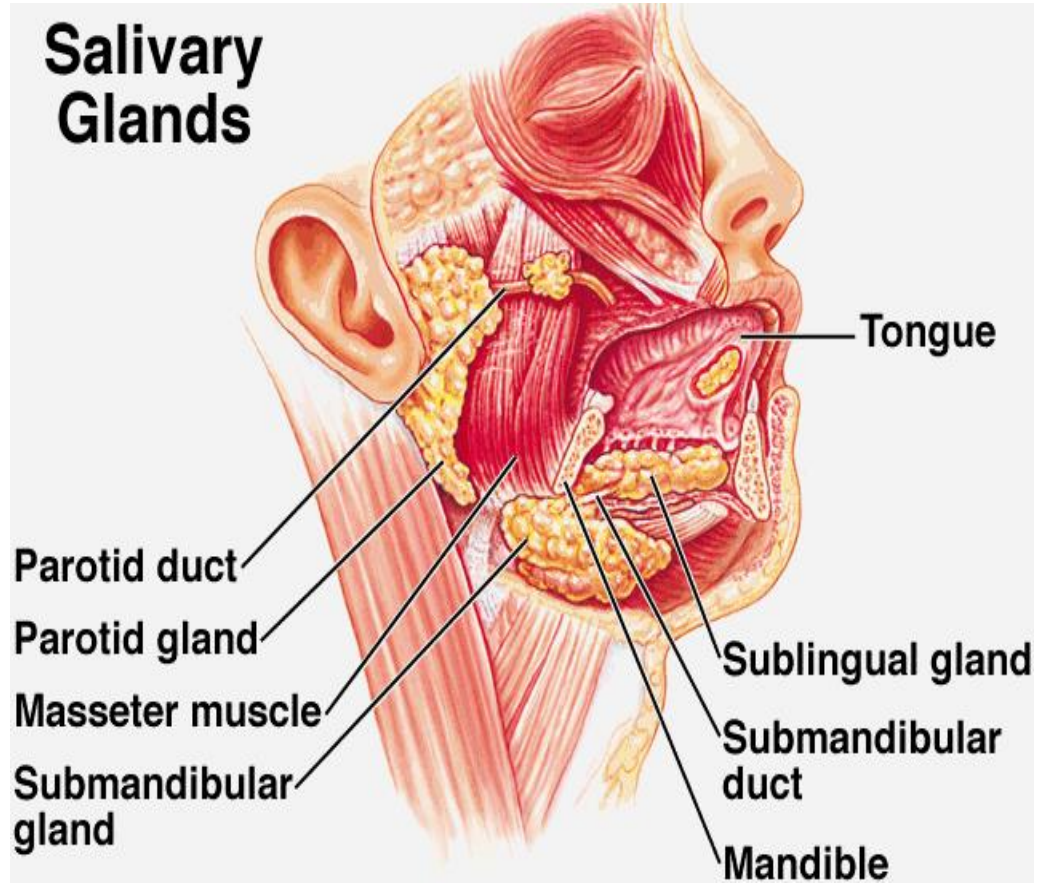


Exocrine gland

possess ducts

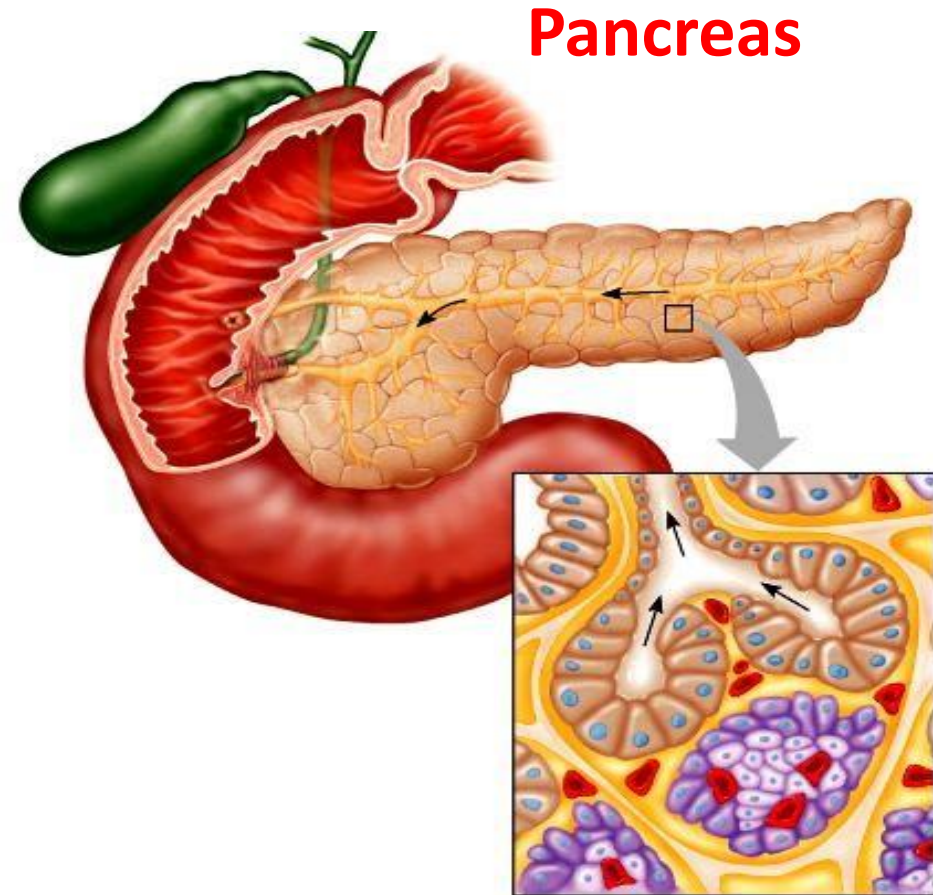
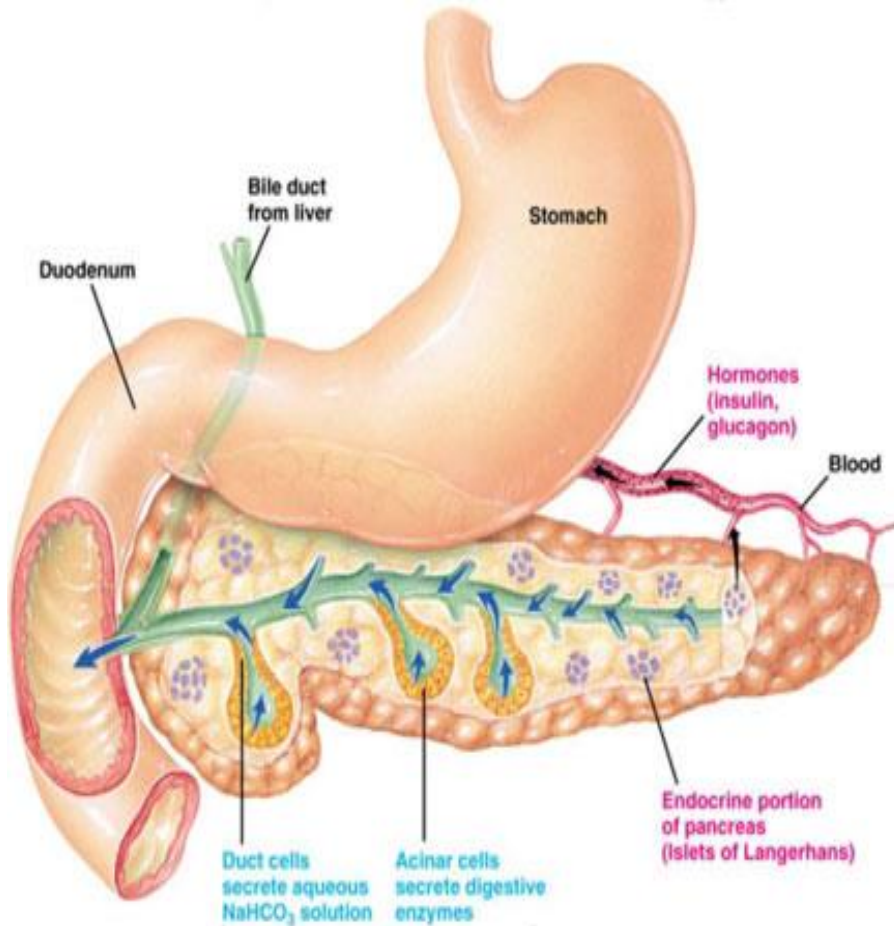
e.g. salivary glands

Lo2



