

Digestive System
Oral Cavity and Salivary Glands
Lec. 19

Histology
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Second year

Digestive System: Oral Cavity and Salivary Glands

The digestive system is a long hollow tube or tract that starts at the oral cavity and terminates at the anus. The system consists of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, and anal canal. Associated with the digestive tract are the accessory digestive organs, the salivary glands, liver, and pancreas. The accessory organs are located outside of digestive tract. Their secretory products are delivered to the digestive tract through excretory ducts that penetrate the digestive tract wall.

The Oral Cavity

The Lips

In the oral cavity, food is ingested, masticated (chewed), and lubricated by saliva for swallowing. Because food is physically broken down in the oral cavity, this region is lined by a protective, nonkeratinized, stratified squamous epithelium, which also lines the inner or labial surface of the lips.

The Lips

- The oral cavity is formed, in part, by the lips and cheeks. The lips are lined by a very thin skin covered by a stratified squamous keratinized epithelium. Blood vessels are close to the lip surface, imparting a red color to the lips. The outer surface of the lip contains hair follicles, sebaceous glands, and sweat glands. The lips also contain skeletal muscle called orbicularis oris. Inside the free margin of the lip, the outer lining changes to a thicker, stratified squamous nonkeratinized oral epithelium. Beneath the oral epithelium are found mucus-secreting labial glands.

The Tongue

Papillae

The tongue is a muscular organ located in the oral cavity. The core of the tongue consists of connective tissue and interlacing bundles of skeletal muscle fibers. The distribution and random orientation of individual skeletal muscle fibers in the tongue allows for increased movement during chewing, swallowing, and speaking.

Papillae

The epithelium on the dorsal surface of the tongue is irregular or rough owing to numerous elevations or projections called papillae. These are indented by the underlying connective tissue called lamina propria. All papillae on the tongue are covered by stratified squamous epithelium that shows partial or incomplete keratinization. In contrast, the epithelium on the ventral surface of the tongue is smooth. There are four types of papillae on the tongue: filiform, fungiform, circumvallate, and foliate.

1. **Filiform Papillae**

The most numerous and smallest papillae on the surface of the tongue are the narrow, conical shaped filiform papillae. They cover the entire dorsal surface of the tongue.

