GLANDULAR EPITHELIUM AND GLANDS

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Objectives:

- Definition
- Development of glands
- Classification of glands
- General structure of a gland
- Histogenesis of epithelium

Glands

- Definition:
- "Glandular epithelia are tissues formed by cells specialized to produce secretion."
  - **OR**
- "An aggregation of gland cells into a definite structure for the purpose of secretion or excretion is called a gland."

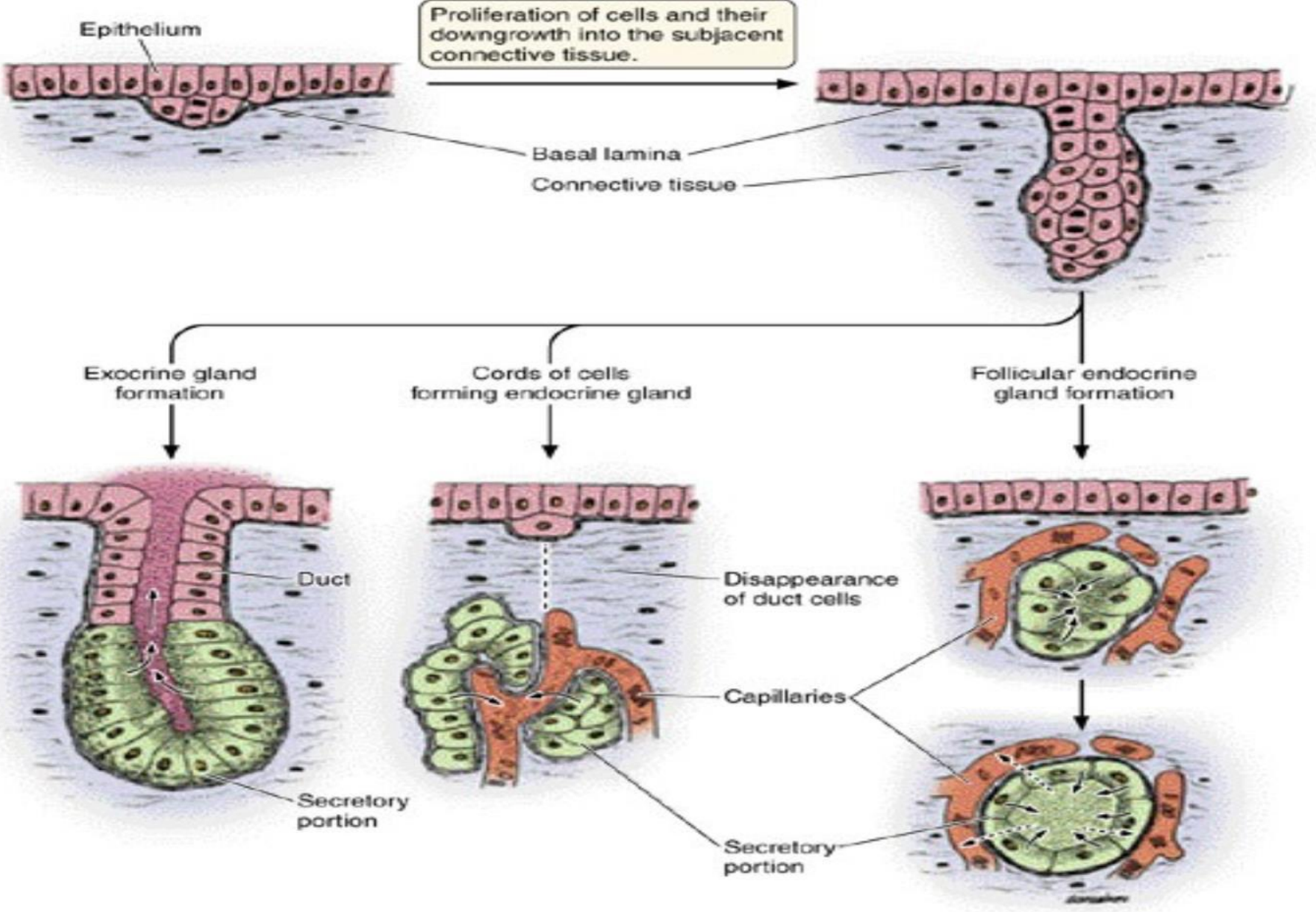
- Secretion: if substances produced are used elsewhere in the body, they are called secretions.
- Excretions: if products are discarded from the body, they are known as excretions.

Glands

- Glandular epithelial cells may synthesize, store, and secrete proteins (e.g; pancreas), lipids (e.g; adrenal, sebaceous glands), or complexes of carbohydrates and proteins (e.g; salivary glands). The mammary glands secrete all 3 substances.
- Less common are the cells of glands that have low synthesizing activity (e.g; sweat glands) and that secrete mostly substances transferred from the blood to the lumen of the gland.

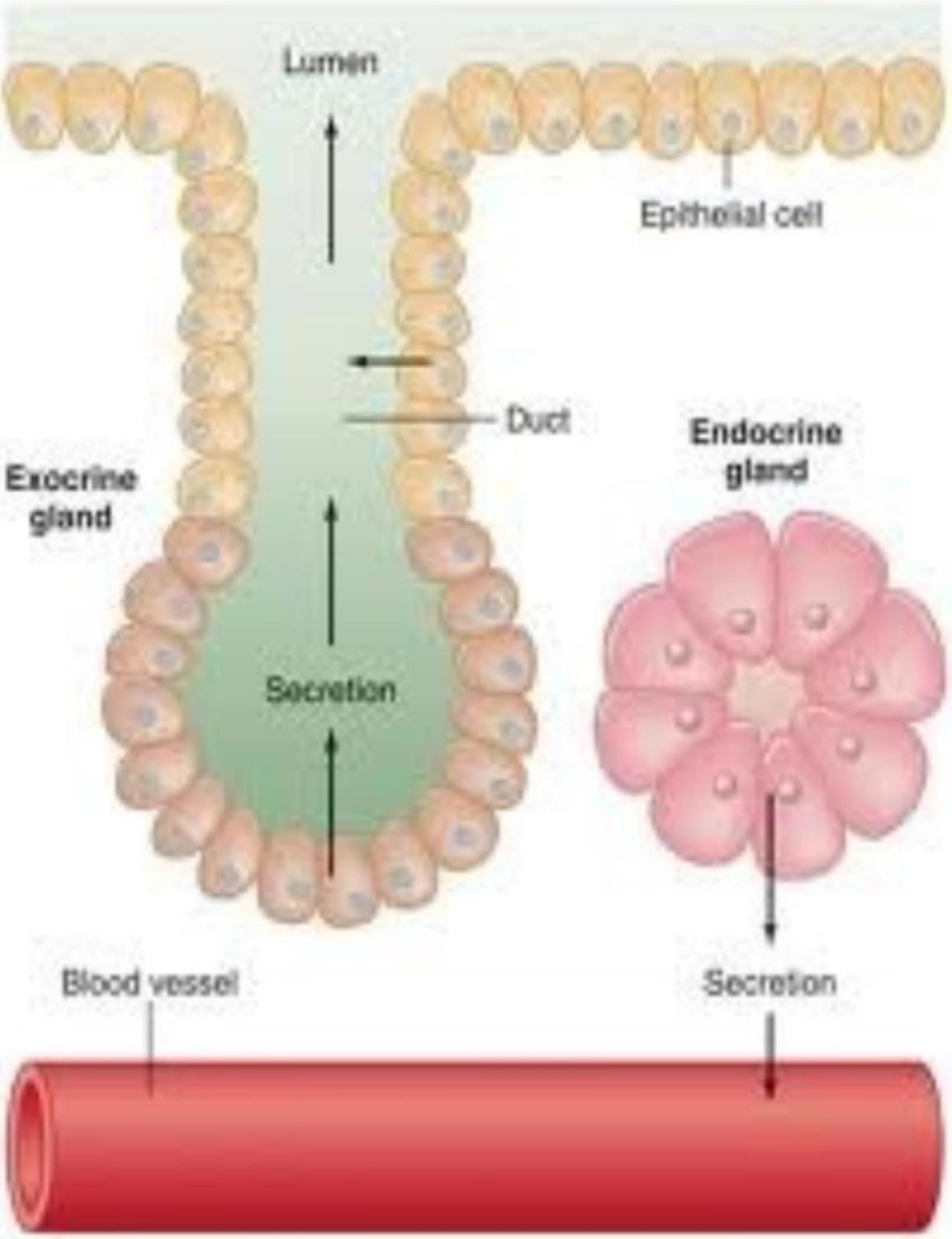
Development of glands:

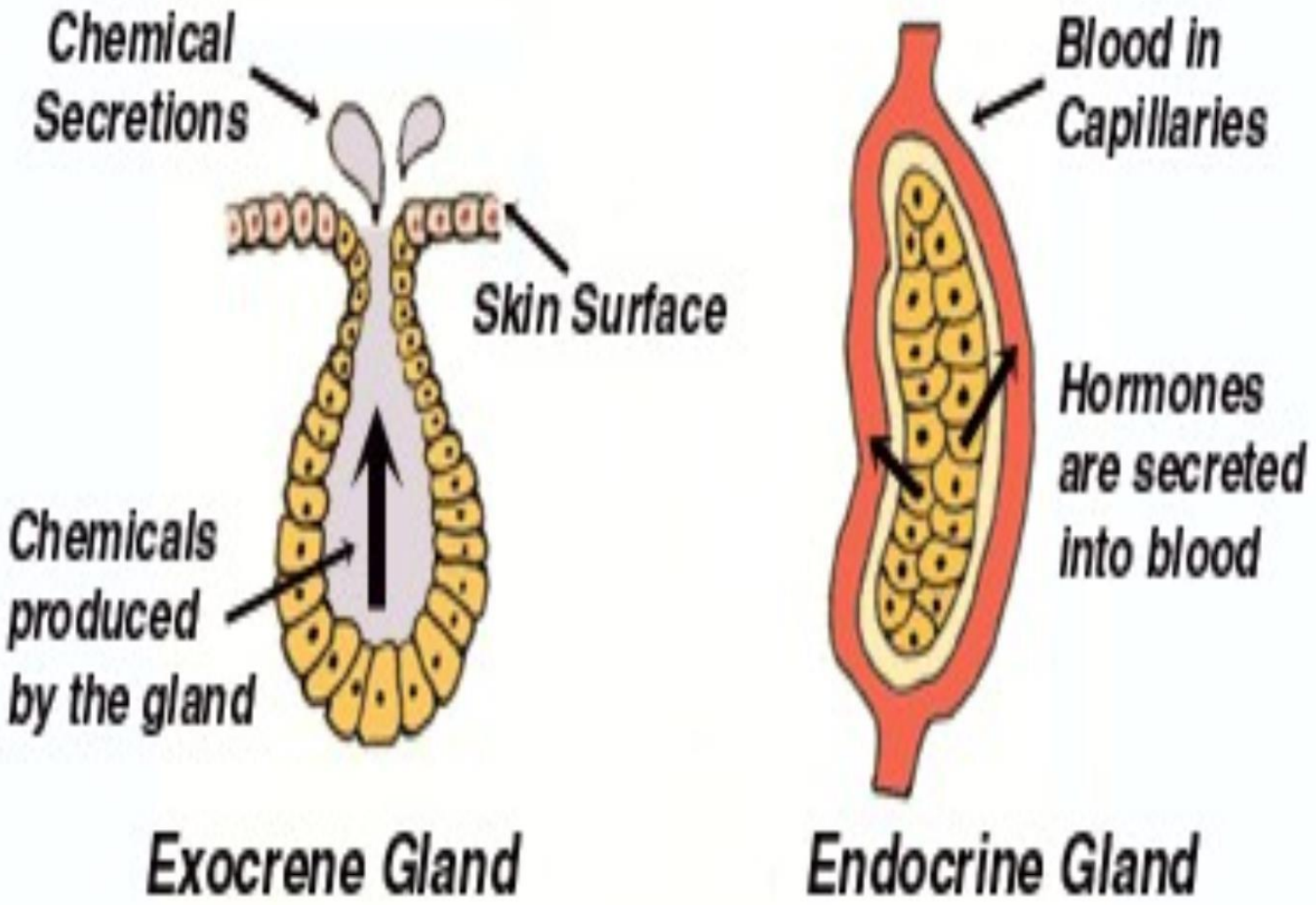
- Formation of glands from covering epithelia. Epithelial cells proliferate and penetrate connective tissue. They may–or may not–maintain contact with the surface. When contact is maintained, **exocrine glands** are formed; without contact, **endocrine glands** are formed.
- The cells of endocrine glands can be arranged in cords or in follicles. The lumens of the follicles accumulate large quantities of secretions; cells of the cords store only small quantities of secretions in their cytoplasm.