Mixed gland (exo and endo)

Lo2



Exocrine glands

Lo2

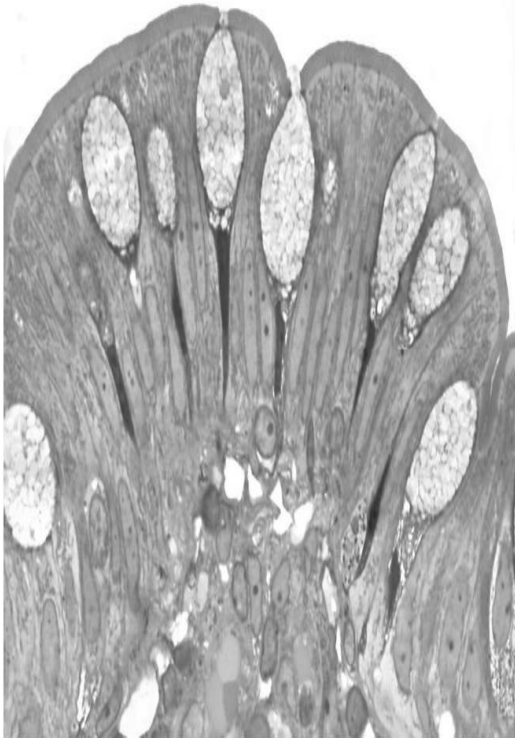
According to secretory part

1. No of cells

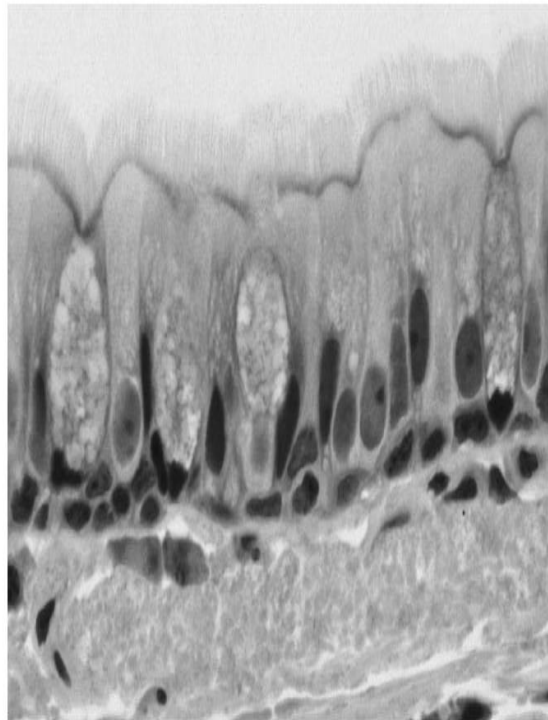
A. UNICELLULAR :

