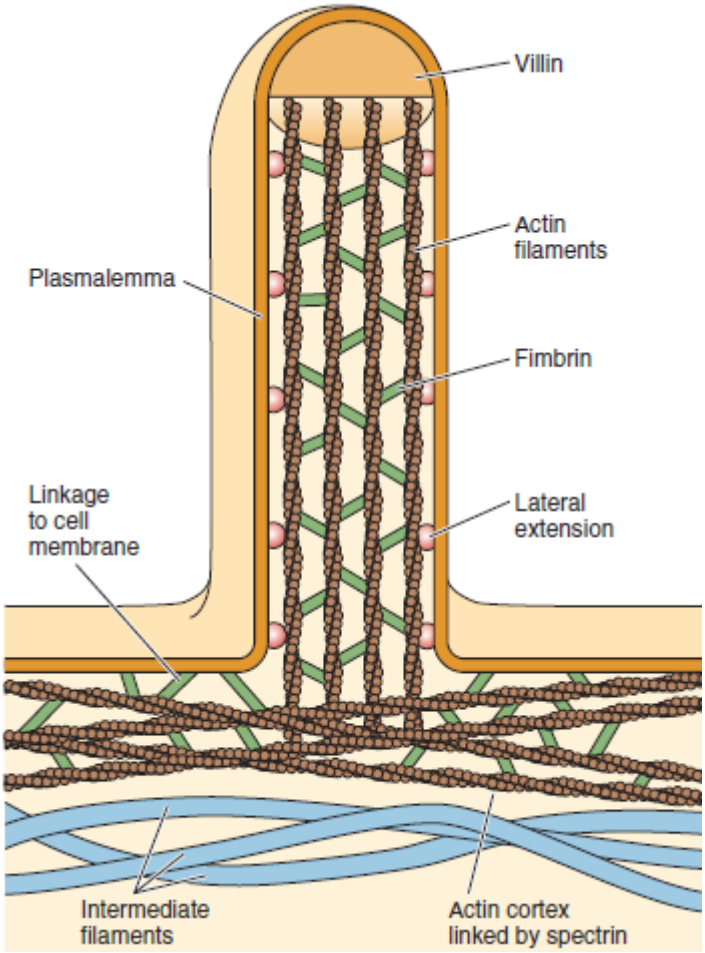
Apical Domain

The apical domain, the region of the epithelial cell facing the free surface, has an abundance of ion channels, carrier proteins, H+-ATPase, aquaporins, glycoproteins, and hydrolytic enzymes.

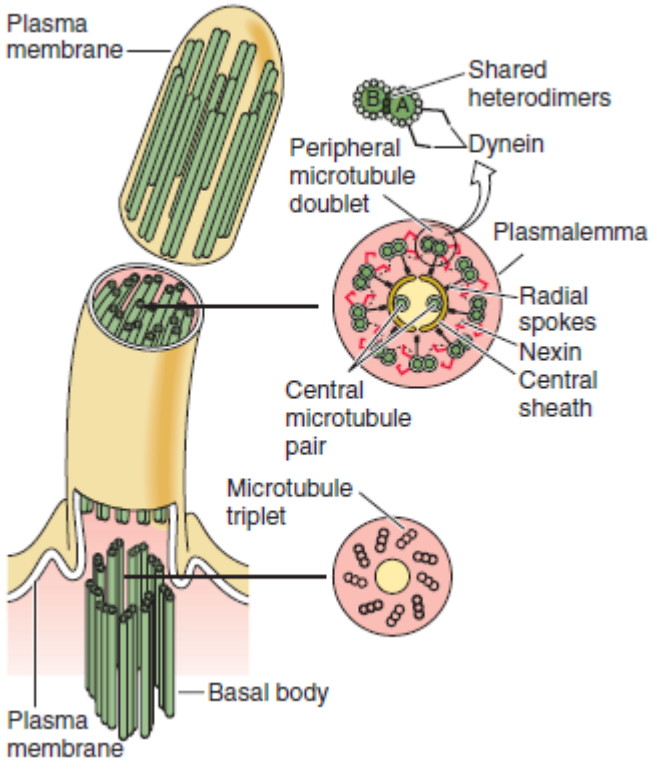
Microvilli :

The microvilli 1- to 2-μm-long membrane-bound, finger-like projections of the apical cell surfaces of simple cuboidal and simple columnar epithelia. The represent the striated and brush borders of light microscopy and, when closely packed, may increase the surface area as much as 20-fold.