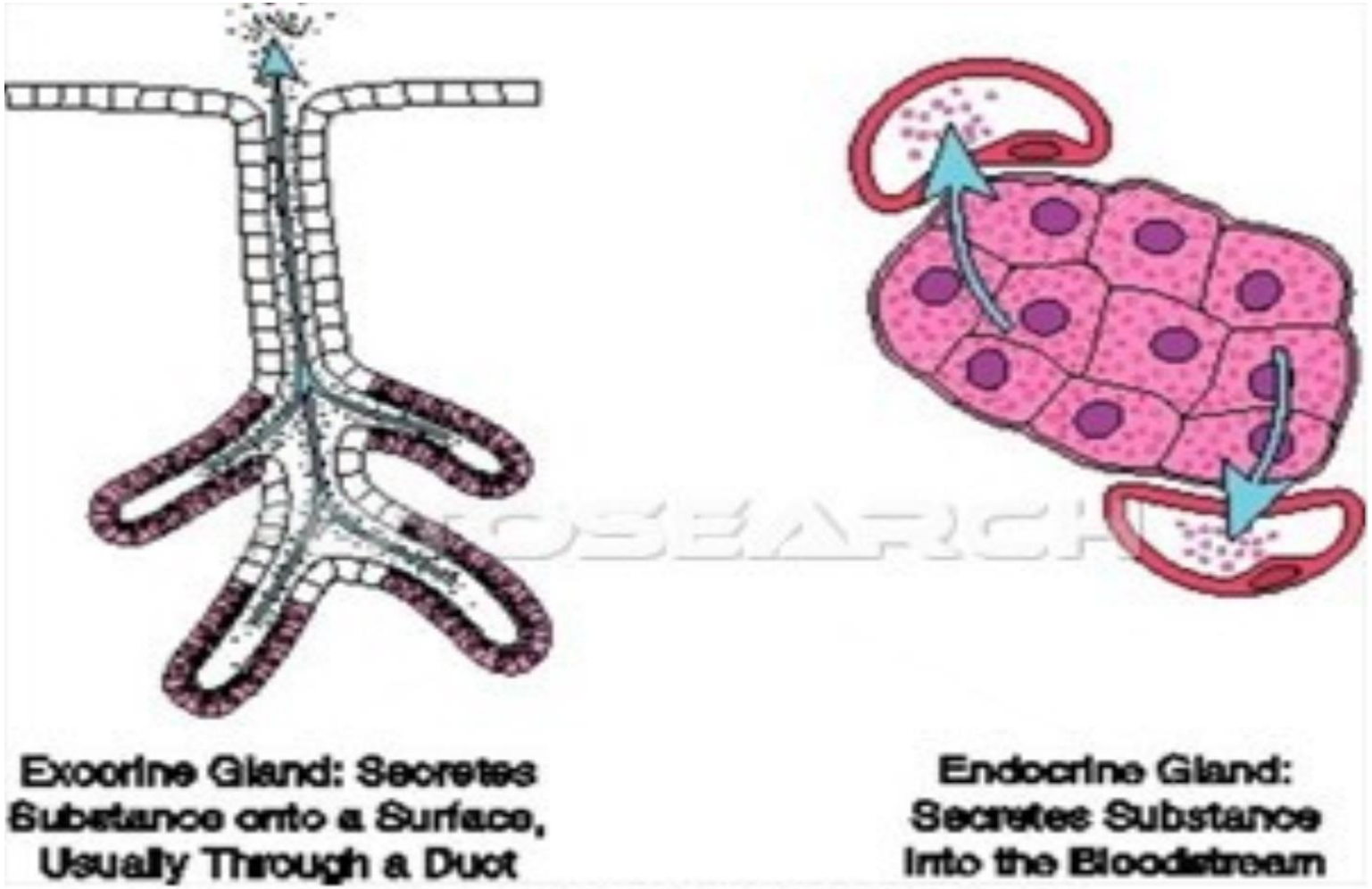

Epithelium
Proliferation of cells and their downgrowth into the subjacent connective tissue.
Basal lamina
Connective tissue
Exocrine gland formation
Cords of cells forming endocrine gland
Follicular endocrine gland formation
Duct
Disappearance of duct cells
Capillaries
Secretory portion
Secretory portion

Classification of glands:

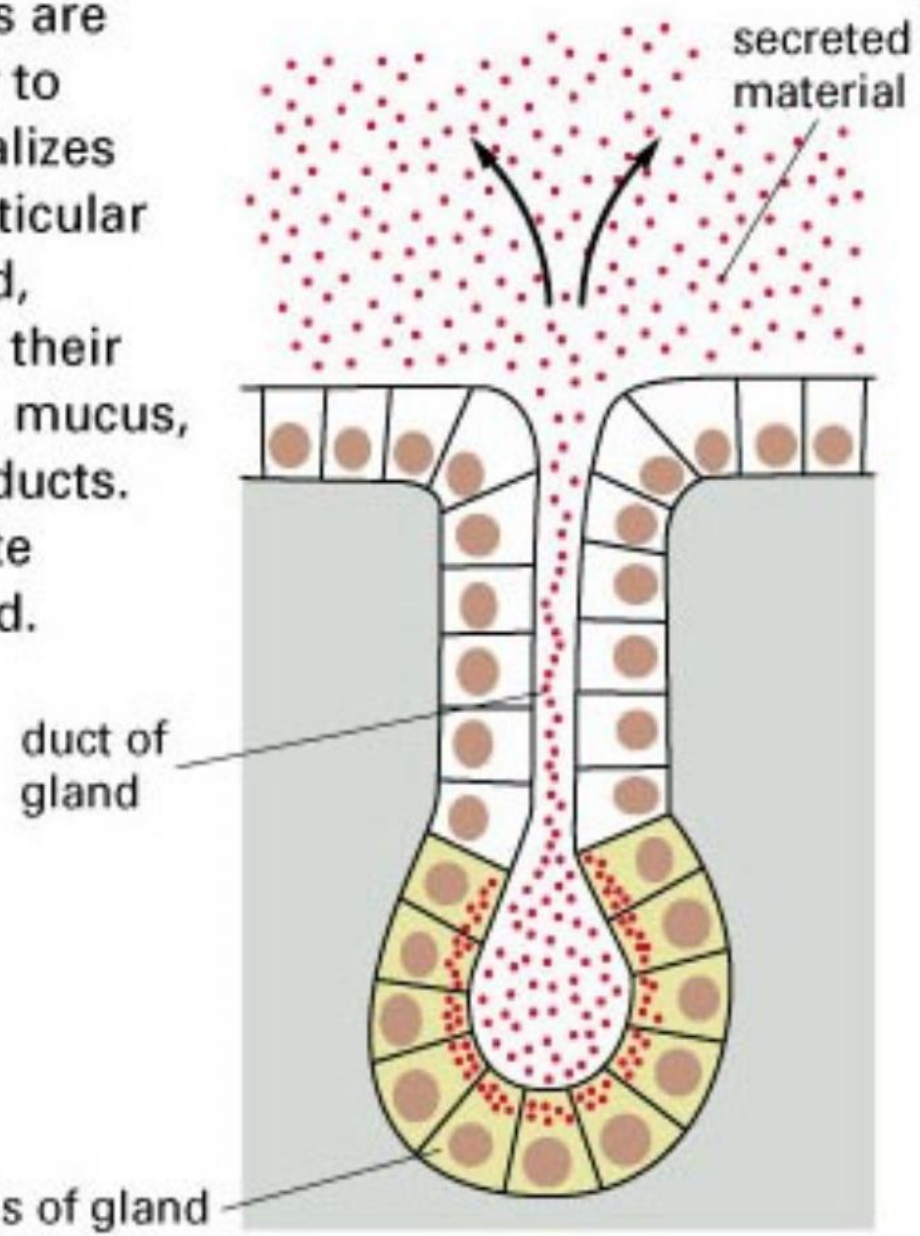
- Glands are generally classified into two major groups:
- Exocrine glands (Gr. Exo, outside,+ krinein, to separate) release their products onto an epithelial surface, either directly or through a duct e.g; the salivary glands.
- Endocrine glands (Gr, endon, within,+ krinein) release their products into the blood stream, e.g; thyroid gland.
- Mixed variety: some glands possess both exocrine and endocrine function e.g; pancreas.


Lumen
Epithelial cell
Duct
Exocrine gland
Endocrine gland
Secretion
Blood vessel
Secretion


Chemical Secretions
Skin Surface
Chemicals produced by the gland
Exocrene Gland
Blood in Capillaries
Hormones are secreted into blood
Endocrine Gland

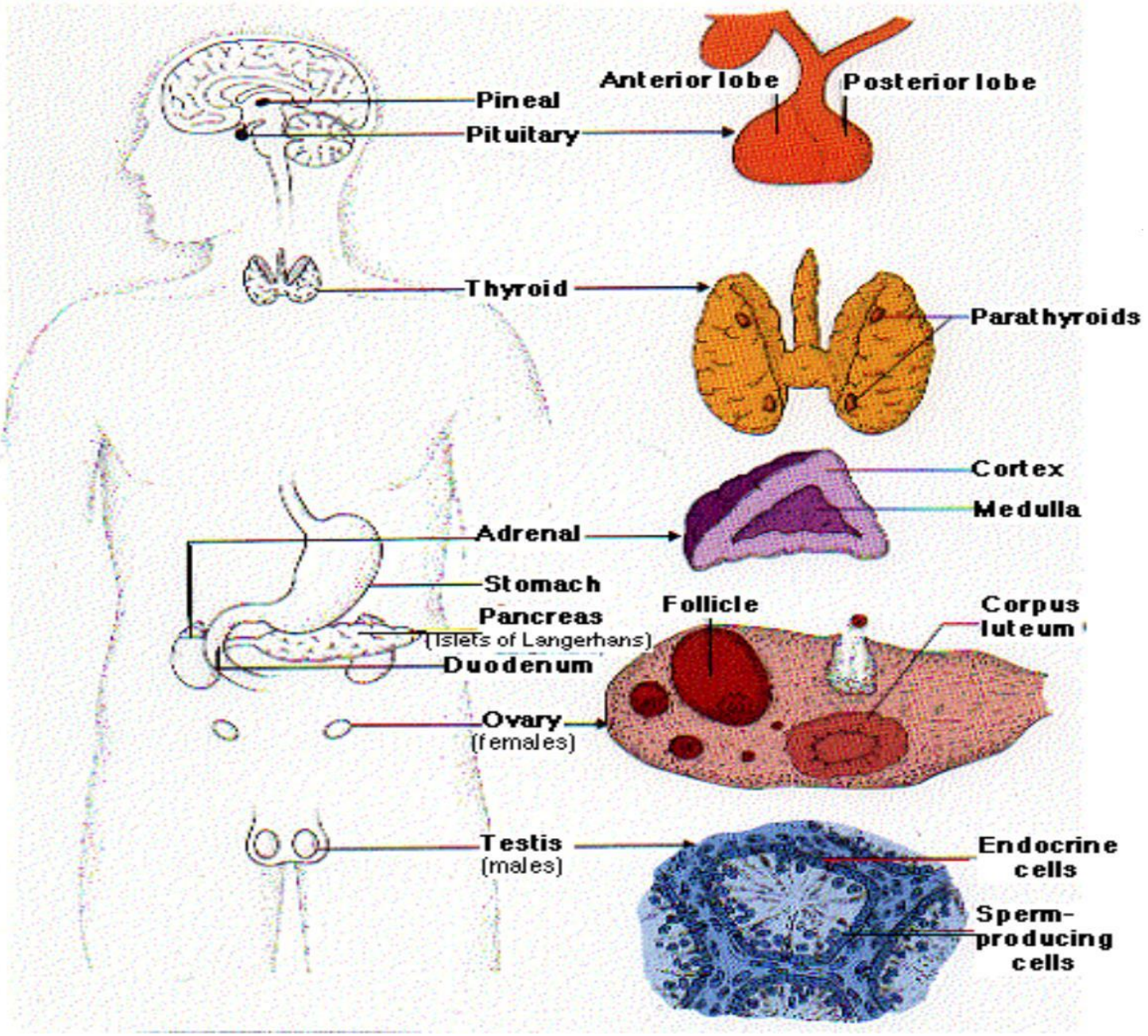

Exocrine Gland: Secretes Substance onto a Surface, Usually Through a Duct
Endocrine Gland: Secretes Substance into the Bloodstream
sa401031 www.fotosearch.com

Secretory epithelial cells are often collected together to form a gland that specializes in the secretion of a particular substance. As illustrated, exocrine glands secrete their products (such as tears, mucus, and gastric juices) into ducts. Endocrine glands secrete hormones into the blood.