B. e.g: Goblet cells (mucous secreting) in the intestine.

Unicellular goblet cells in the epithelium of a villus



Unicellular goblet cells in the upper respiratory epithelium



simple columnar cells
with microvilli

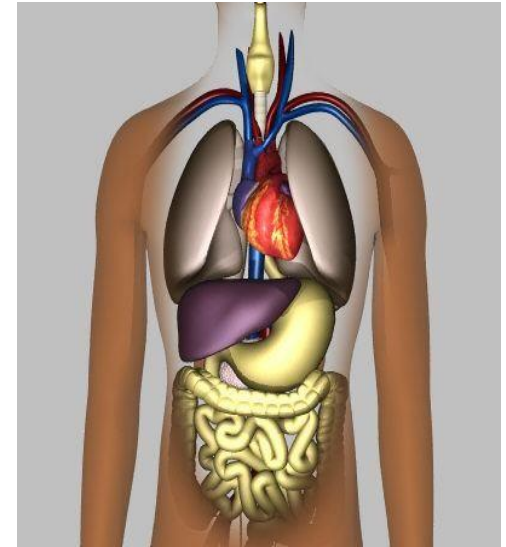


B. MULTICELLULAR :

1. SIMPLE GLANDS :

single unbranched duct.

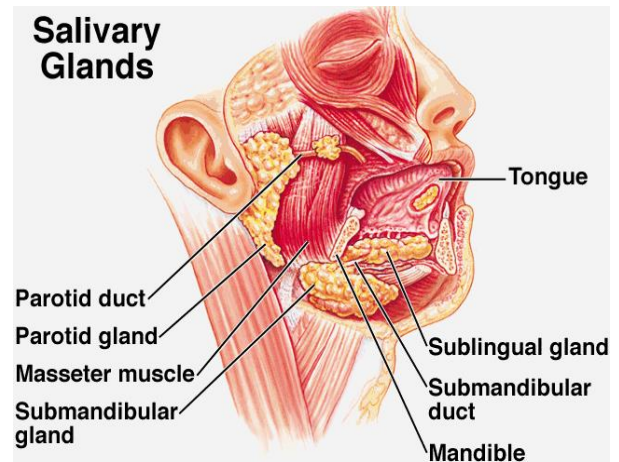
e.g intestinal gland.



2. COMPOUND GLANDS :

3. Branched duct.

e.g submandibular gland.





Simple tubular

Crypt of Lieberkuhn



Simple coiled tubular

Sweat glands



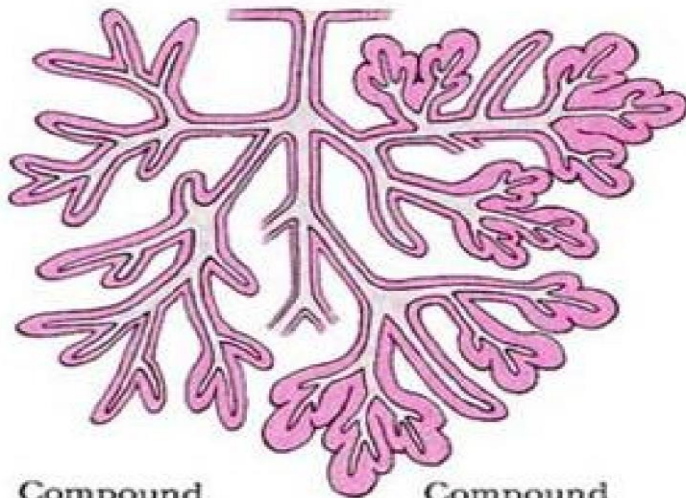
Simple branched tubular

Fundic glands of stomach



Simple branched acinar

Meibomian glands

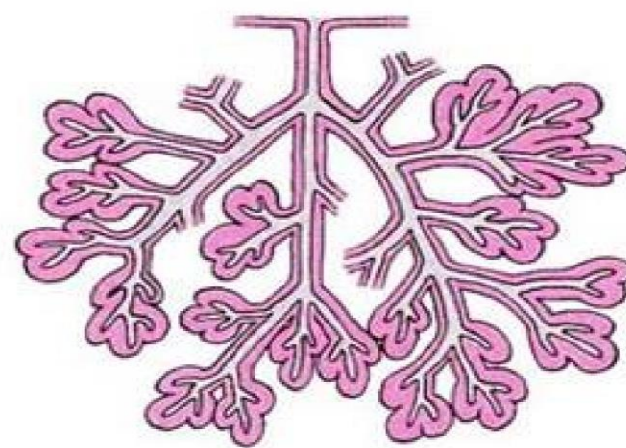


Compound tubular

Brunner glands

Compound tubuloacinar

Submandibular gland



Compound acinar

Mammary gland

According to the secretory part.

2. Shape:

Tubular glands

have tubular secretory parts
e.g. intestinal glands and liver

Alveolar glands:

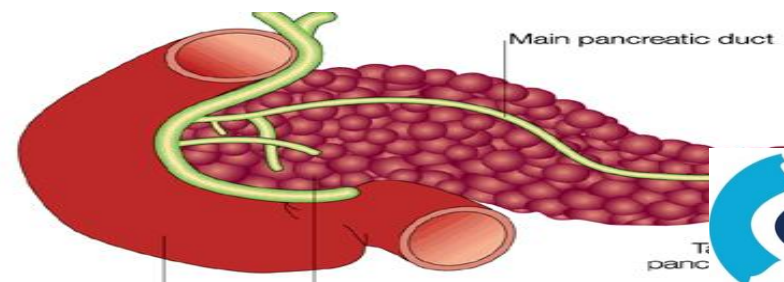
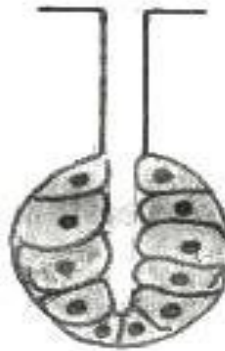
have alveolar (flask shaped) or
acinar (grape like) secretory parts

e.g. sebaceous and mammary
glands.