2. **Fungiform Papillae**

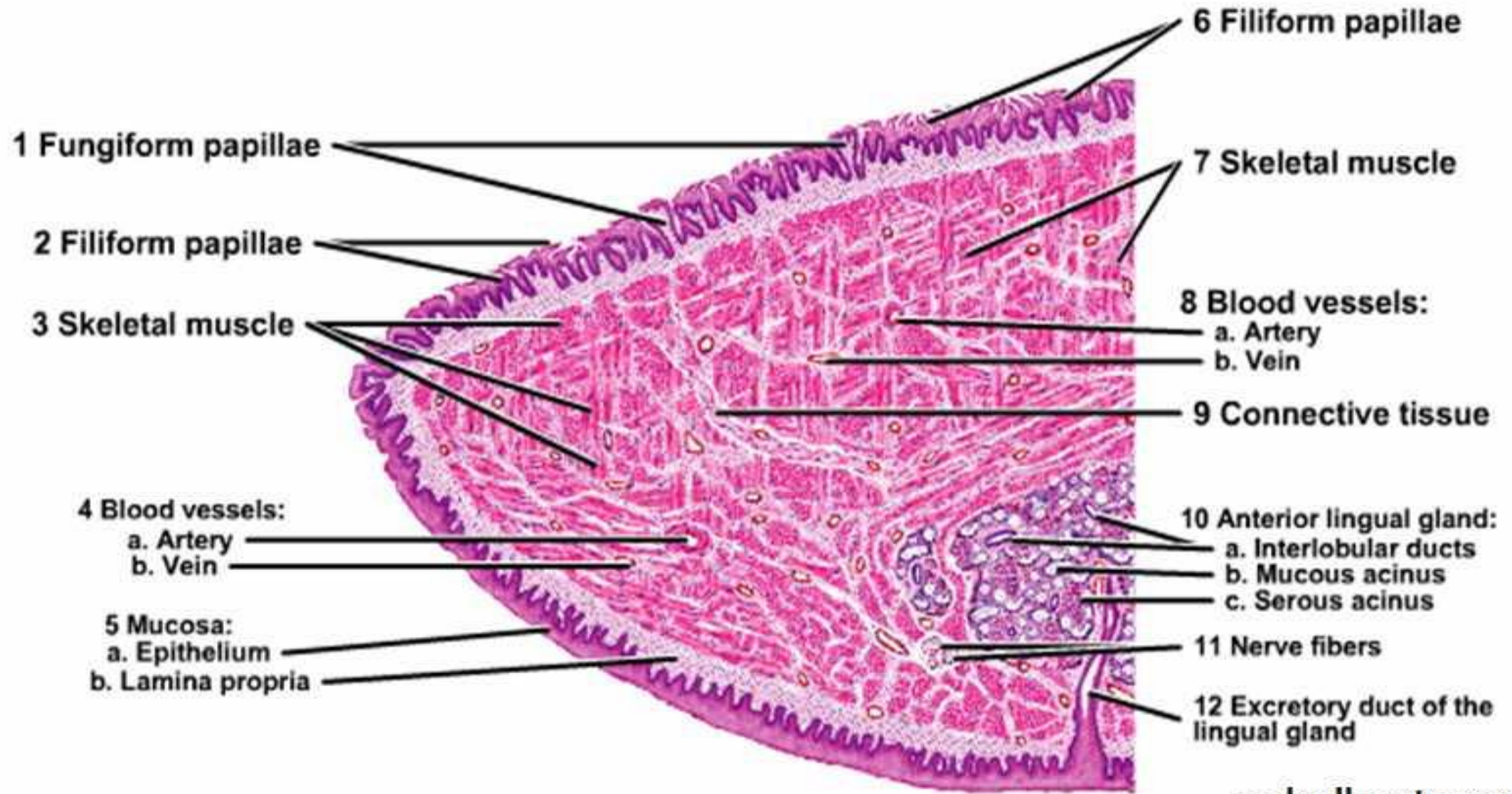
Less numerous but larger, broader, and taller than the filiform papillae are the fungiform papillae. These papillae exhibit a mushroom-like shape and are more prevalent in the anterior region of the tongue. Fungiform papillae are interspersed among the filiform papillae.

3. **Circumvallate Papillae**

Circumvallate papillae are much larger than the fungiform or filiform papillae. Eight to 12 circumvallate papillae are located in the posterior region of the tongue. These papillae are characterized by deep moats or furrows that completely encircle them. Numerous excretory ducts from underlying serous (von Ebner's) glands, located in the connective tissue, empty into the base of the furrows.

4. **Foliate Papillae**

Foliate papillae are well developed in some animals but are rudimentary or poorly developed in humans.



1 Fungiform papillae

2 Filiform papillae

3 Skeletal muscle

4 Blood vessels:

- a. Artery
- b. Vein

5 Mucosa:

- a. Epithelium
- b. Lamina propria

6 Filiform papillae

7 Skeletal muscle

8 Blood vessels:

- a. Artery
- b. Vein

9 Connective tissue

10 Anterior lingual gland:

- a. Interlobular ducts
- b. Mucous acinus
- c. Serous acinus

11 Nerve fibers

12 Excretory duct of the lingual gland

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Taste Buds

Located in the epithelium of the foliate and fungiform papillae, and on the lateral sides of the circumvallate papillae, are barrel-shaped structures called the taste buds. In addition, taste buds are found in the epithelium of the soft palate, pharynx, and epiglottis. The free surface of each taste bud contains an opening called the taste pore. Each taste bud occupies the full thickness of the epithelium. Located within each taste bud are elongated neuroepithelial (taste) cells that extend from the base of the taste bud to the taste pore. The apices of each taste cell exhibit numerous microvilli that protrude through the taste pore. The cells that are receptors for taste are closely associated with small afferent nerve fibers. Also present within the confines of the taste buds are elongated supporting sustentacular cells. These cells are not sensory. At the base of each taste bud are basal cells. These cells are undifferentiated and are believed to serve as stem cells for the specialized cells in taste buds.