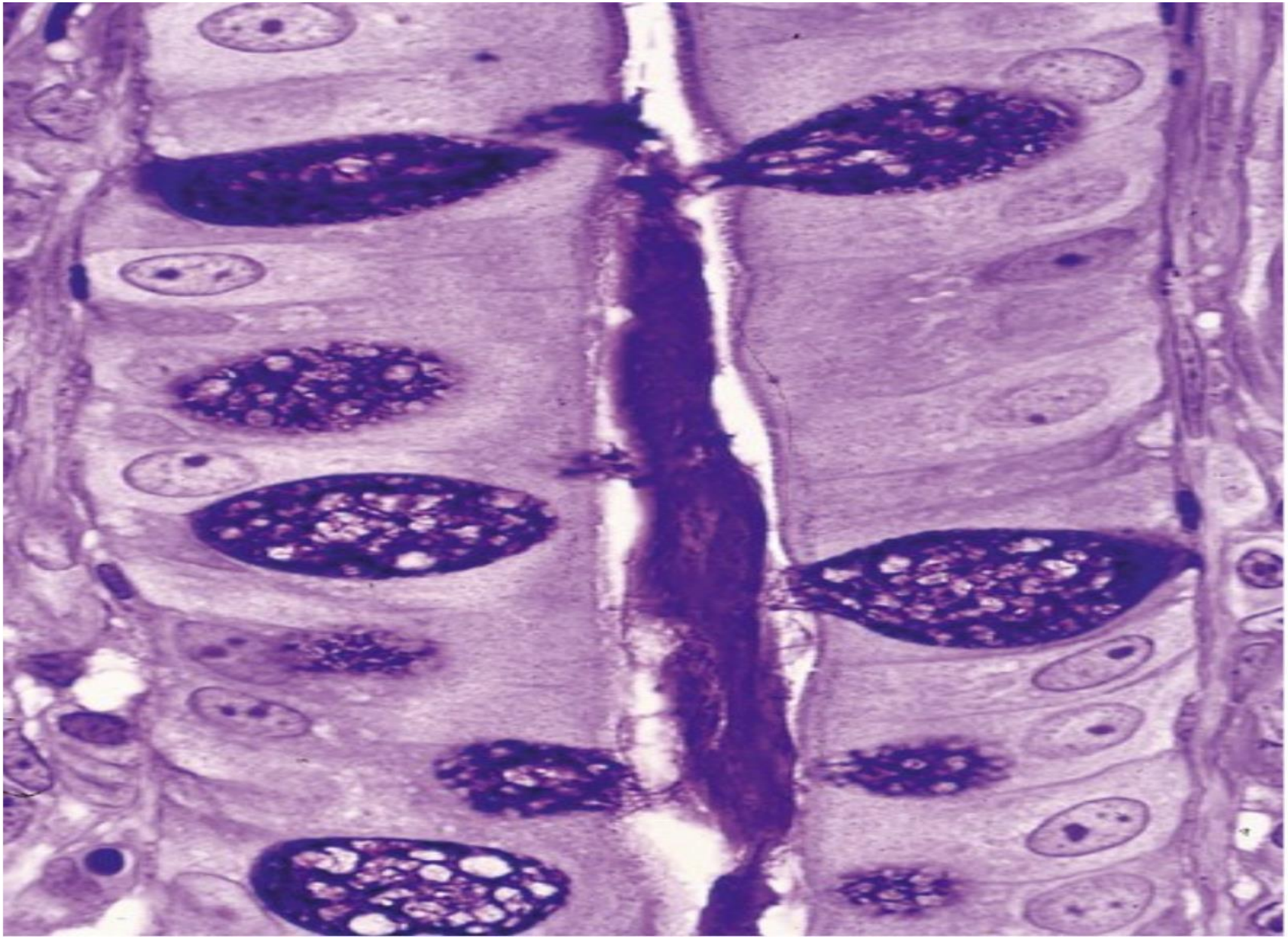
Endocrine glands:

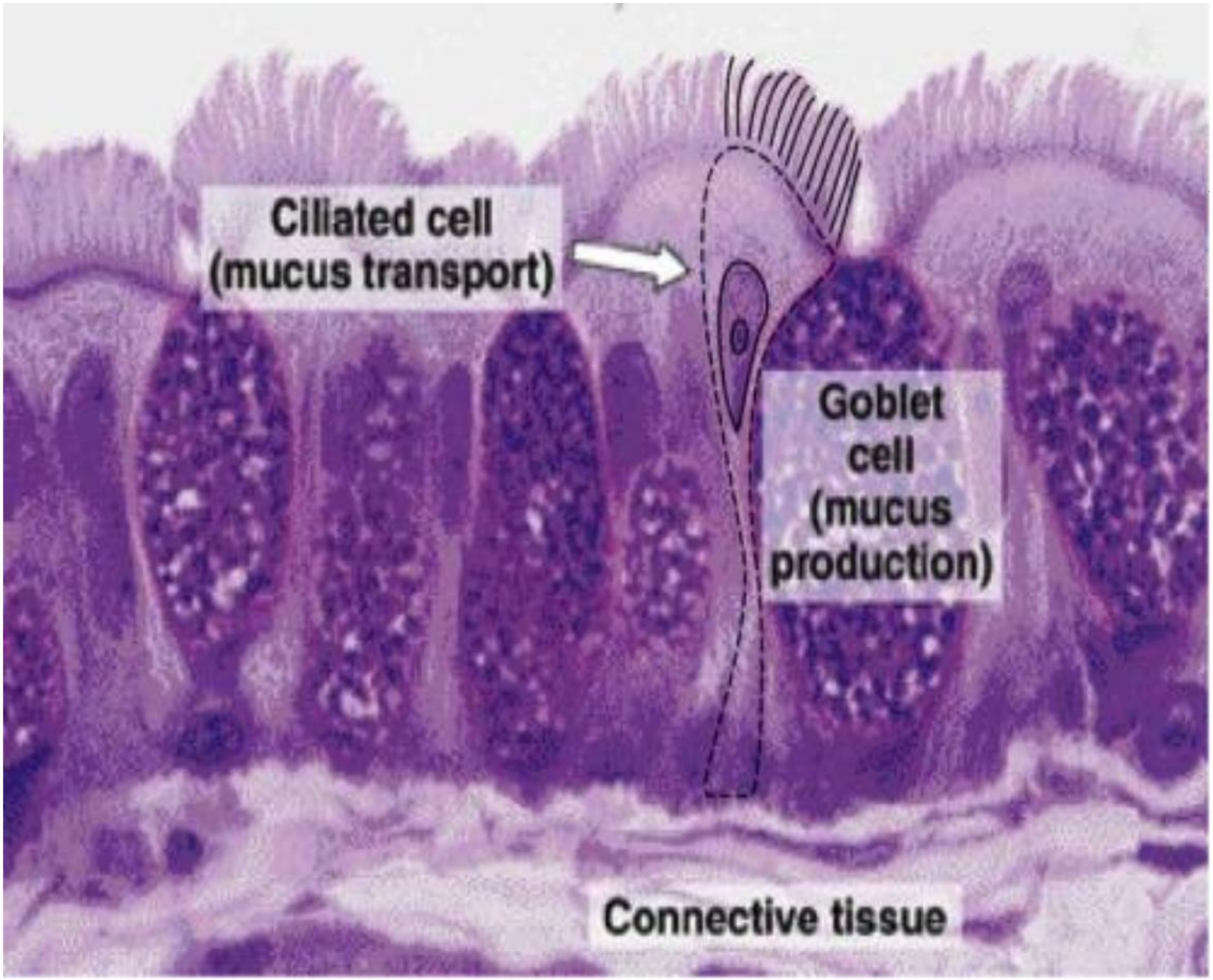
- Major endocrine glands are:
- Pituitary gland
- Thyroid gland
- Parathyroid glands
- Pancreas
- Adrenal glands
- Ovaries
- testes

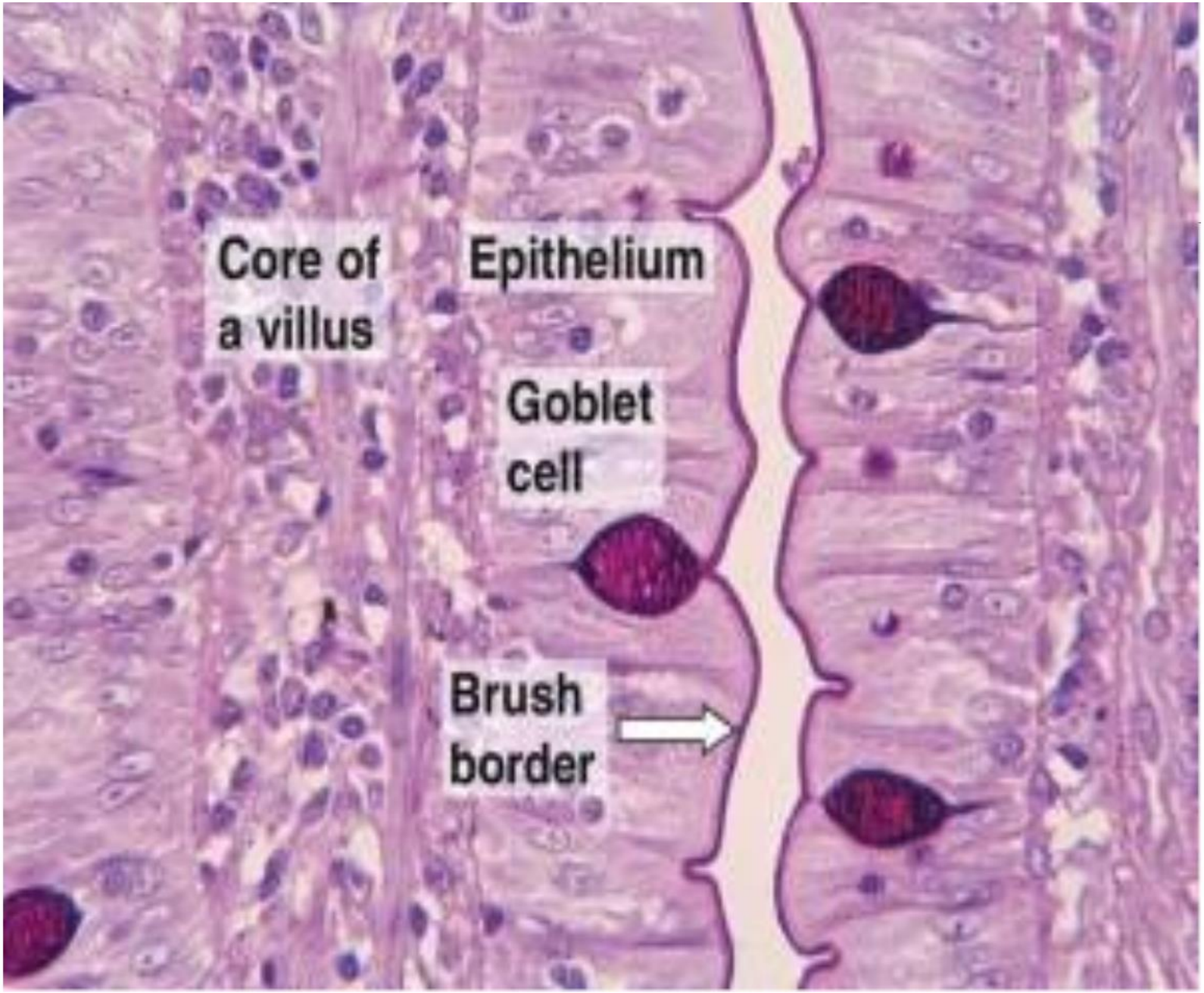

Pineal
Pituitary
Anterior lobe
Posterior lobe
Thyroid
Parathyroids
Cortex
Medulla
Adrenal
Stomach
Pancreas
(Islets of Langerhans)
Duodenum
Follicle
Corpus luteum
Ovary
(females)
Testis
(males)
Endocrine cells
Sperm-producing cells

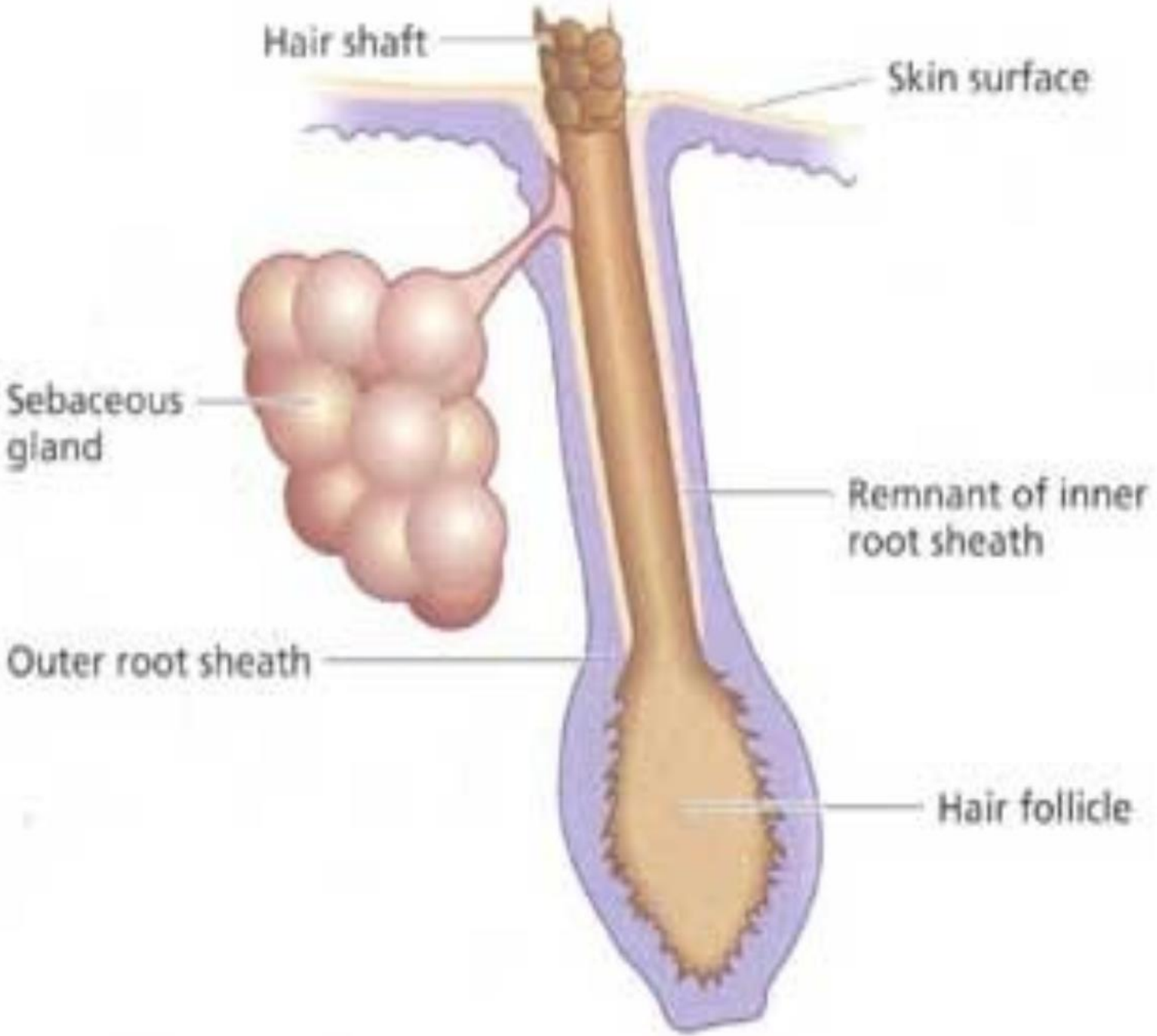
Exocrine glands:

- These can be classified according to the no. of cells:
- **Unicellular glands**: example goblet cell (in GIT n in certain passages of respiratory tract).
- **Multicellular glands**: are composed of many cells, which line an epithelial invagination from free surface.
- In some of these glands all cells lining the lumen are secreting cells. But in most of the multicellular glands secretory activity is limited to the deeper cells (which constitue the secreting portion of the gland), while remainder of the gland serves as a non-secretory duct, which carries the secretions to the surface.