Tubulo-alveolar glands:

the secretory part is formed of the
two types

e.g. salivary glands , pancreas.



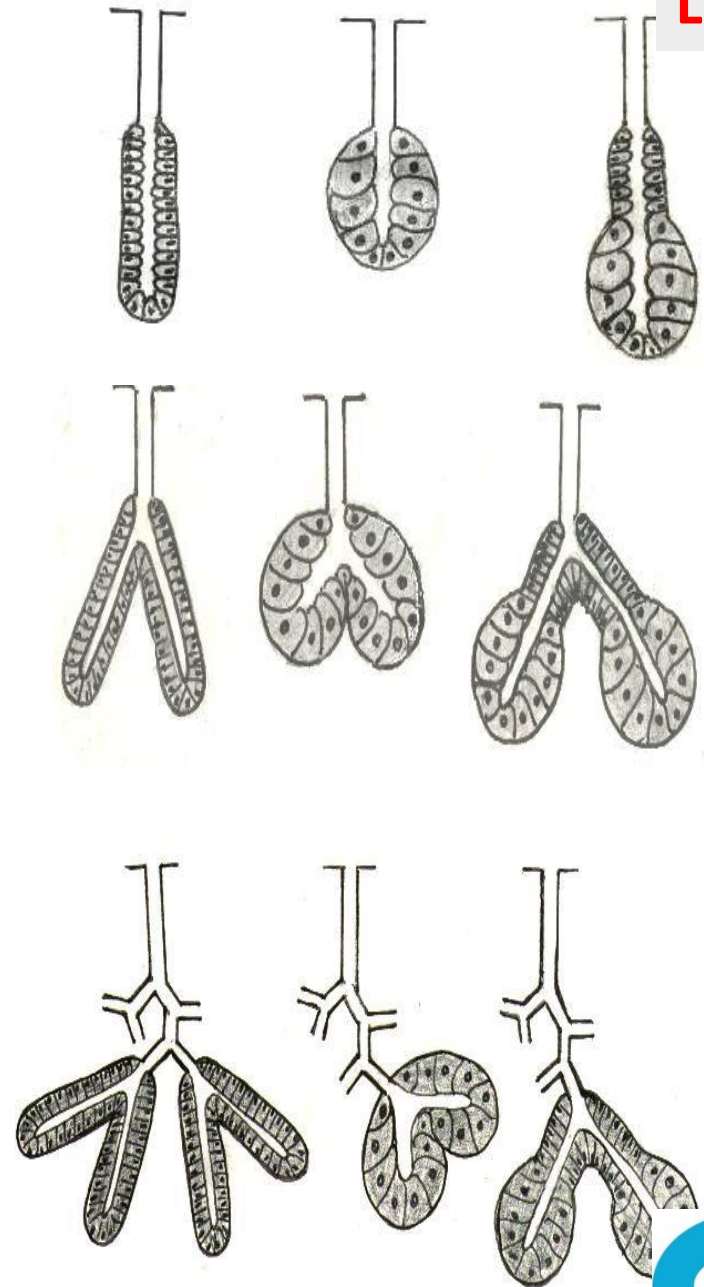
3. Branching : of the secretory part:

Simple glands:

e.g. intestinal glands.

Branched glands:

e.g. salivary glands,
Liver and pancreas.



According to **nature** of secretion

- * **Mucous glands**: produce **viscid** mucous poor in enzymes
e.g. goblet cells and minor salivary glands.
- * **Serous glands**: produce watery solution rich in enzymes
e.g. Parotid glands and pancreas.
- * **Mucoserous glands**: produce both types of secretions
e.g. submanibular and sublingual glands.
- * **Sweat glands** of skin produce watery secretion
containing some enzymes and waste products
- Oily glands**: secrete fatty secretion
e.g. sebaceous and tarsal glands
- Waxy glands**: secrete waxy secretion /external ear
e.g. ceruminous
- Cellular glands**: produce cells
e.g. testis and ovary



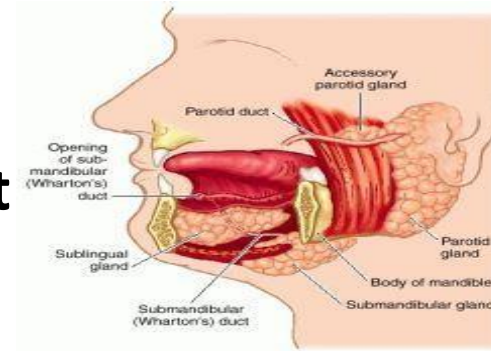
Mechanism of secretion: glands classified into :

1. MEROCRINE
2. APOCRINE
3. HOLOCRINE

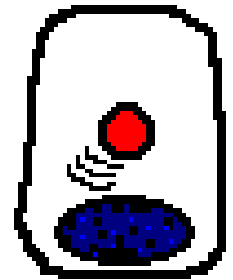
MEROCRINE GLAND AND EXOCYTOSIS

L03

- Merocrine glands :
- Membrane bounded compartment approaches cell surface
- It fuses with plasma membrane
- Its contents are in continuity with extracellular spaces
- Plasma membrane transiently larger
- Membrane retrieved , stabilizing
- cell surface area