Cilia:

cilia long (7 to 10 μm in length and 0.2 μm in diameter), finger-like structures projecting from the apical domain of the cell. In pithelial sheet, such as that lining the respiratory tract, can have 2 billion cilia/cm2, their coordinated action can propel a fluid along an epithelial sheet.



Basolateral Domain

Two regions constitute the basolateral domain of epithelia, the lateral and basal plasma membranes. Specialized junctional complexes and signal receptors, ion channels, and Na^+, K^+-ATPase abound in these regions, which also function as sites for constitutive
secretion.

Lateral Membrane Specializations:

Terminal bars, as viewed by light microscopy, are sites of apparent attachment of epithelial cells that have been shown to be structures that are continuous around the circumference of the entire cell. Terminal bars occupy restricted regions of the cell located in the vicinity of its apex. When examined with the electron microscope, the terminal bars were resolved to be **junctional complexes** that facilitate the adherence of contiguous cells to each other.

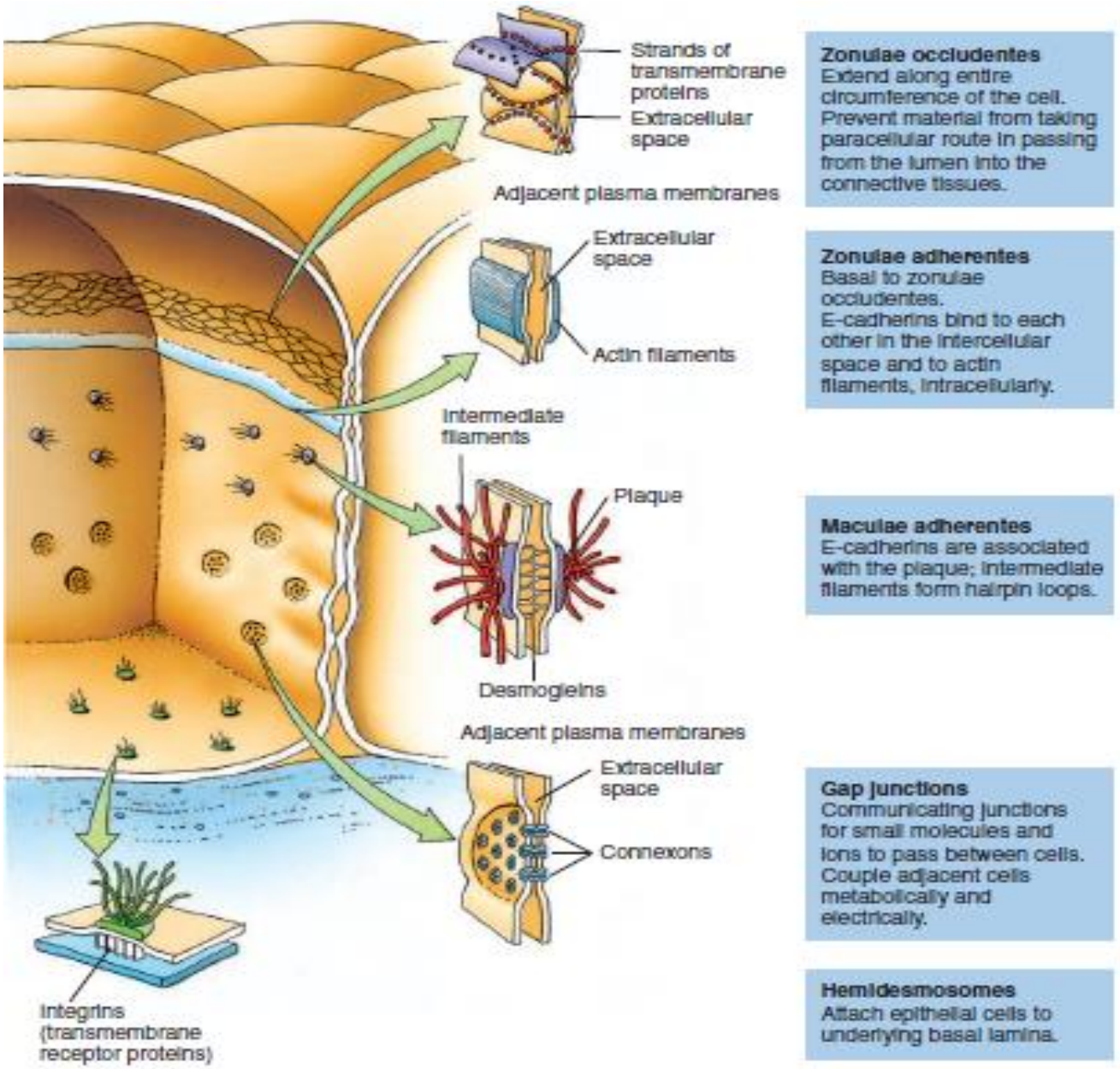
Occluding junctions (**zonulae occludentes**)