Ciliated cell
(mucus transport)
Goblet
cell
(mucus
production)
Connective tissue


Core of
a villus
Epithelium
Goblet
cell
Brush
border


Hair shaft
Skin surface
Sebaceous gland
Remnant of inner root sheath
Outer root sheath
Hair follicle

Exocrine glands:

- These can also be classified on the basis of:
- Morphology of ducts and secreting portions.
- Nature of secretory product.
- Mode of secretion.

A. Classification on the basis of morphology:

- Exocrine glands are further classified upon the basis of the following two structural features:

2. Morphology of the duct/duct system.
3. Shape of the secreting portion/portions.

1. According to morphology of duct system:

- Simple glands:

  "if a gland consists of a single secretory passage or a single system of secretory passages opening into an unbranched duct, it is called a simple gland."

- Compound glands:

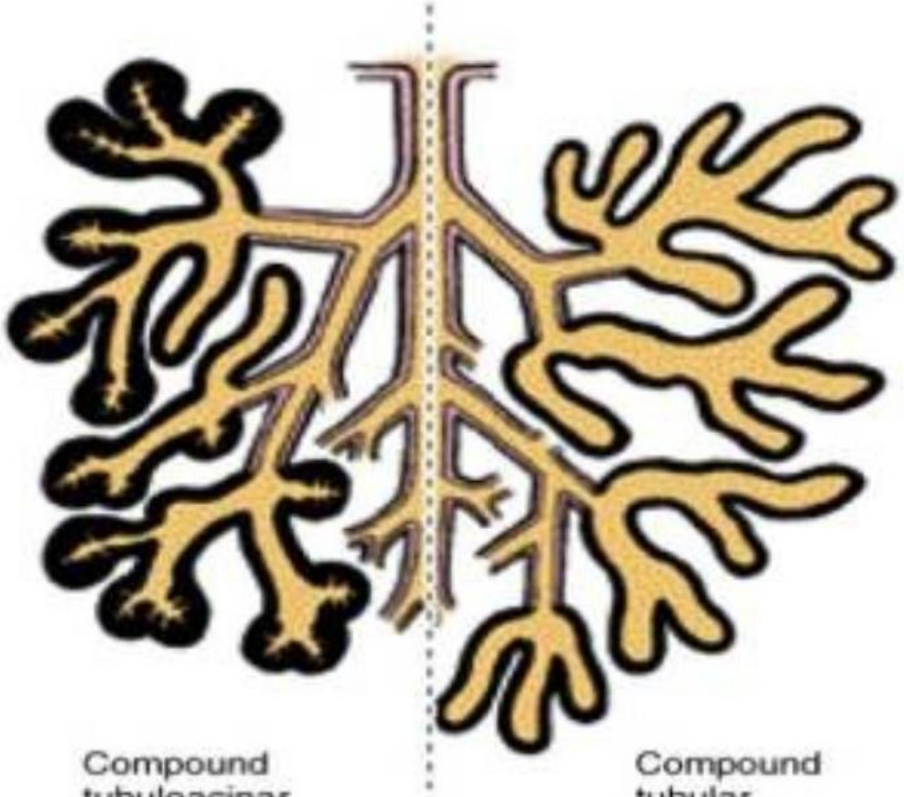
  "a gland containing a branched duct system is called a compound gland."

Simple tubular

Simple coiled tubular

Simple branched tubular

Simple branched acinar



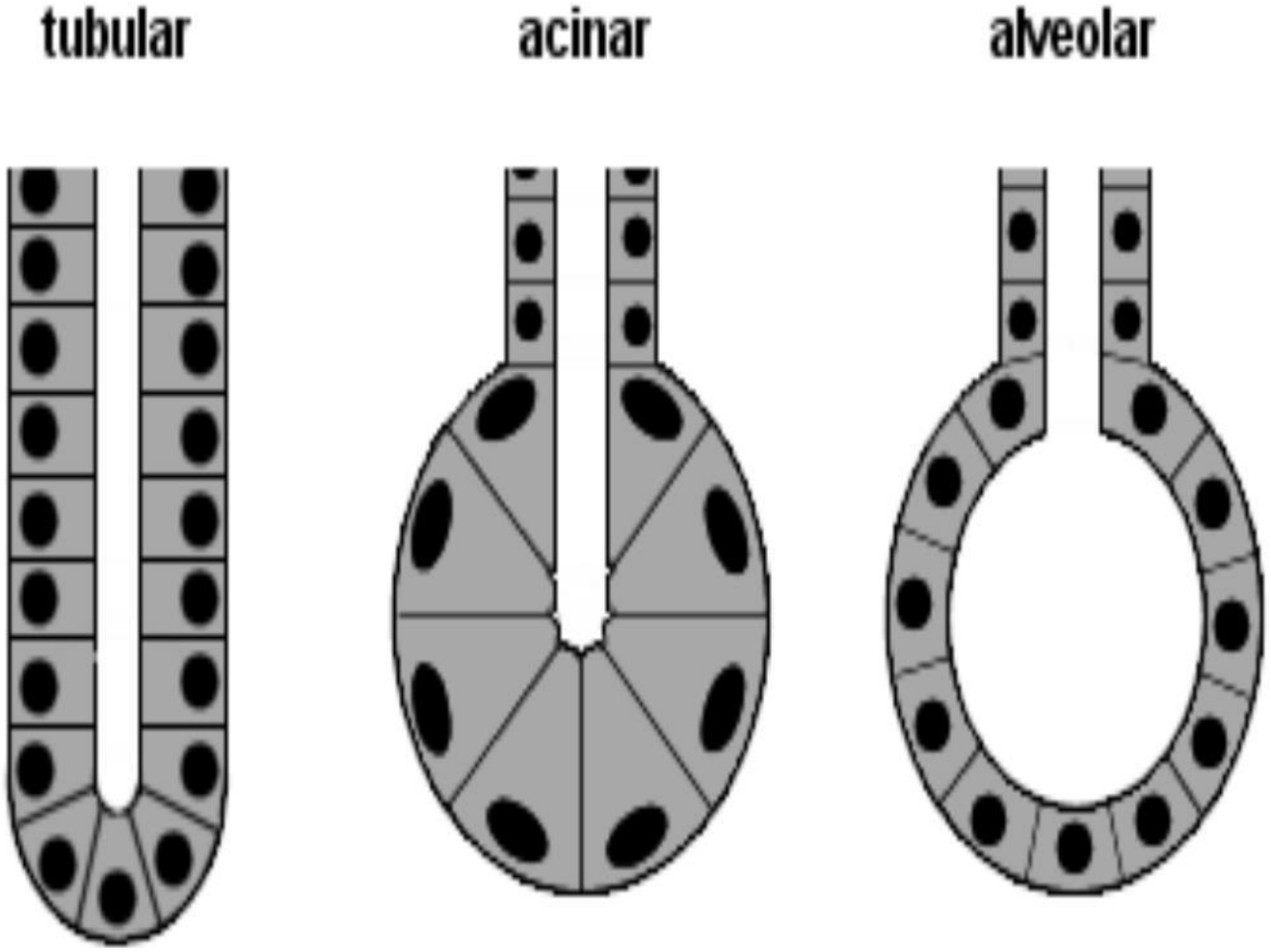
Compound tubuloacinar

Compound tubular

Compound acinar

2. According to the shape of the secreting portion:

- The secreting portions of the glands also vary in shape. When the secreting portion is in the form of a tubule, the gland is called a **tubular gland.**
- When the secreting portion is dilated in the form of a sac (called alveolus or acinus), the gland is referred to as an alveolar or **acinar gland.**
- In some glands the secreting portions are neither typically tubular nor alveolar, but combine certain features of both: such glands are known as **tubulo-alveolar (tubulo-acinar) glands.**



glands

So the exocrine glands are classified and sub-classified as follows:

A. Simple glands: the glands have a simple unbranched duct. These glands are further classified into three subvarieties:

2. Simple tubular glands.
3. Simple alveolar glands
4. Simple tubulo-alveolar glands

Simple tubular glands:

In these glands the glandular cells make simple tubules which open onto the epithelial surface. In most of the simple tubular glands one can distinguish three parts:

a. mouth (opening)

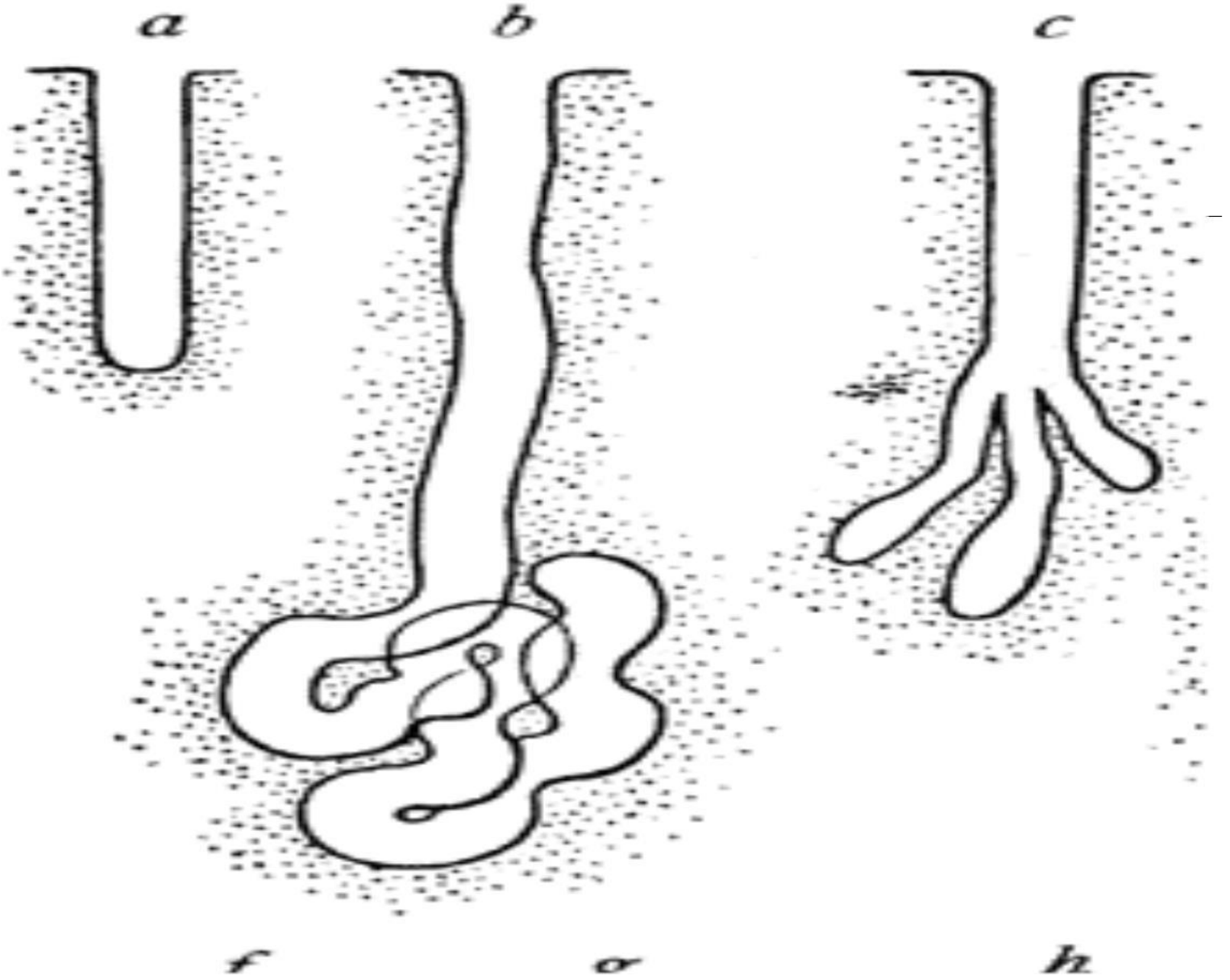
b. neck (narrow part of gland)

c. fundus (distal secreting portion of the gland).