Lymphoid Aggregations: Tonsils (Palatine, Pharyngeal, and Lingual)

The tonsils are aggregates of diffuse lymphoid tissue and lymphoid nodules that are located in the oral pharynx. The palatine tonsils are located on the lateral walls of the oral part of the pharynx. These tonsils are lined with stratified squamous nonkeratinized epithelium and exhibit numerous crypts. A connective tissue capsule separates the tonsils from adjacent tissue. The pharyngeal tonsil is a single structure situated in the superior and posterior portion of the pharynx. It is covered by pseudostratified ciliated epithelium. The lingual tonsils are located on the dorsal surface of the posterior one third of the tongue. They are several in number and are seen as small bulges composed of masses of lymphoid aggregations. The lingual tonsils are lined by stratified squamous nonkeratinized epithelium. Each lingual tonsil is invaginated by the covering epithelium to form numerous crypts, around which are found aggregations of lymphatic nodules.

The Major Salivary Glands

- There are three major salivary glands: the **parotid, submandibular,** and **sublingual**. Salivary glands are located outside of the oral cavity and convey their secretions into the mouth via large excretory ducts. The paired **parotid glands** are the largest of the salivary glands, located anterior and inferior to the external ear. The smaller, paired **submandibular (submaxillary) glands** are located inferior to the mandible in the floor of the mouth. The smallest salivary glands are **the sublingual glands**, which are aggregates of smaller glands located inferior to the tongue. Salivary glands are composed of cellular secretory units called acini (singular, acinus) and numerous excretory ducts. The secretory units are small, saclike dilations located at the end of the first segment of the excretory duct system, the intercalated ducts.

Cells of the Salivary Gland Acini

- Cells that comprise the secretory acini of salivary glands are of two types: serous or mucous. Serous cells in the acini are pyramidal in shape. Their spherical or round nuclei are displaced basally by secretory granules accumulated in the upper or apical regions of the cytoplasm. Mucous cells are similar in shape to serous cells, except their cytoplasm is completely filled with a light-staining, secretory product called mucus. As a result, the accumulated secretory granules flatten the nucleus and displace it to the base of the cytoplasm. In some salivary glands, both mucous and serous cells are present in the same secretory acinus. In these mixed acini, where mucous cells predominate, serous cells form a crescent or moon shaped cap over the mucous cells called a serous demilune. The secretions from serous cells in the demilunes enter the lumen of the acinus through tiny intercellular canaliculi between mucous cells.

- Myoepithelial cells are flattened cells that surround both serous and mucous acini. Myoepithelial cells are also highly branched and contractile. They are sometimes called basket cells because they surround the acini with their branches like a basket. Myoepithelial cells are located between the cell membrane of the secretory cells in acini and the surrounding basement membrane.

- **Salivary Gland Ducts**

- Connective tissue fibers subdivide the salivary glands into numerous lobules, in which are found the secretory units and their excretory ducts.

1. Intercalated Ducts

- Both serous and mucous, as well as mixed secretory, acini initially empty their secretions into the intercalated ducts. These are the smallest ducts in the salivary glands with small lumina lined by low cuboidal epithelium. Contractile myoepithelial cells surround some portions of intercalated ducts.