provide an impermeable, or selectively permeable, barrier that prevents material from traversing an epithelial membrane between adjoining cells (paracellular route).

Anchoring junctions (**zonulae adherentes**, **maculae adherentes**, **hemidesmosomes**, **actinlinked cell-matrix adhesions**) permit epithelial cells to adhere to each other or to the basal lamina or both.

Communicating junctions (**gap junctions**)

permit the trans-cytoplasmic movement of ions and small molecules between adjacent cells, coupling them electrically and metabolically.



Renewal of Epithelial Cells

There is a high replacement rate for cells of an epithelium, but this rate is faster in some organs, as in the lining of the gastrointestinal tract, and slower in other regions, as in the epidermis of skin. The renewal rate for a particular organ is generally constant, however. In the event that numerous cells are lost because of infection or injury, mitotic activity is increased to restore the cell population to normal levels.

The glands:

- During the development of certain regions of the body, epithelial cells invade the underlying connective tissue, form the **parenchyma** (secretory units and ducts) of glands, and surround themselves with a basal lamina that they secrete.

- The surrounding connective tissue, referred to as the **stroma**, supports the parenchyma of the gland by providing vascular and neural supplies, and its structural elements such as capsules, which envelop the entire gland, and septa, which subdivide the gland into lobes and lobules.

- The individual cells of the gland's secretory units synthesize secretory products and store them in intracellular compartments known as **secretory granules** until the secretion is released. Depending on the gland, these secretory products may be as varied as:

• A hormone, such as insulin from the islets of Langerhans;

• An enzyme, such as salivary amylase from the parotid gland, or a bicarbonate-rich fluid from Brunner's glands of the duodenum.

• A tear, a watery secretion from the lacrimal gland.

Two principal categories of glands exist based on the manner of delivery of their secretory products:

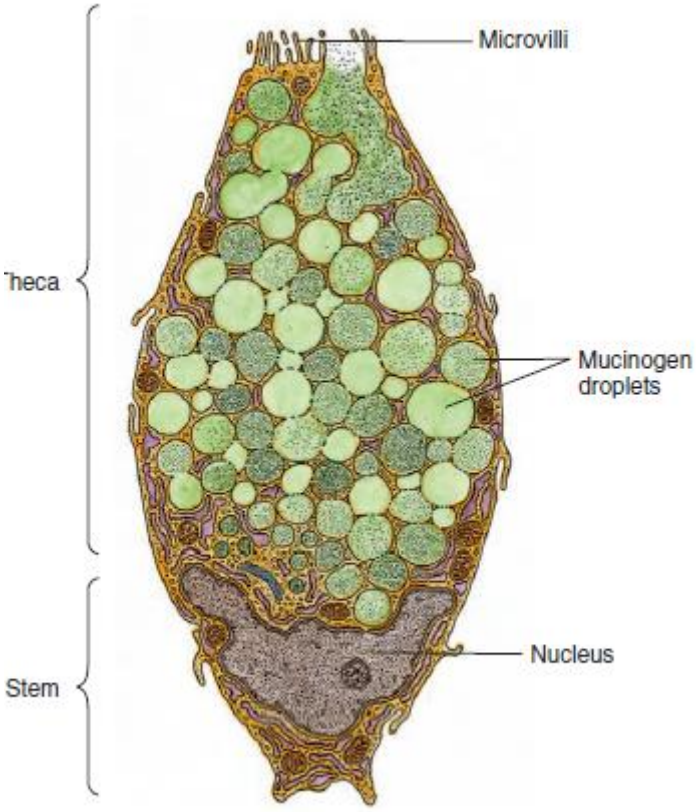
• **Exocrine glands** possess ducts through which their secretory products are delivered onto an epithelial surface.