Simple tubular glands:

Taking into account the shape of the fundus, simple tubular glands are further classified into three subtypes:

- Straight simple tubular glands (e.g; intestinal crypts
- Coiled simple tubular glands (e.g; sweat glands)
- Branched simple tubular glands (e.g; principal glands of stomach and endometrial glands of uterus).


a
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c
f
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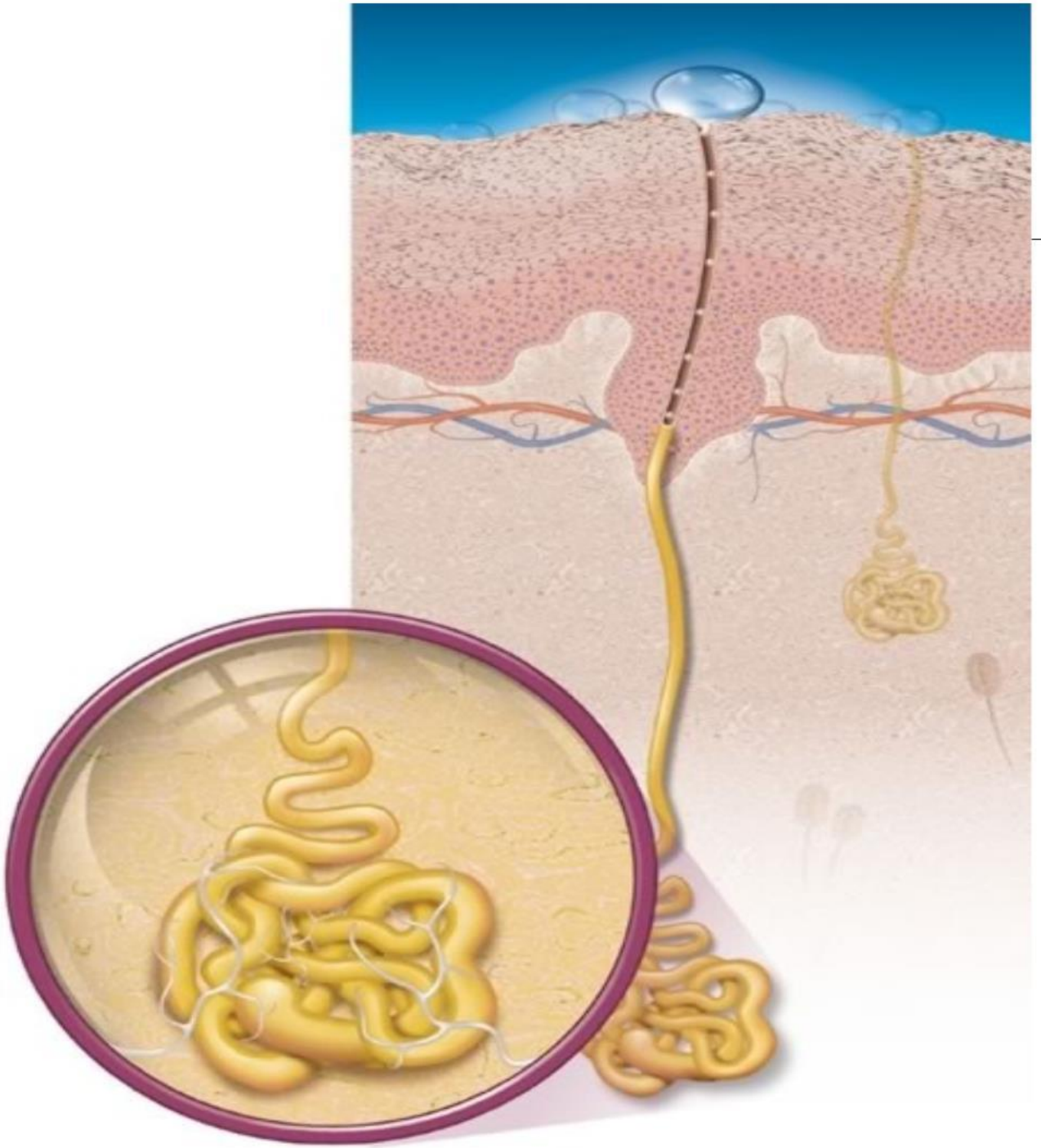


2. Simple alveolar glands: a simple alveolar gland consists of a single alveolus (acinus) which opens onto the surface by a very short duct.

- Simple alveolar glands (e.g; uretha: paraurethral glands and periurethral glands)
- Simple branched alveolar glands (e.g; stomach: mucus secreting glands of cardia, sebaceous glands of skin, meibomian glands of eyelids).

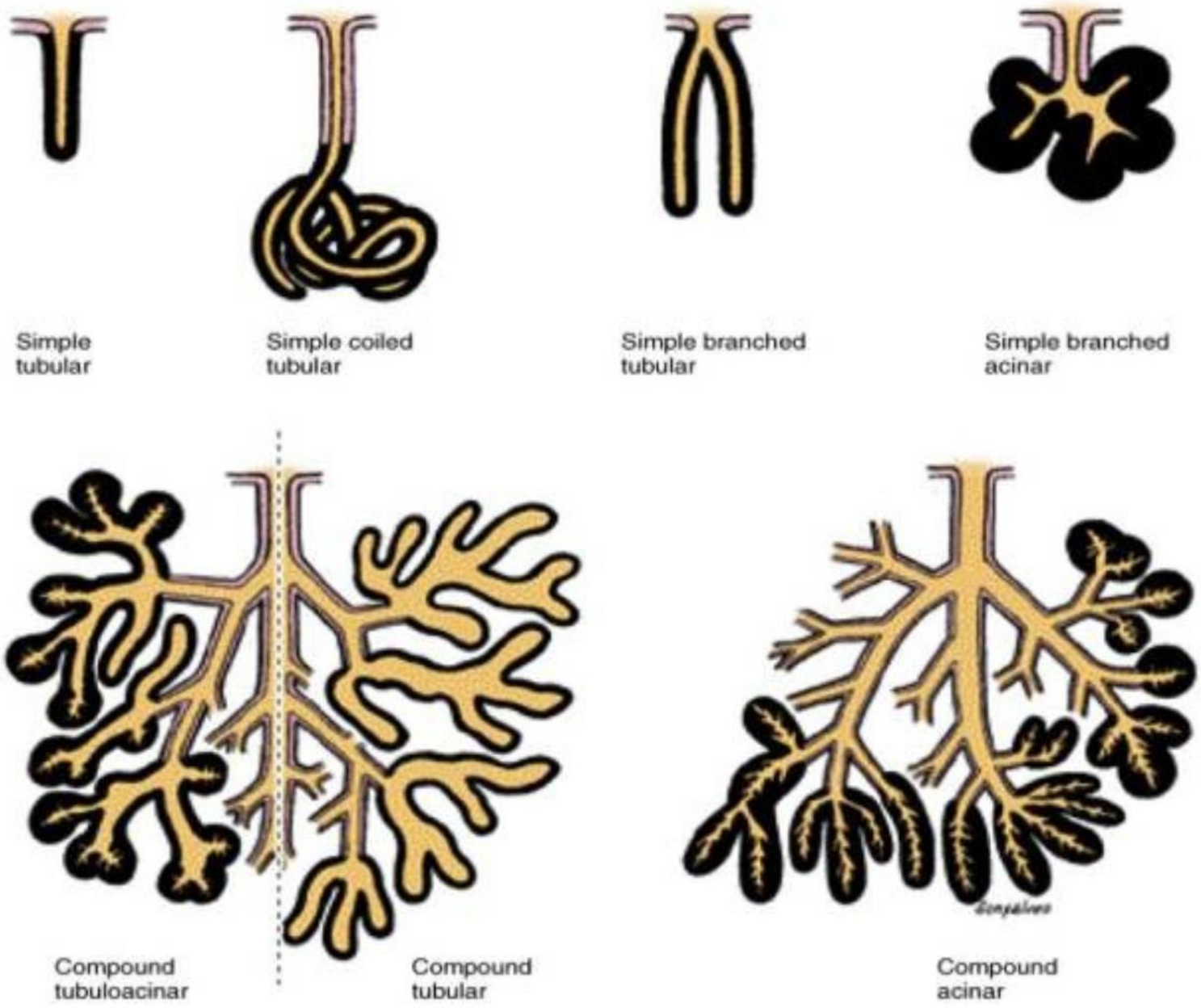
3. Simple tubulo-alveolar glands:

- These glands are found only in the branched form i.e; their secretory portions consist of branched tubules which bear alveoli at their distal ends.
- e.g; the small salivary glands of oral cavity, the mucous glands of the conducting part of the respiratory tract, and the submucosal glands of duodenum.

B. Compound glands:

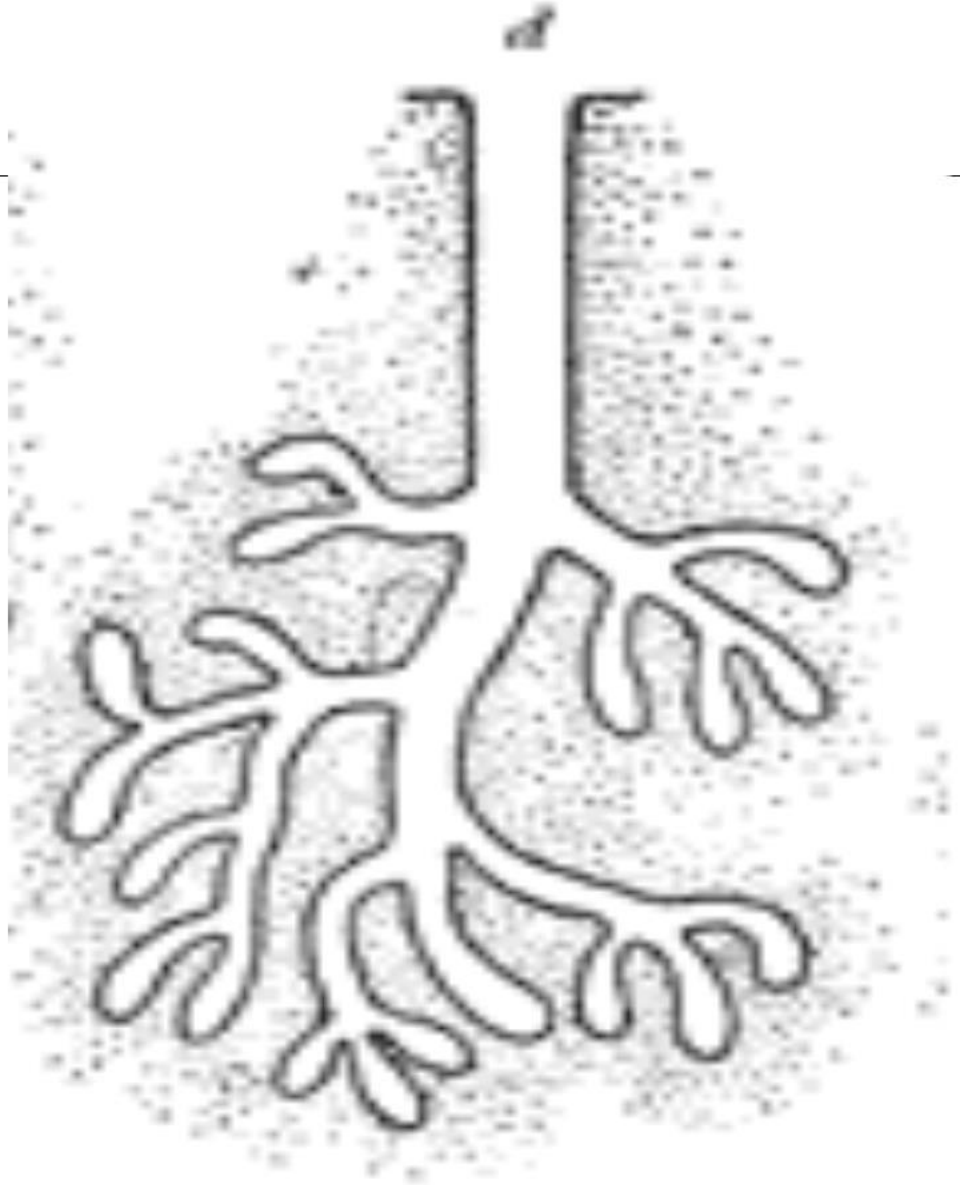
- The duct of the compound gland branches repeatedly. Depending on the shape of the terminal (secretory) portions, the compound glands are further classified into the following three varieties:

2. Compound tubular glands
3. Compound alveolar glands
4. Compound tubulo-alveolar glands


Simple tubular
Simple coiled tubular
Simple branched tubular
Simple branched acinar
Compound tubuloacinar
Compound tubular
Compound acinar

- Compound tubular glands: these glands consist of a number of distinct duct systems that open into a main excretory duct. The secretory portions are in the form of long branching tubules which are usually coiled or convoluted.

  e.g; kidneys and testes are examples of compound tubular glands.