2. Striated Ducts

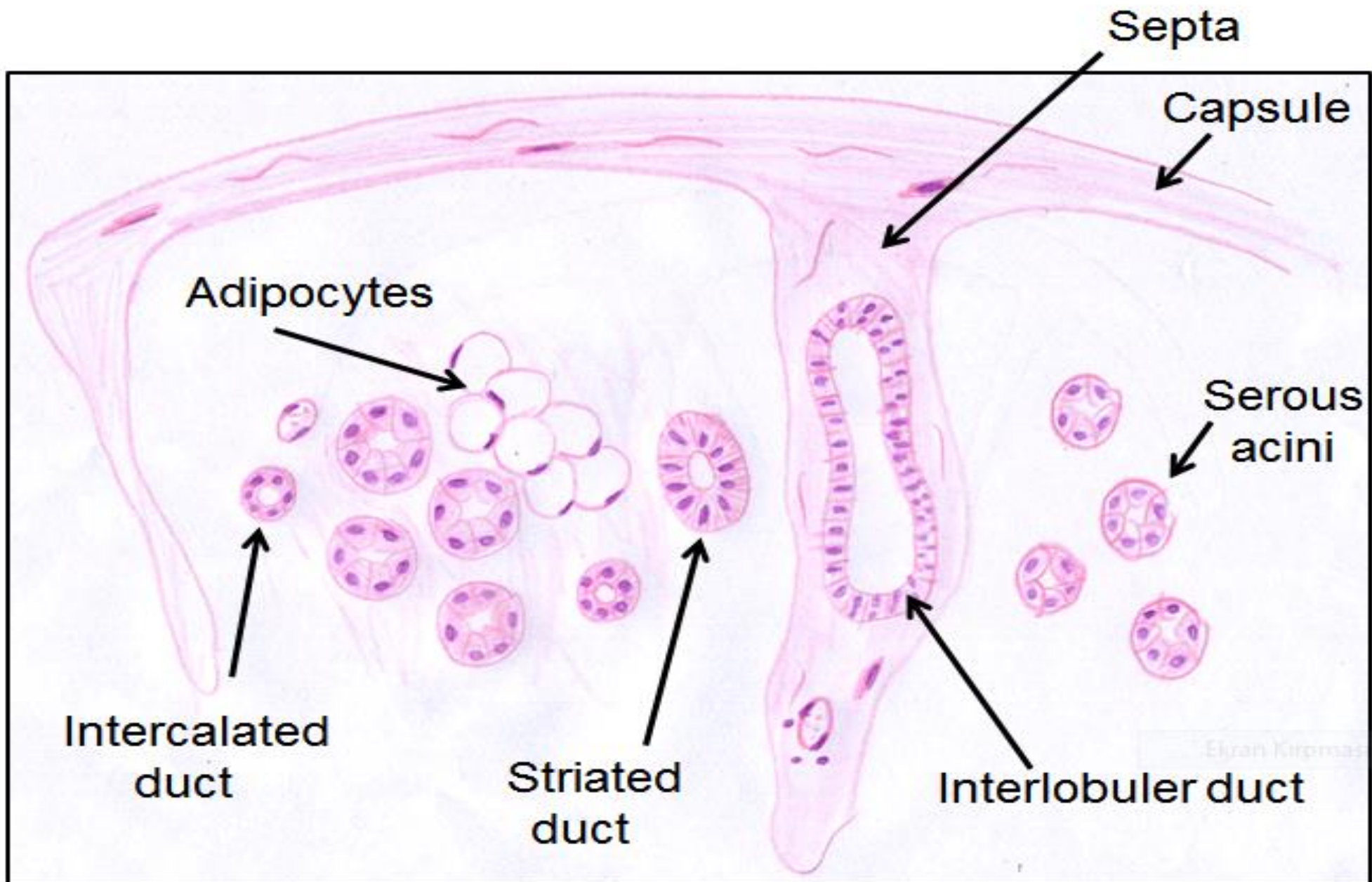
- Several intercalated ducts merge to form the larger striated ducts. These ducts are lined by columnar epithelium and, with proper staining, exhibit tiny basal striations. The striations correspond to the basal infoldings of the cell membrane and the cellular interdigitations. Located in these basal infoldings of the cell membrane are numerous and elongated mitochondria.