• **Endocrine glands** are **ductless**; consequently, their secretory product is delivered directly into the bloodstream or lymphatic vessels.

• **Exocrine Glands**

Exocrine glands may be classified by the number of cells that compose the gland:

• **Unicellular**: a single cell is the entire gland (e.g., goblet cell)



• **Multicellular**: the gland is composed of more than just a single cell (e.g., submandibular gland).

Additional classifications are based on the type of secretion the gland produces:

• **Serous**: watery (e.g., parotid gland)

• **Mucous**: viscous (e.g., minor salivary glands of the palate)

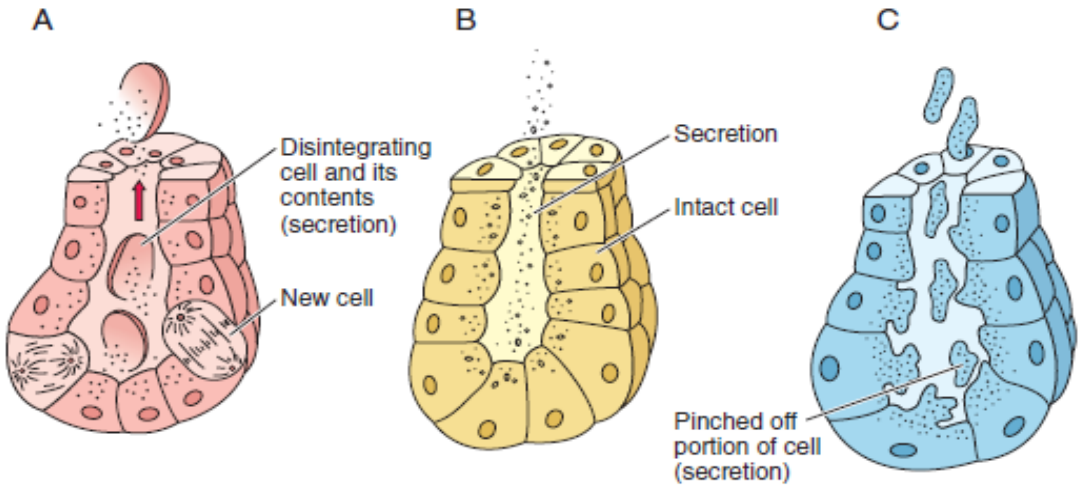
• **Mixed**: serous and mucous (e.g., sublingual gland)

Still other classifications are based on the mechanism whereby the cells of the gland release their secretory products:

• **Merocrine**:
The secretory product is released (as in the parotid gland)

• **Apocrine**:
A small piece of the cell's cytoplasm accompanies the secretory product (as, perhaps, in the lactating mammary gland)