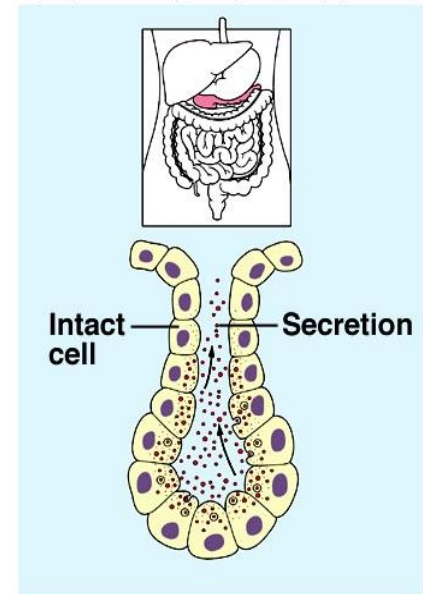


merocrine



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Merocrine Gland



APOCRINE GLAND

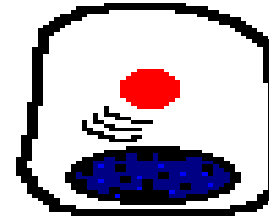
lo3

The apical part of the cells is demolished during secretion
e.g. **mammary glands**

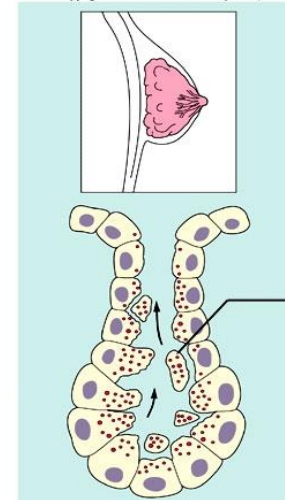
.Non-membrane bounded structure (e.g. lipid) approaches cell surface

- Makes contact and pushes up apical membrane
- Thin layer of apical cytoplasm drapes around droplet
- Membrane surrounding droplet pinches off from cell
- Plasma membrane transiently smaller
- Membrane added to regain original area

apocrine



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Apocrine Gland

Pinched off portion of cell (secretion)



HOLOCRINE GLAND

LO3

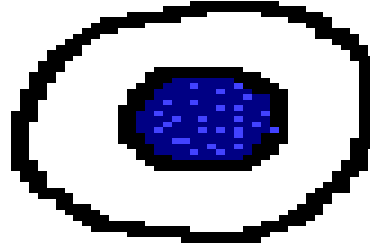
the whole cell is demolished during secretion

e.g. sebaceous glands

Disintegration of the cell

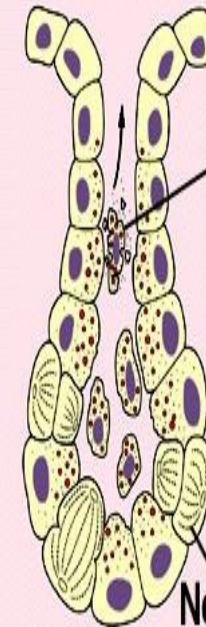
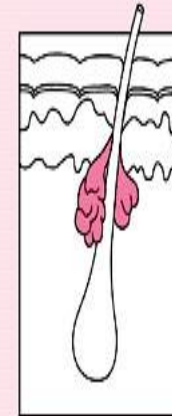
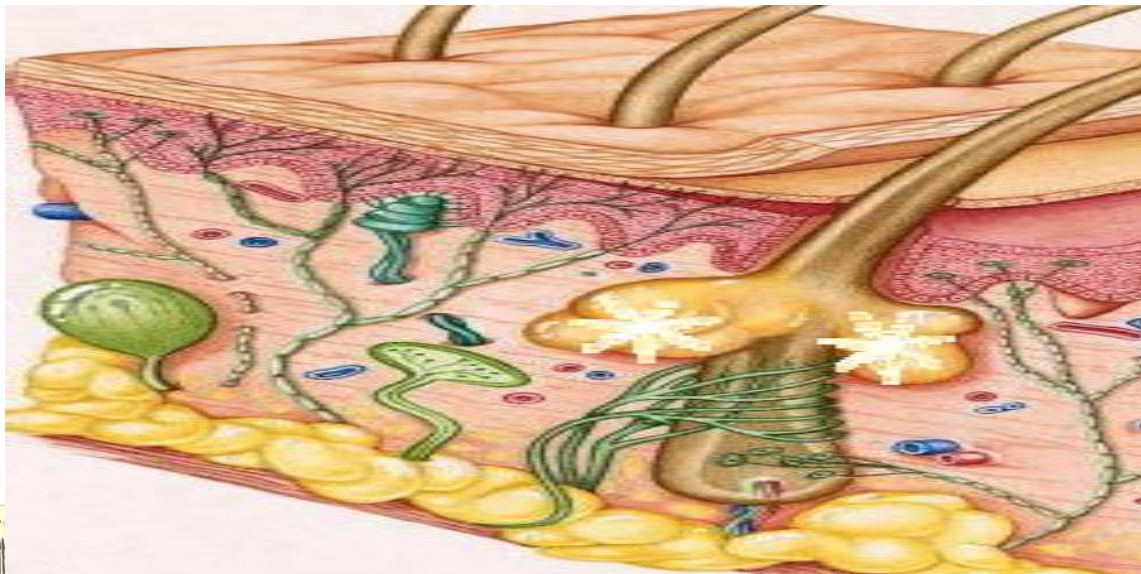
- *Release of contents*