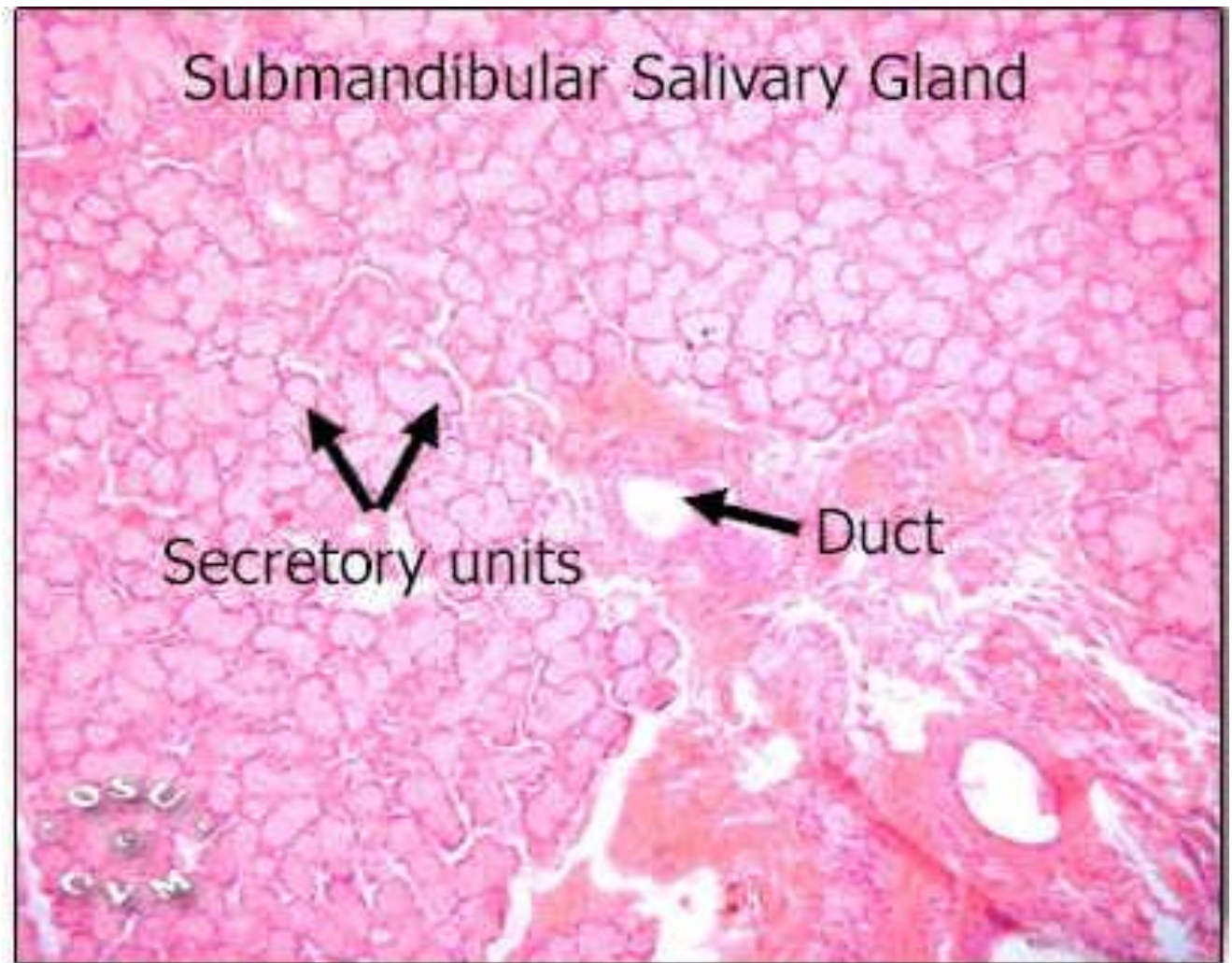