2. Compound alveolar glands:

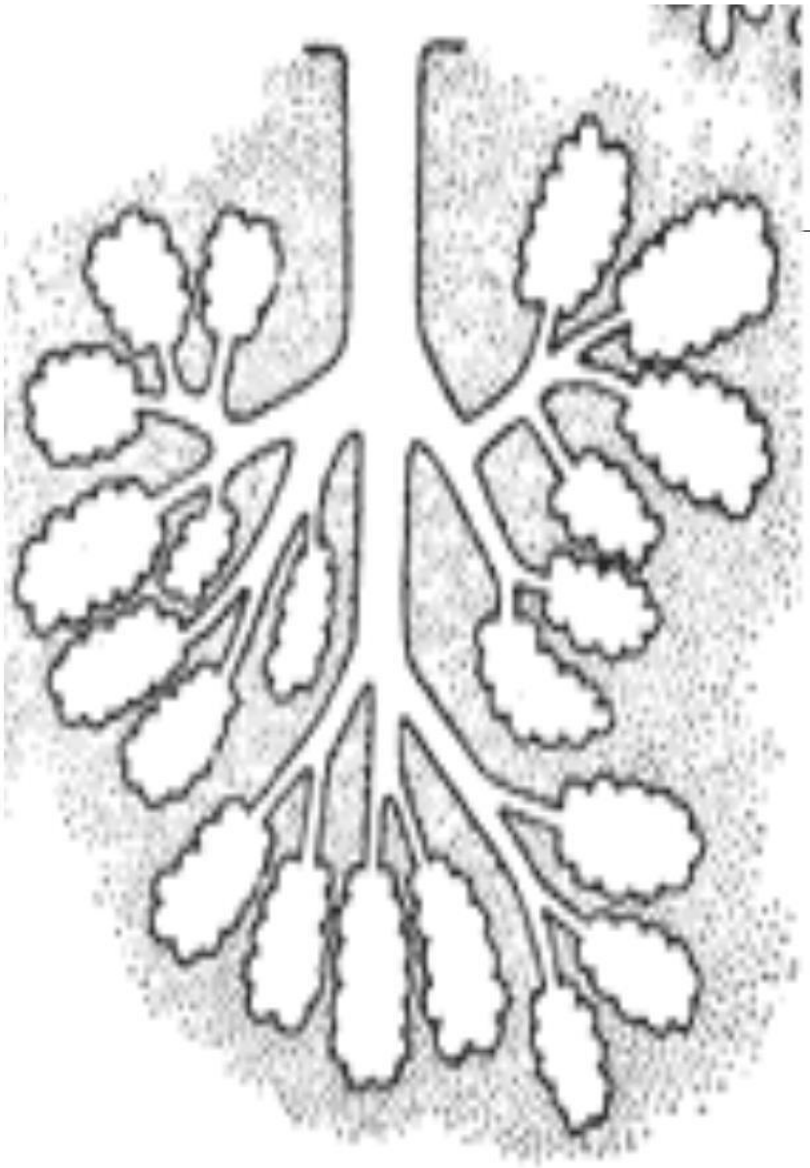
These glands have a large number of duct systems. The terminal excretory ducts end in dilated sac-like alveoli.

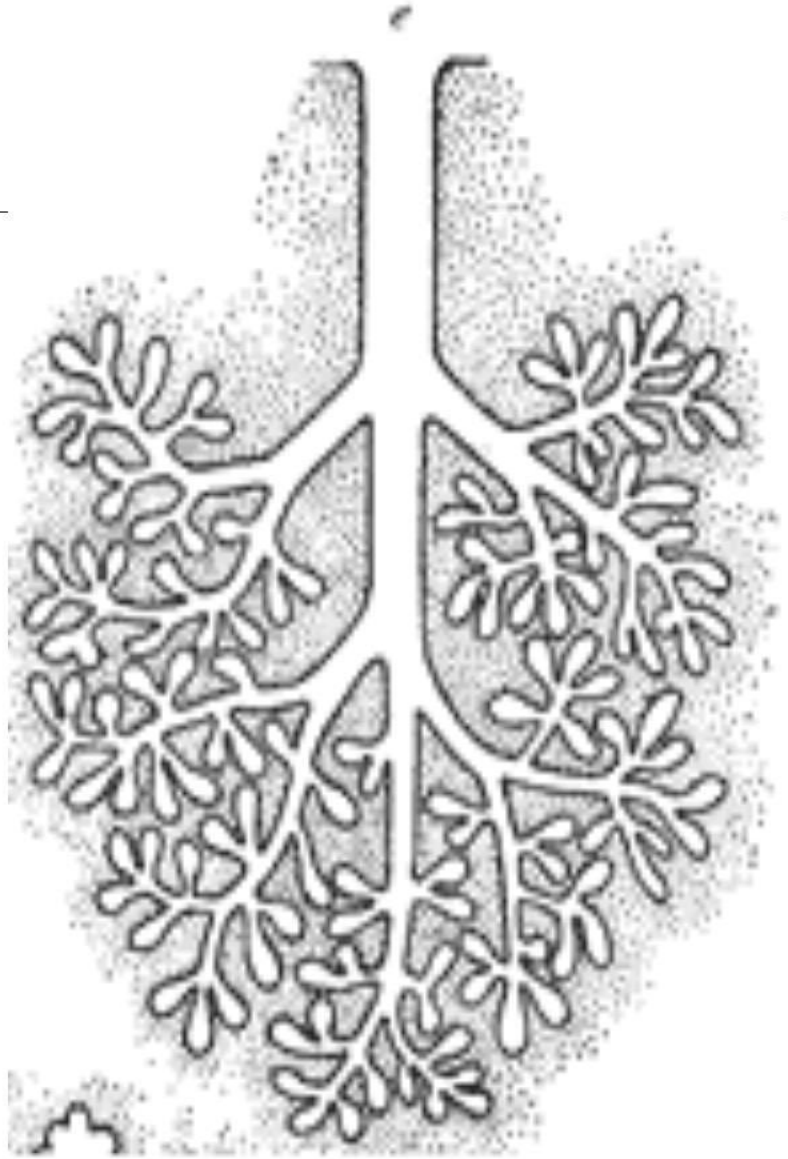
E.g; pancreas: excretory portion.

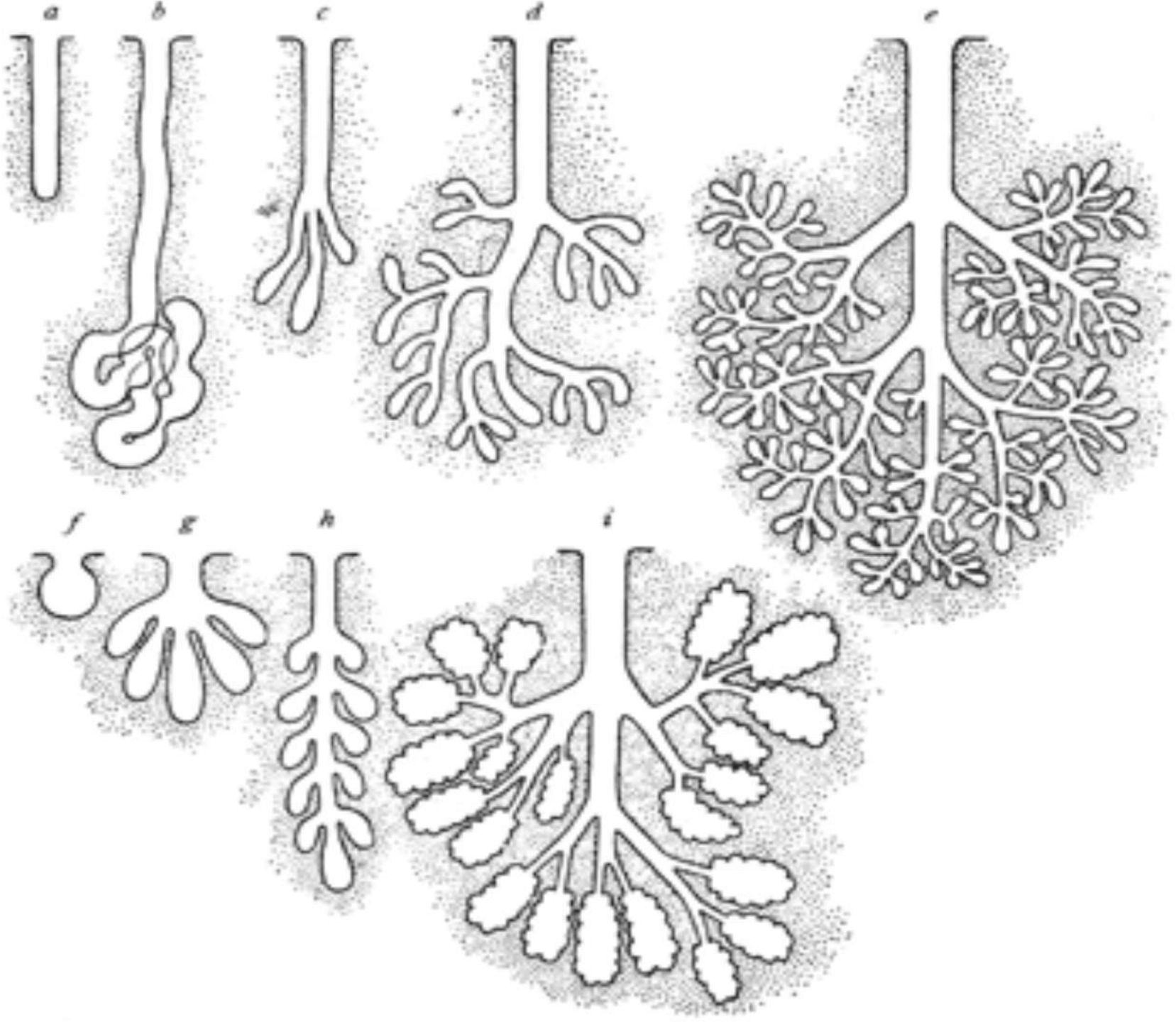
3. Compound tubulo-alveolar glands:

In these glands the secretory portions are in the form of irregularly branched tubules with numerous acinar outgrowths on the walls and on the blind ends. The duct system is highly branched.

E.g; submandibular salivary gland, mammary gland, lacrimal gland.