- *Discharge of whole cell*



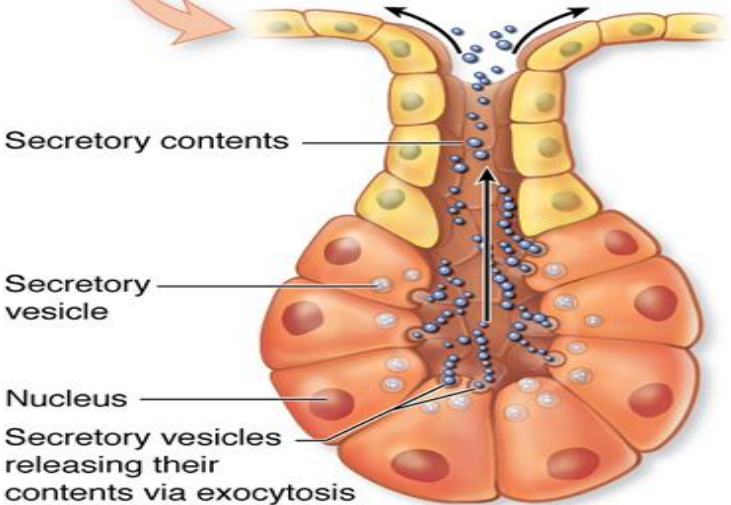
Holocrine
Gland

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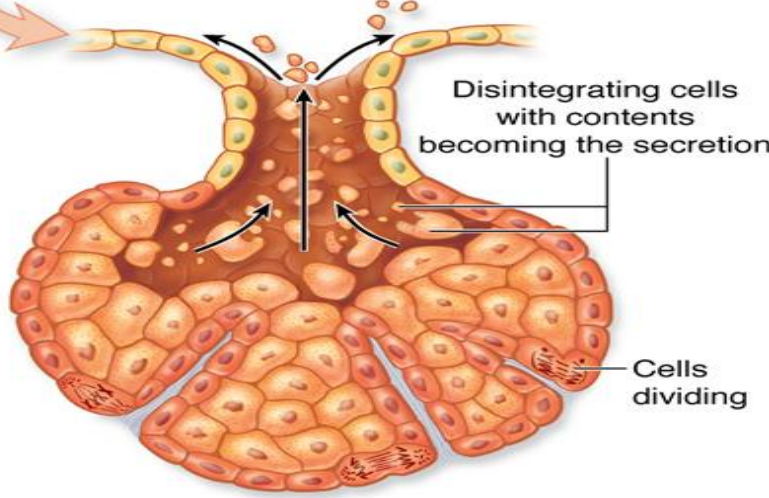
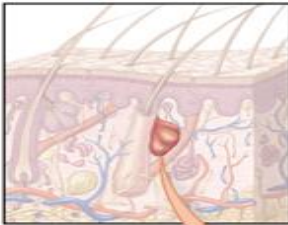


Disintegrating
cell and its
contents
(secretion)

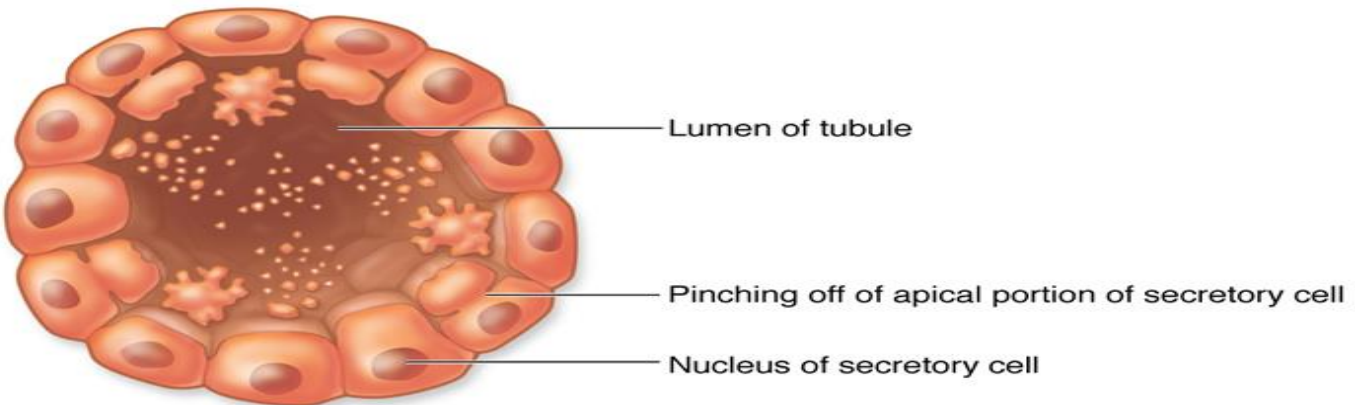
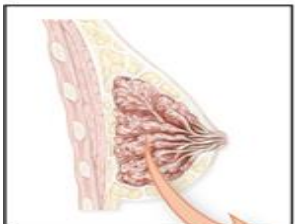
New cell forming
by mitosis