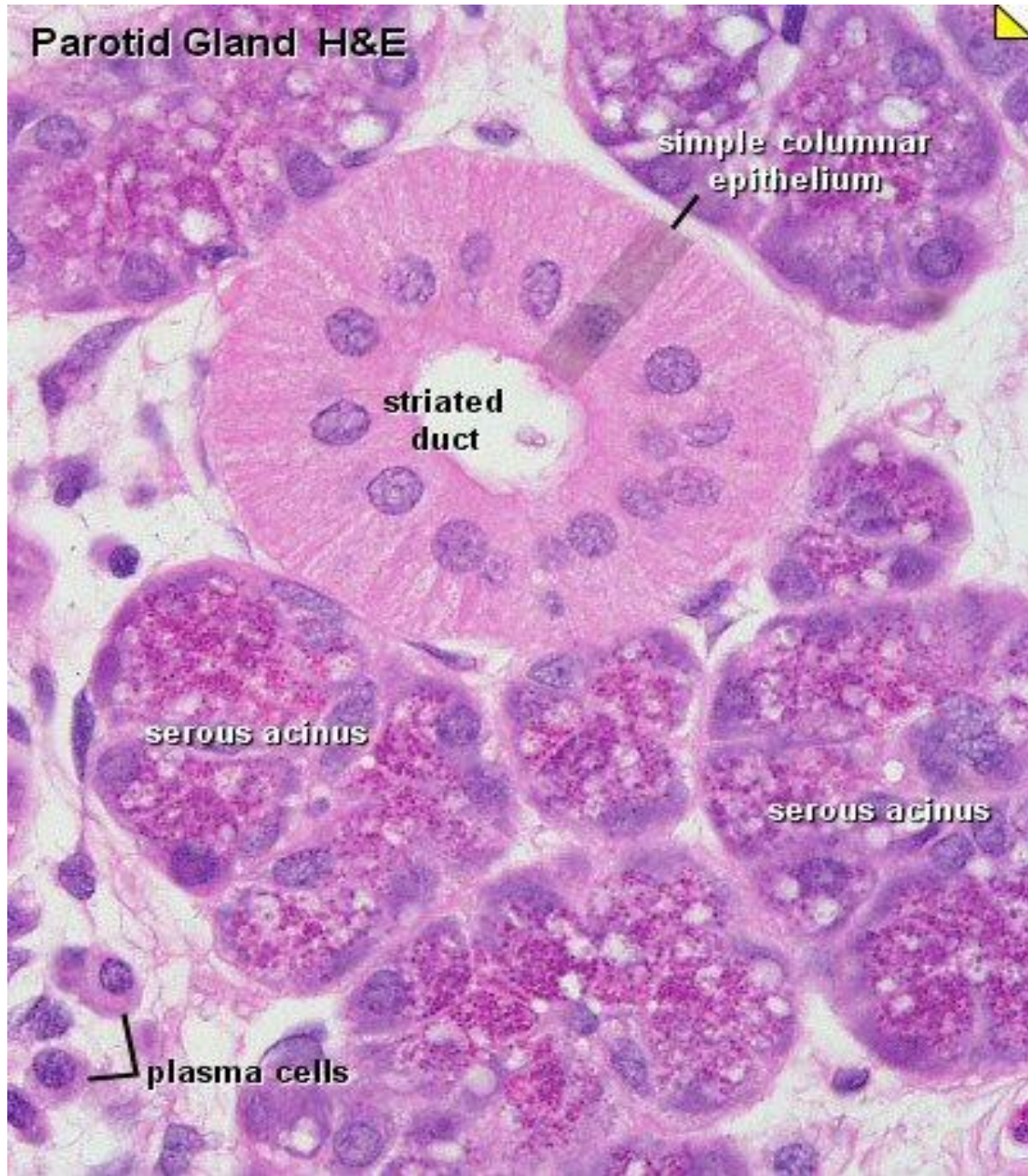
3. Excretory Intralobular Ducts