a
b
c
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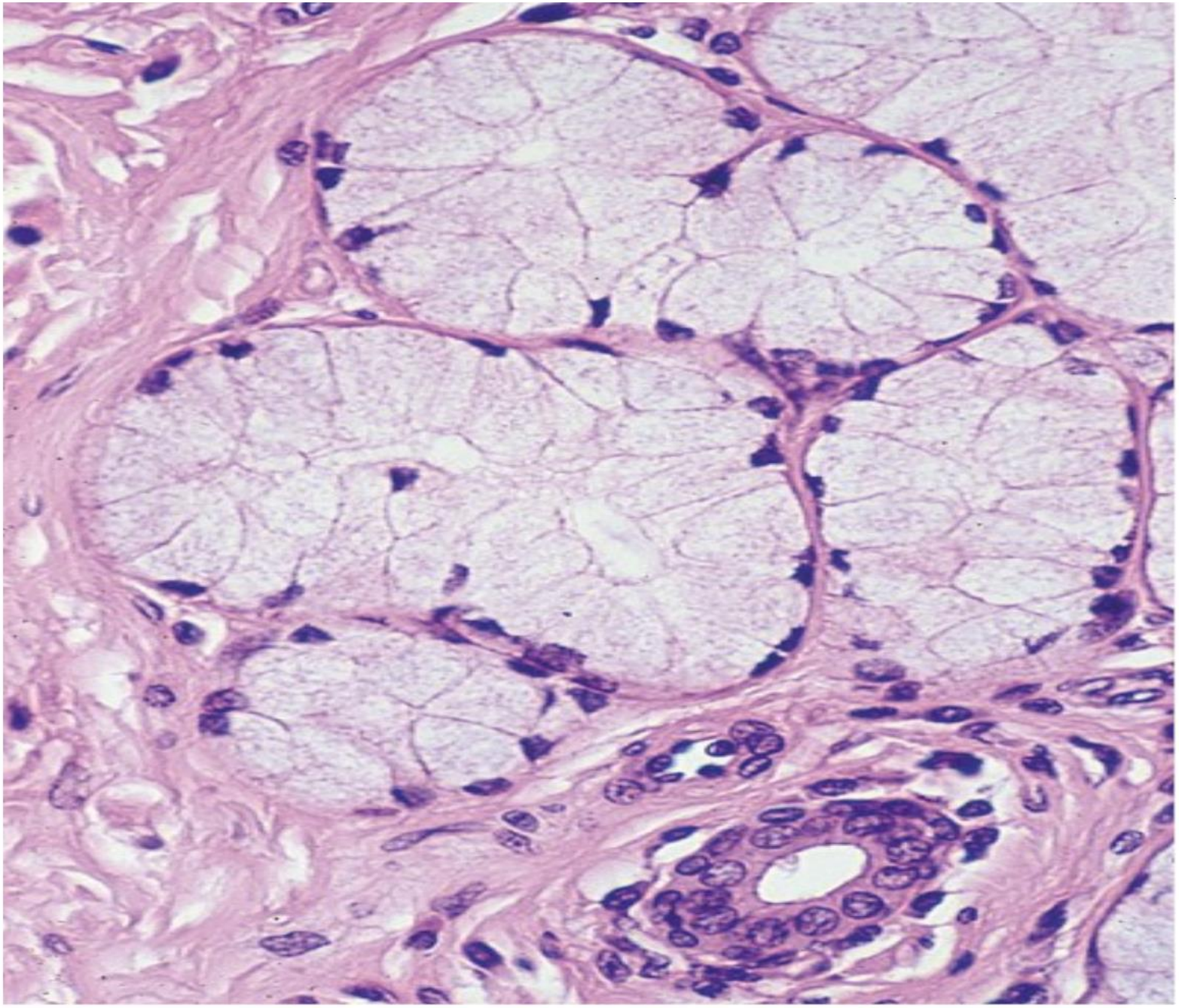
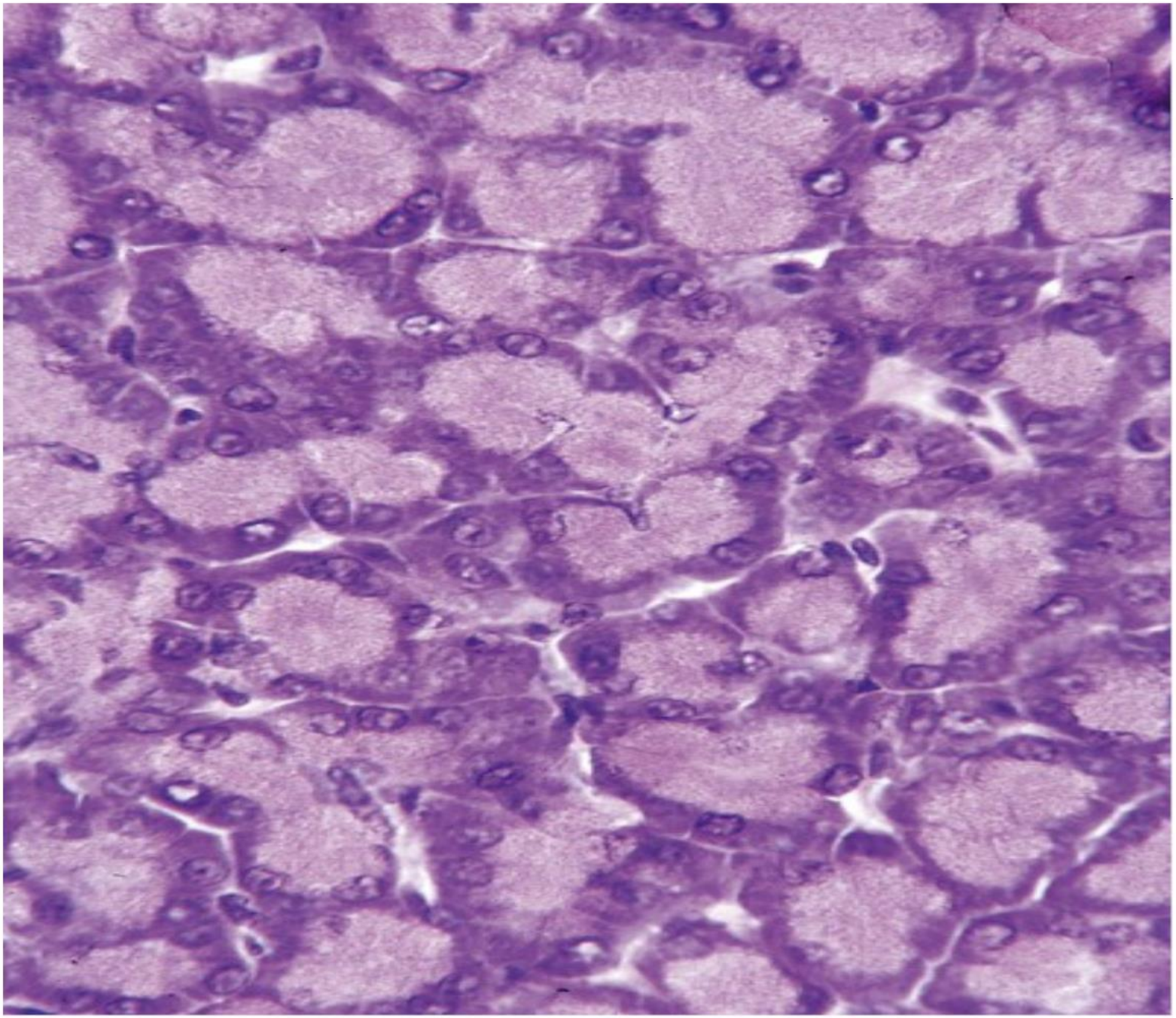
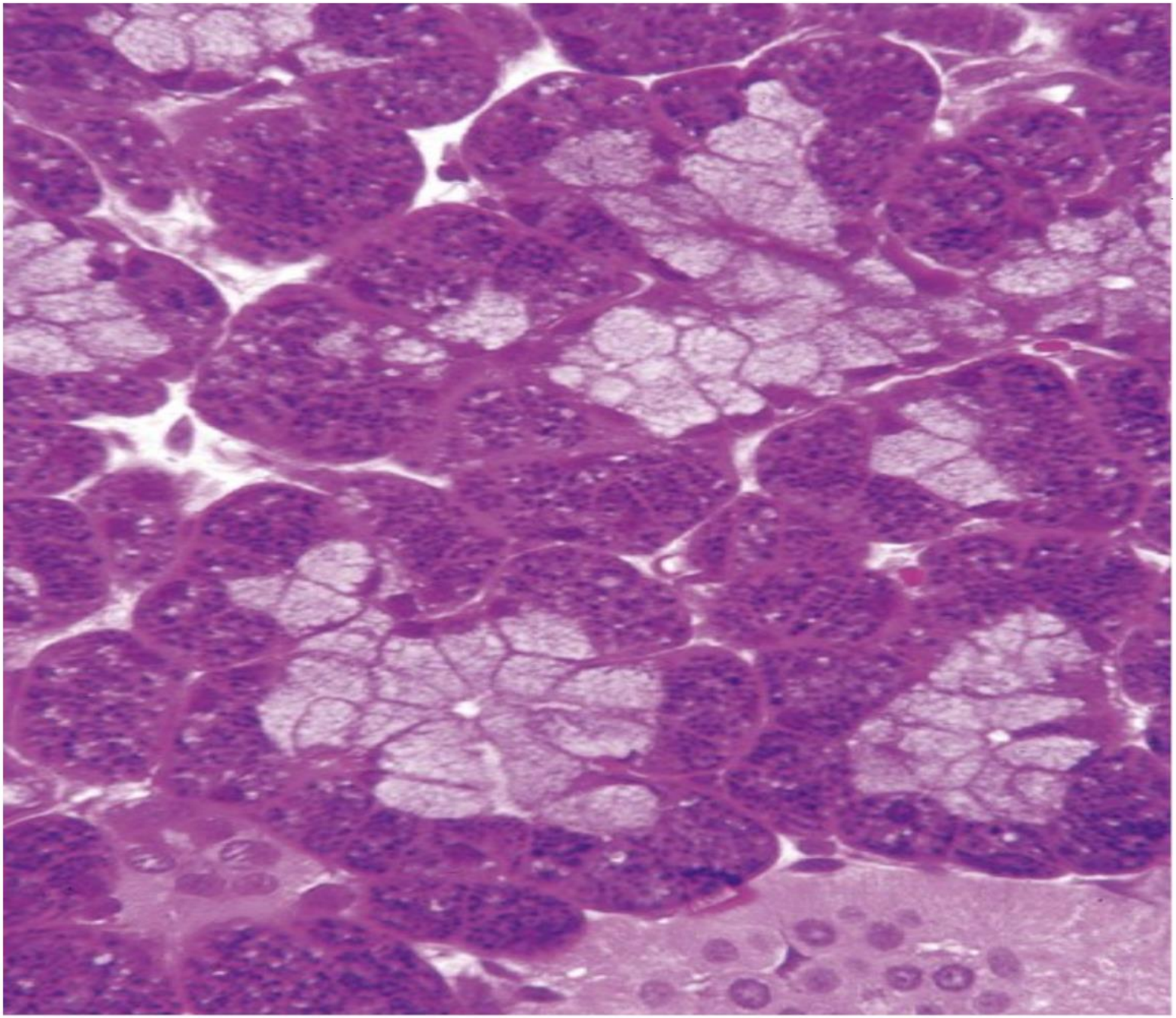
i

B. 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 pyloric gland of stomach.
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.







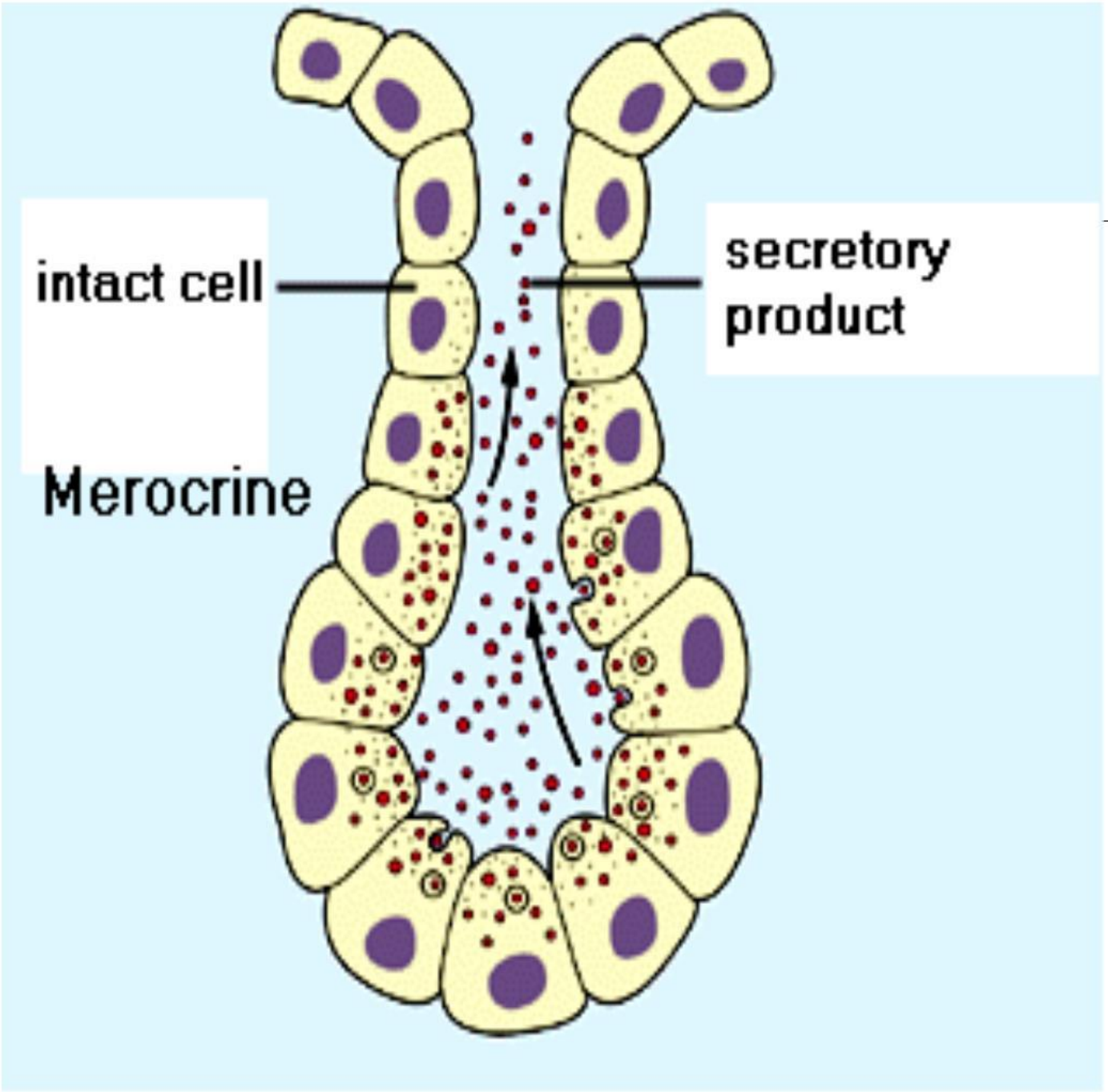
C. Classification on the basis of the mode of secretion:

- 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 four varieties:

1. Merocrine glands
2. Apocrine glands
3. Holocrine glands
4. Cytogenic glands

1. Merocrine glands: the secretory product is delivered in membrane-bounded vesicles to the apical surface of the cell. Here, vesicles fuse with the plasma membrane and extrude their contents by exocytosis.