a Merocrine gland



b Holocrine gland



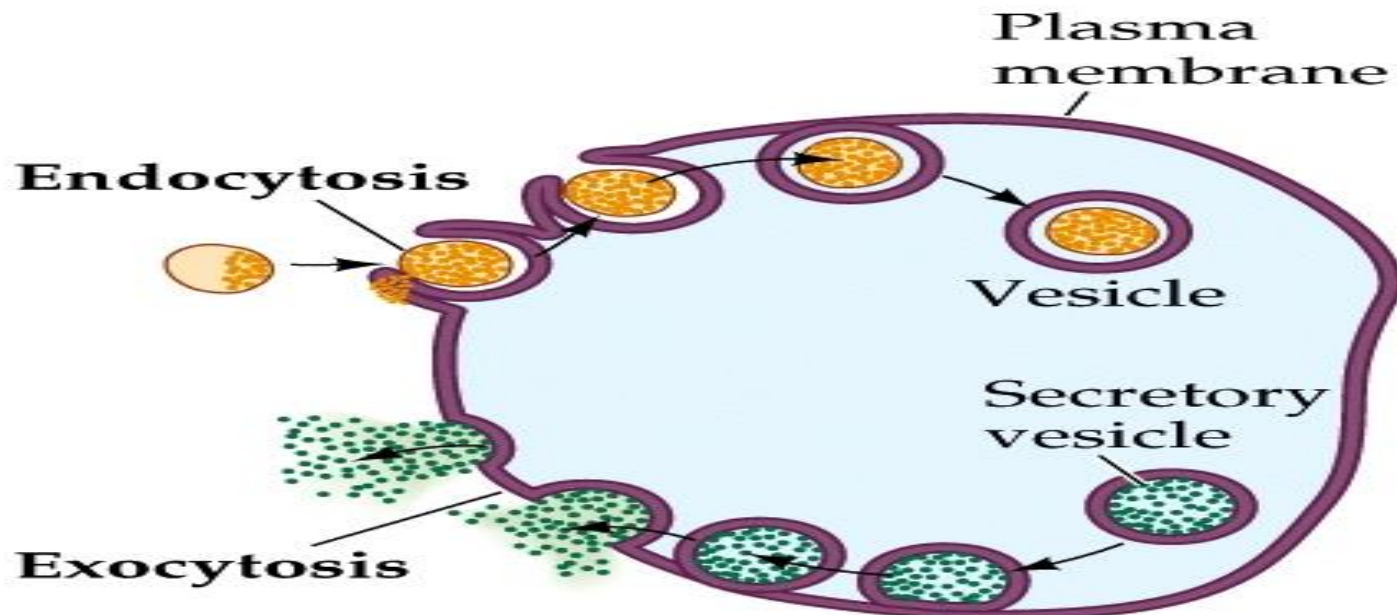
c Apocrine gland



Endocytosis:

: def: Cellular process by which the substances were brought into the cell material, neutralized at the cell membrane

Then will buds off inside the cell forming a vesicle which containing ingested material, types: pinocytosis, phagocytosis, receptor mediated endocytosis



Trans epithelial transport:

Exocytosis

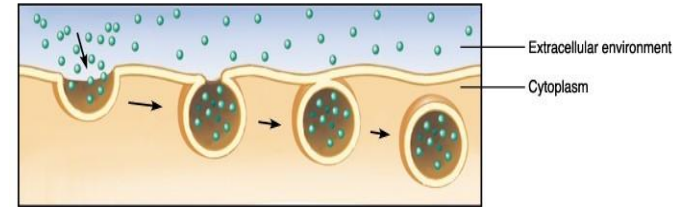
:{Exo (exit) cytosis (cell)} : The process by which large amounts of material, or large non-dissolved particles, are moved from the cell's cytoplasm to the outside environment

N: tran epithelial transport

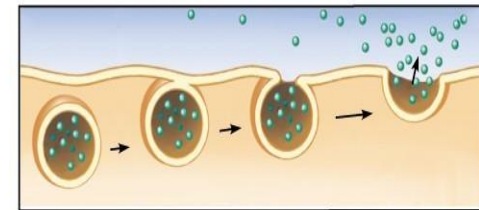
material endocytosed at one surface

transport vesicle shuttles across cytoplasm

material exocytosed at opposite surface



(a) Endocytosis



(b) Exocytosis

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Mechanism of glycosylation

Lo6

glycosylation :

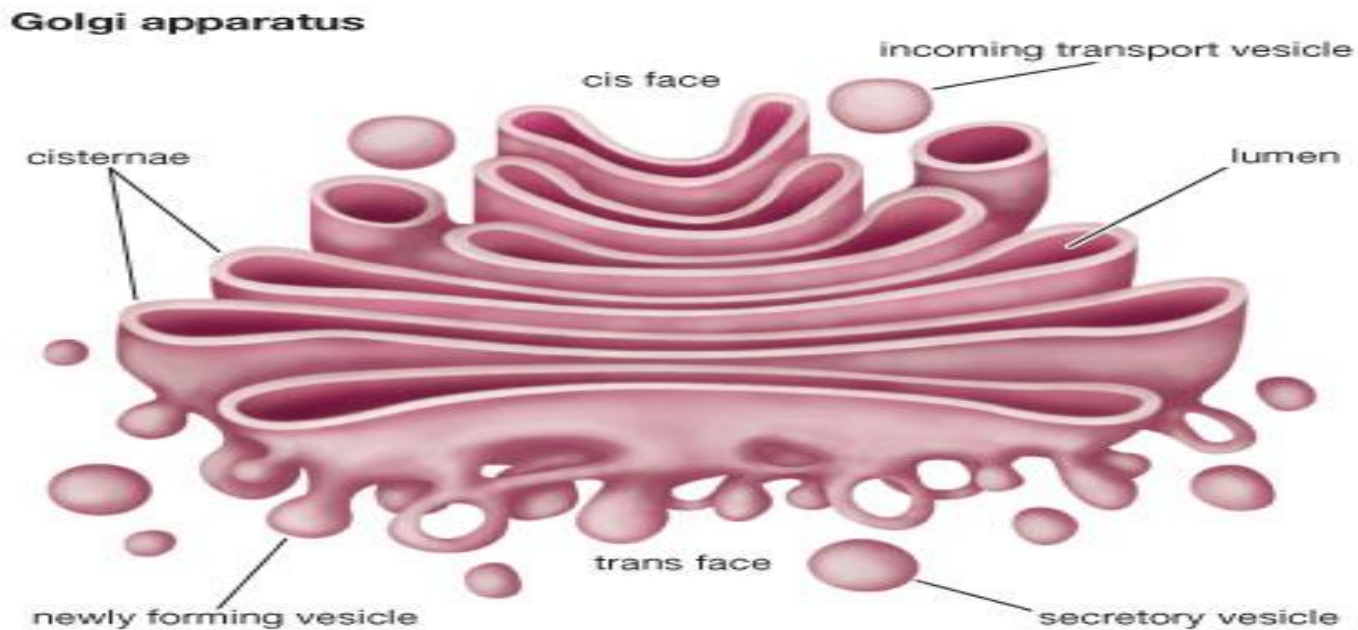
- mainly refers in particular to the enzymatic process that attaches glycans to proteins, or other organic molecules.
- This enzymatic process produces one of the fundamental biopolymers found in cells (along with DNA, RNA, and proteins
- the cell relies on segregating enzymes into different cellular compartments (e.g., endoplasmic reticulum,
- cisternae in Golgi apparatus).