- Striated ducts, in turn, join to form larger intralobular ducts of gradually increasing size, surrounded by increased layers of connective tissue fibers.

4. Interlobular and Interlobar Ducts

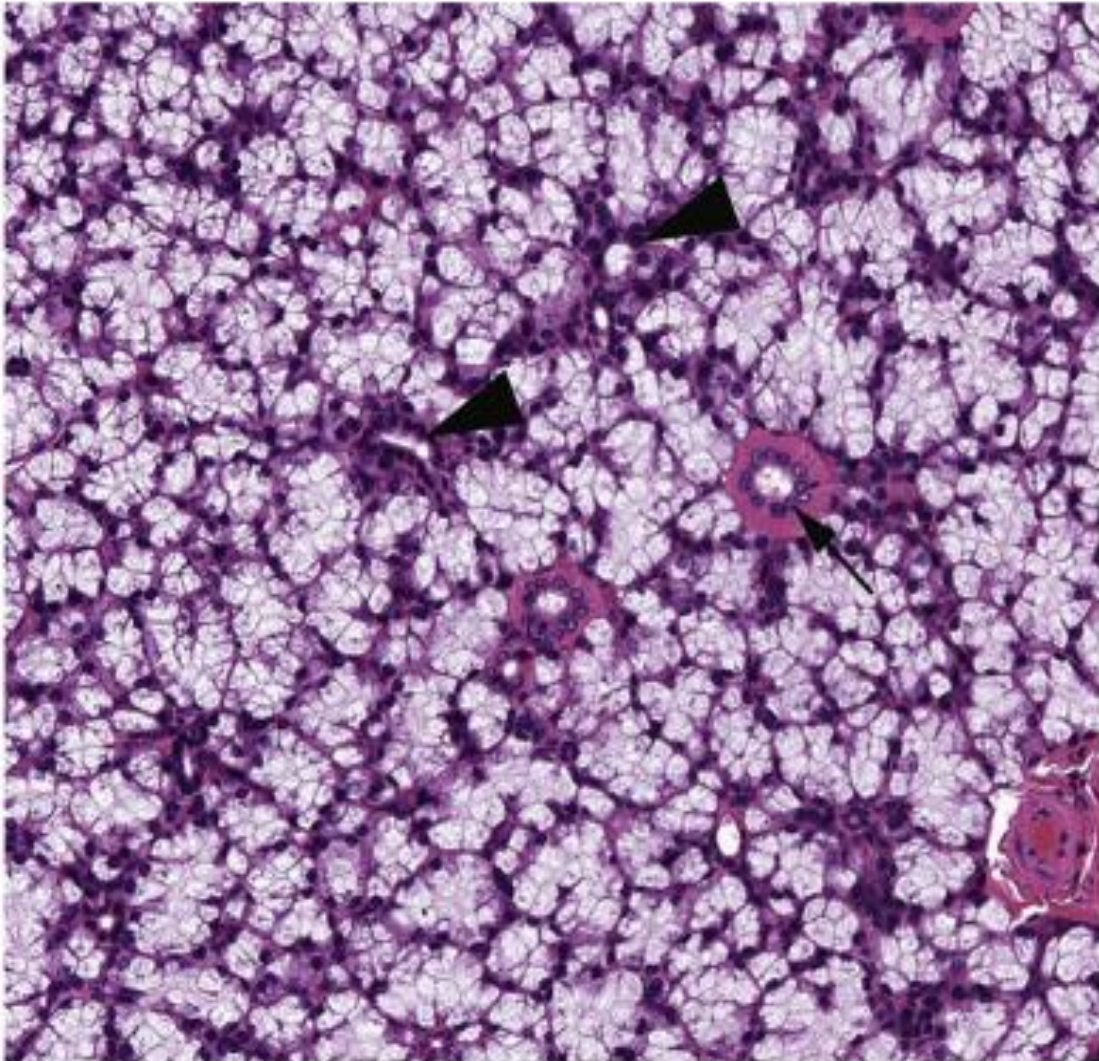
- Intralobular ducts join to form the larger interlobular ducts and interlobar ducts. The terminal portion of these large ducts conveys saliva from salivary glands to the oral cavity. Larger interlobular ducts may be lined with stratified epithelium, either low cuboidal or columnar.





sublingual glands

(A)



(B)