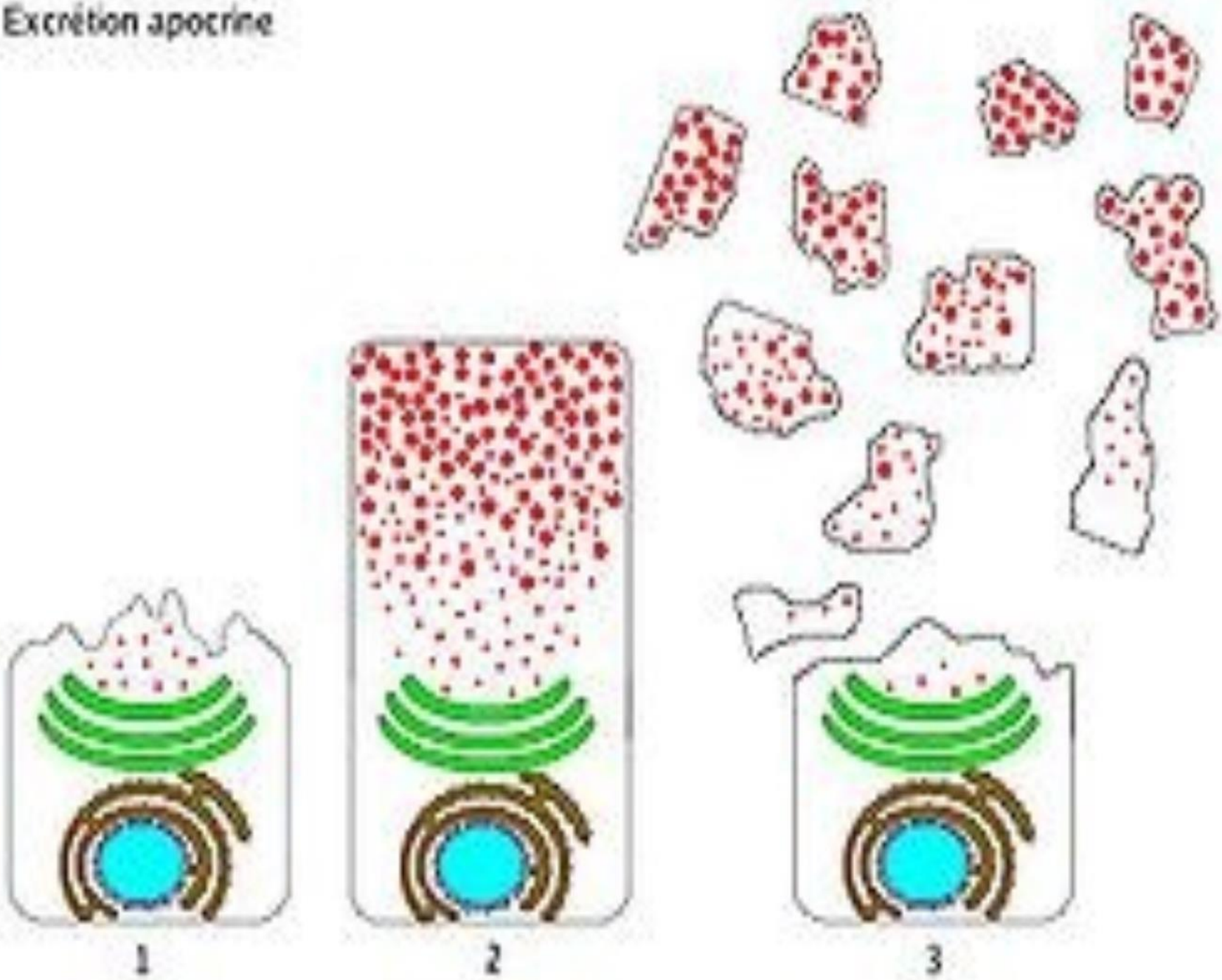
e.g; pancreatic acinar cells, salivary glands, lacrimal glands and intestinal glands.

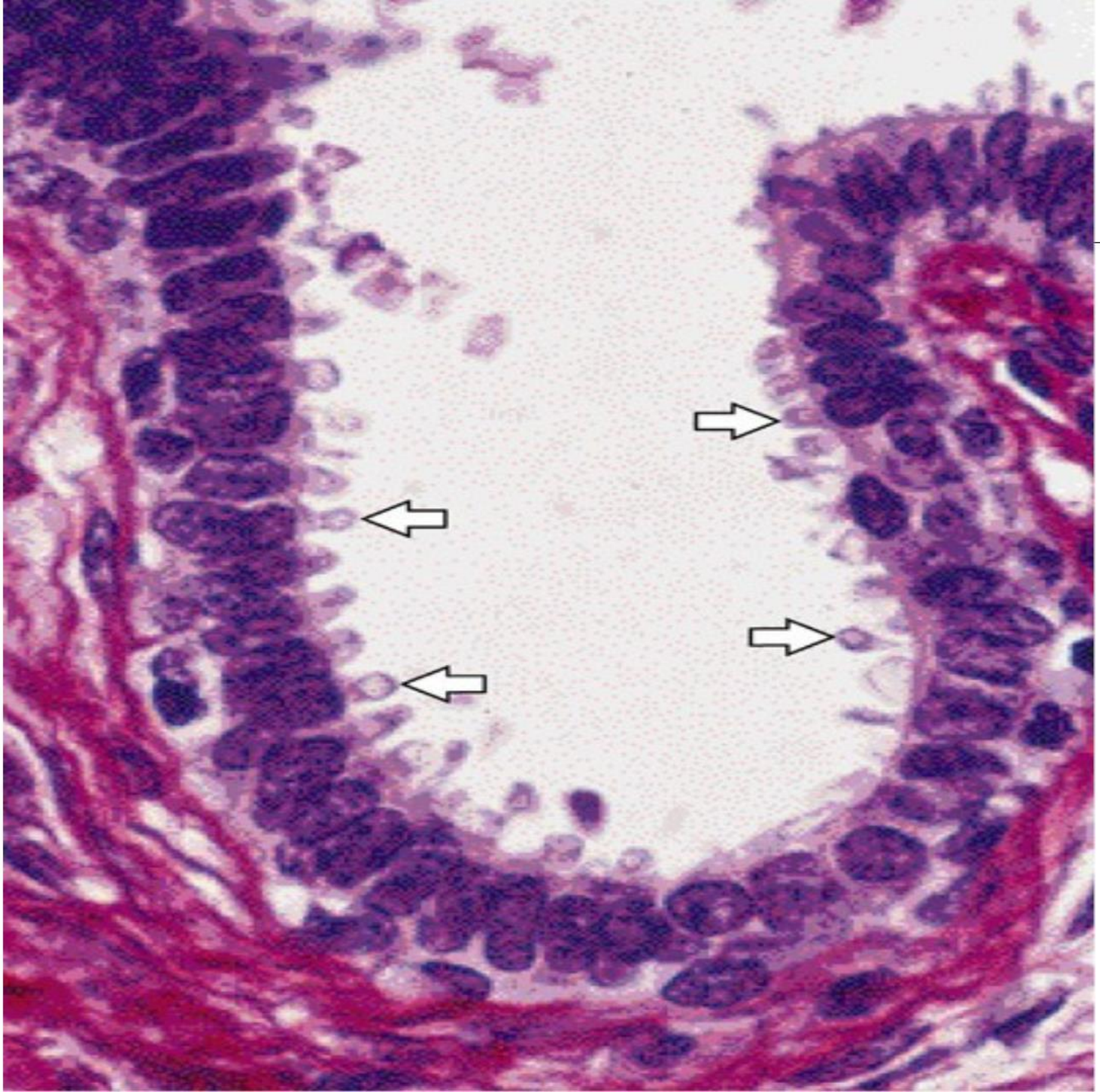

intact cell
secretory product
Merocrine

2. 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

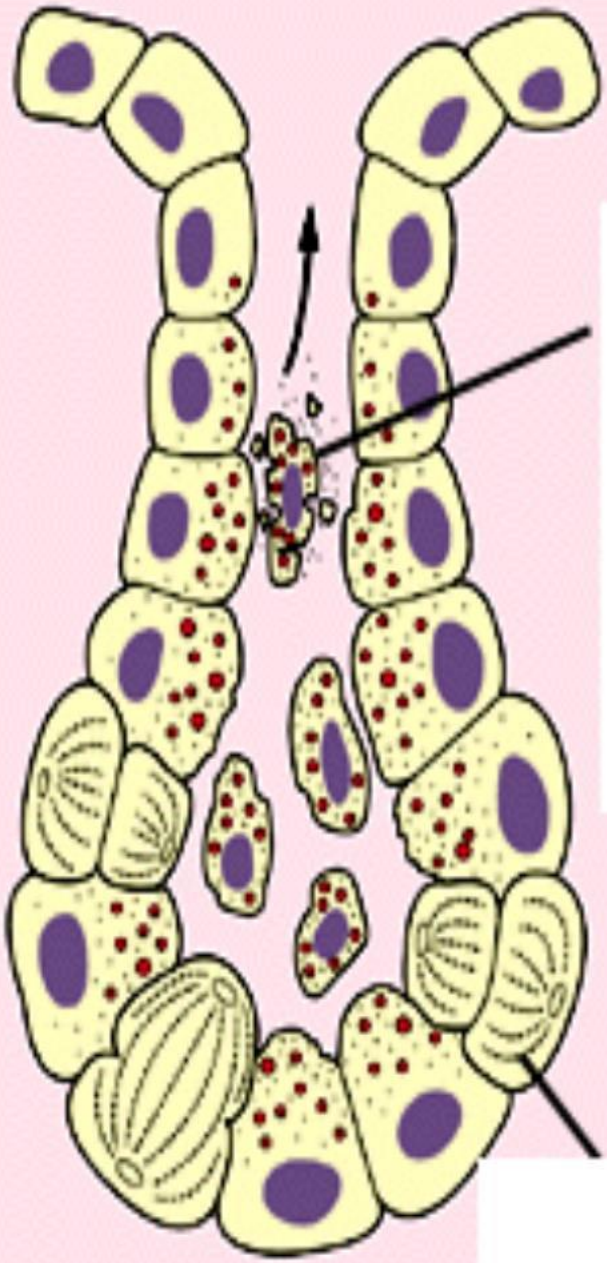
Excrétion apocrine





3. 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, tarsal (meibomian) glands of the eyelid.



Disintegrating cell and its released contents

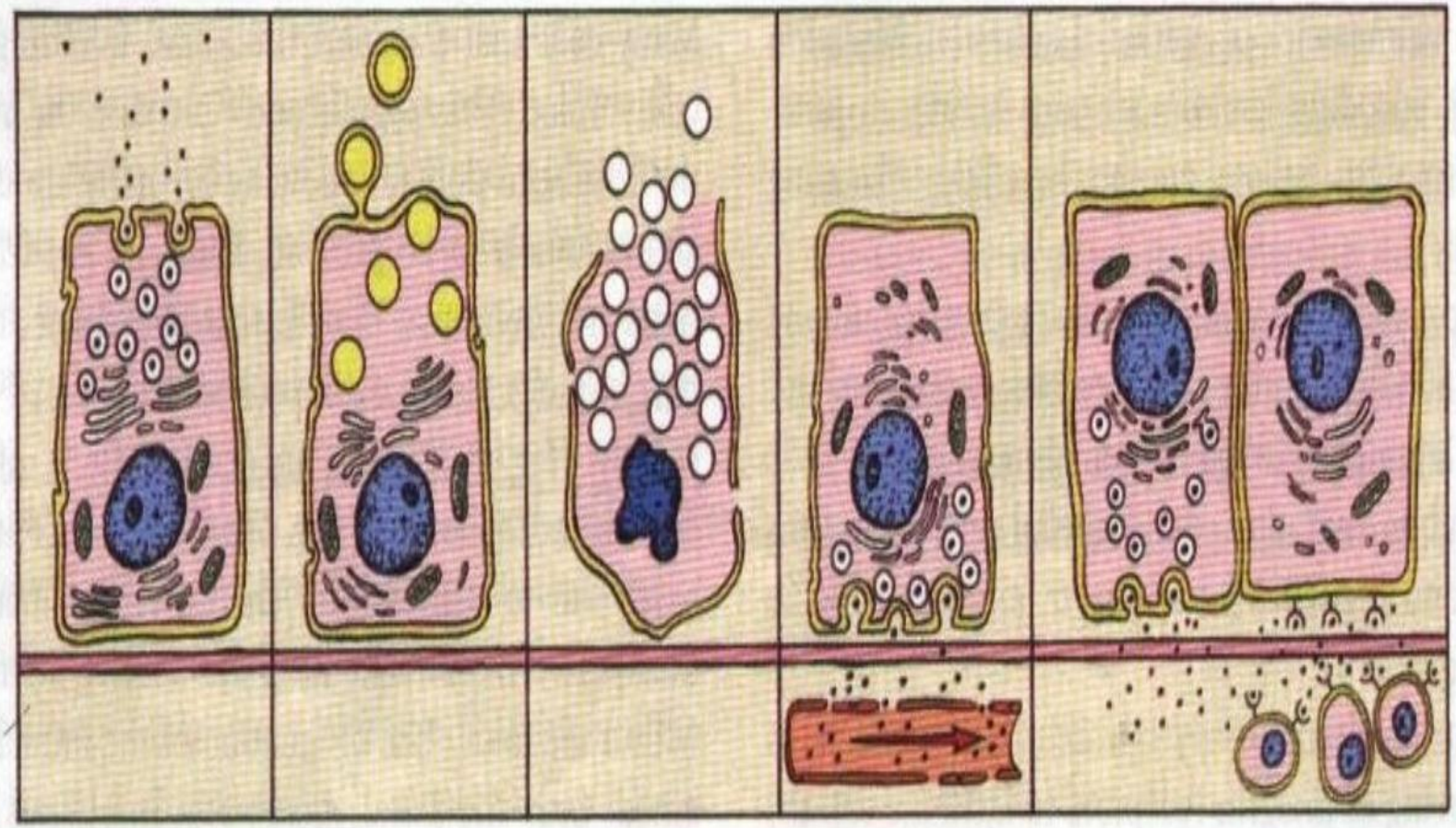
Holocrine

Mitotic divisions to replace cells

4. Cytogenic glands: these glands produce living cells e.g; the testes and ovaries.

TABLE 5.4 Types of Glands

Exocrine Glands			Endocrine Glands	Paracrine Glands
Merocine	Apocrine	Holocrine		



General histological structure of exocrine glands

- 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.
- The functional part of a gland, formed by its secretory cells, is known as **parenchyma of the gland**.
- The supporting elements of the gland, which consists mainly of connective tissue, are referred to as **stroma of the gland.**

Simple tubular

Simple coiled tubular

Simple branched tubular

Simple alveolar

Simple branched alveolar

Compound tubular

Compound alveolar

Compound tubuloalveolar