Mechanism of glycosylation

Golgi Apparatus:

- Stack of disc-shaped cisternae
- One side of discs are flattened; other concave
- Discs have swellings at their edges
- Distal swellings pinch off as migratory Golgi Vacuoles



- **Function**
 - Packaging through condensation of contents
 - Transport
 - Adding sugars to proteins and lipids
(**Glycosylation**)

Golgi Product Destinations

- - Majority extruded in **secretory vesicles**
 - Some retained for use in the cells (e.g. **lysosomes**)
- Some enters the plasma membrane as glycolax

Glycosylation & Specificity

glycosylation is a site-specific modification.

- Branching sugars offer complex shapes for specific interaction in the **glycocalyx**

Destruction of this layer by enzymes alters many specificity based properties of cells as

- Adhesion to substrates & neighboring cells
- Mobility of cells
- Communication with neighboring cell
- - Contact inhibition of movement and division

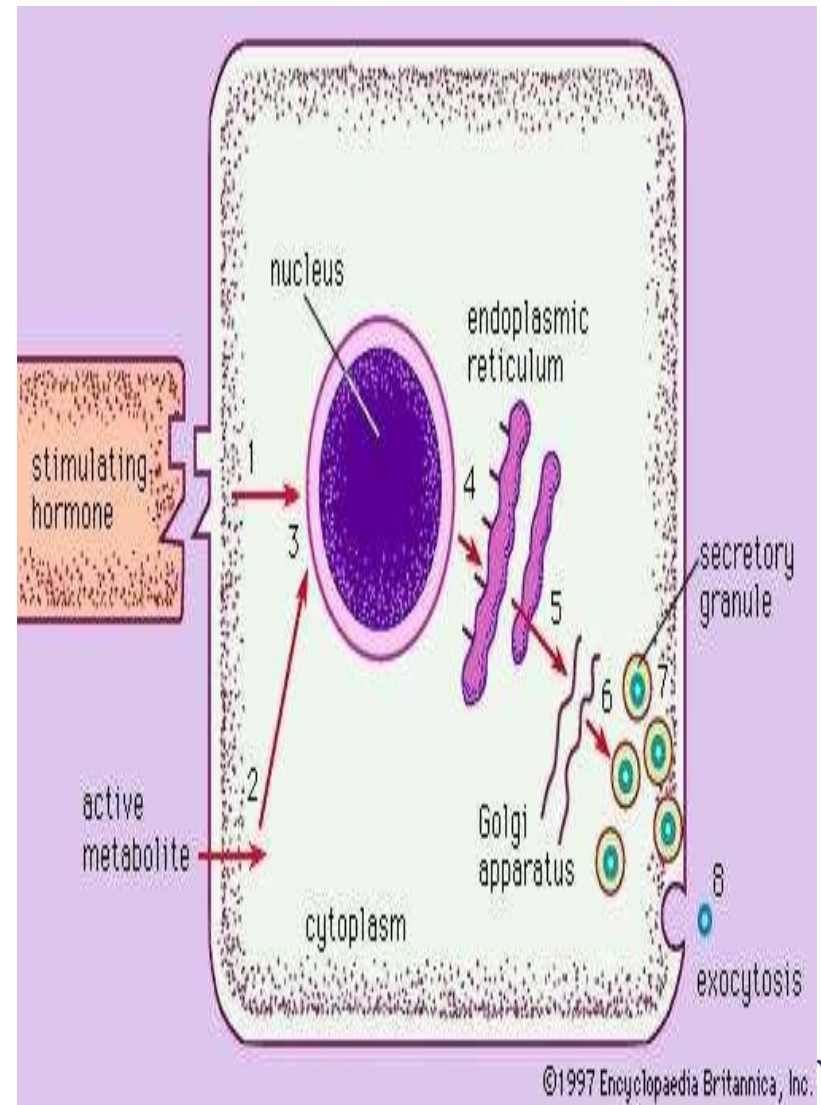


Role of secretions in cell functions

An example is:

the **chemical transmitted** from nerve to muscle that causes the muscle to contract.

The muscle cells have regions specialized to receive chemical signals from an adjacent nerve cell.



Control of Secretion

Negative feed back chemical mechanism

neural

endocrine

or neuro-endocrine

Nervous : example secretion of **epinephrine** from medulla of adrenal gland

- **Endocrine** control secretion of thyroxin from thyroid gland by stimulate **TSH** from pituitary gland.
- **Neuro-endocrine** control secretion of **gastrin**
- Negative feedback **chemical** mechanism suger /pancreas