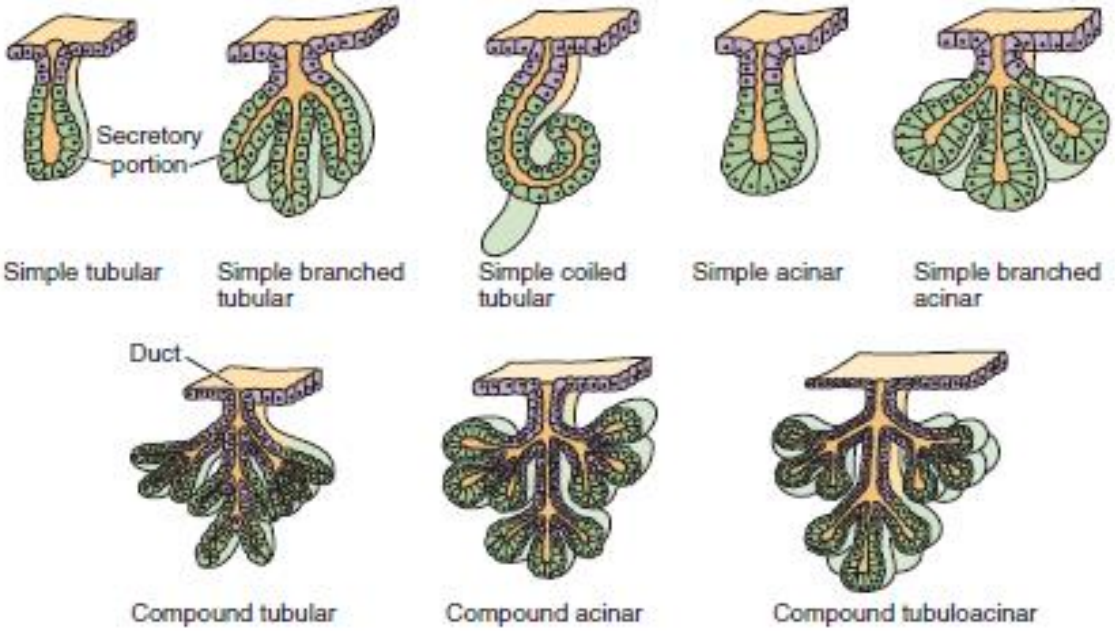
• **Holocrine**:
The entire cell dies and becomes the secretion (as in the sebaceous gland)



Multicellular Exocrine Glands Secretory cells that are grouped together and organized to act as secretory organs are **multicellular exocrine glands**.

• **Simple,** where the ducts do not branch.

• **Compound,** where the ducts branch.



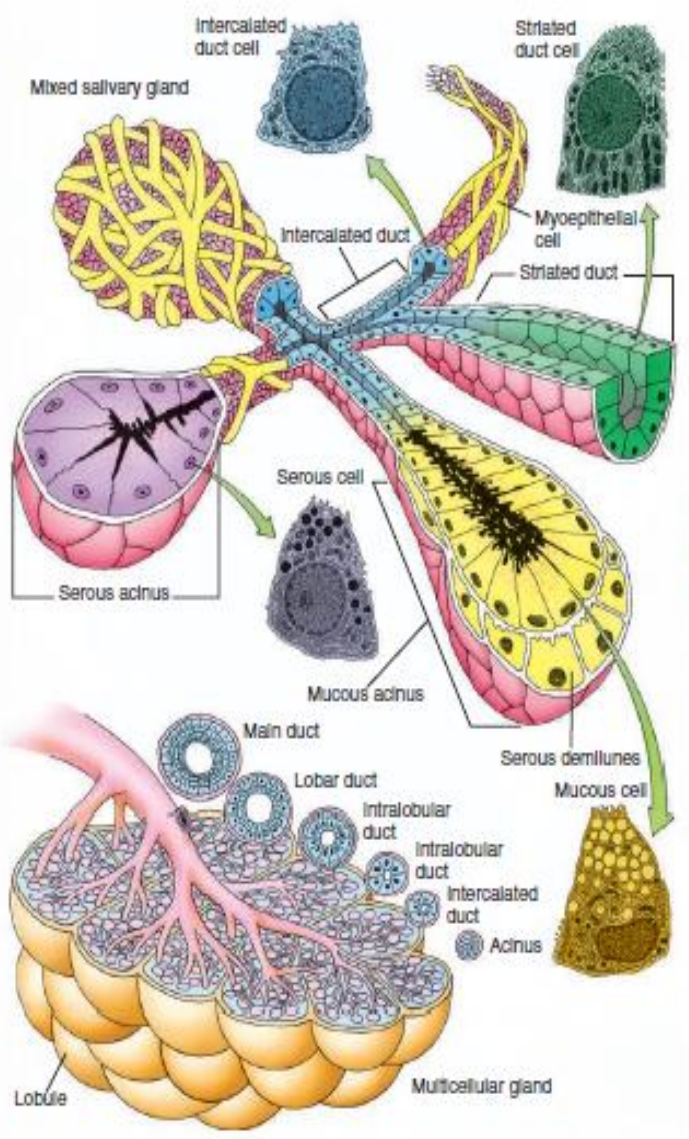


Figure 5.11 Salivary gland: its organization, secretory units, and system of ducts. *(From Cartner LP, Hiatt JL: Color Textbook of Histology, 3rd ed. Philadelphia, Saunders, 2007, p 108.)*