The Digestive System
Lecture 2

Salivary Glands

- Are cells or organs that discharge a secretion into oral cavity.

A. Major salivary glands

- Lie at some distance from oral mucosa, with which they communicate through one or more extraglandular ducts.
- In man they comprise: the parotid, submandibular, and sublingual glands.

B. Minor salivary glands

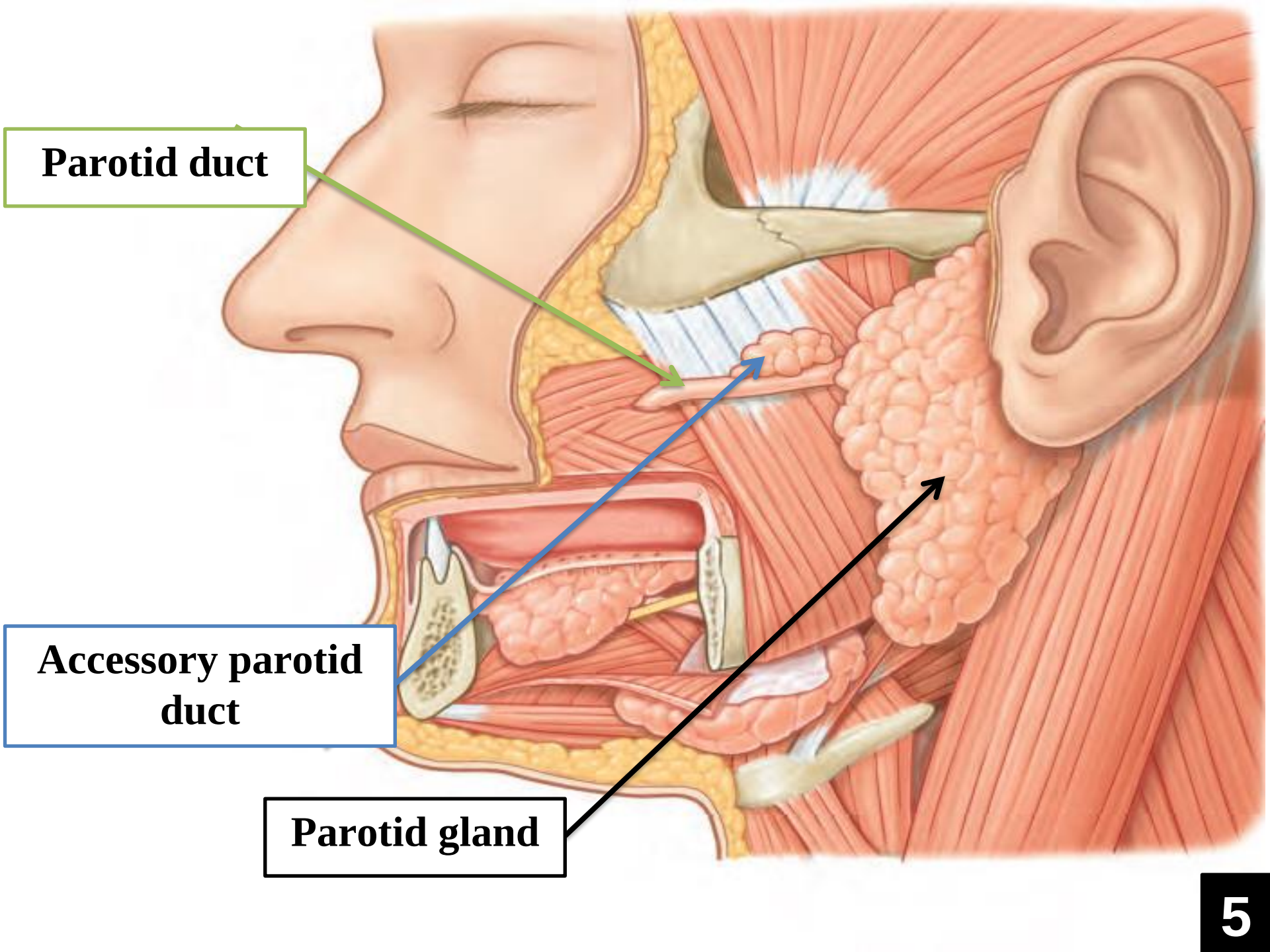
- Lie in the oral mucosa or submucosa and open directly or indirectly via many short excretory ducts, on the epithelial surface of the mucosa.

- They comprise: labial, buccal, and palatal glands, and Ebner's glands in mucosa of tongue.

Parotid Gland

- The largest of the salivary glands, composed almost entirely of serous acini, and it has a very irregular shape.
- It is wedged in the fossa posterior to ramus of the mandible, and extends from the external acoustic meatus above, to the upper part of carotid triangle below.
- Medially, it extends to the styloid process (close to side of pharynx).

- **Posteriorly, it overlaps sternocleido-mastoid.**
- **Anteriorly, it extends forwards over masseter for a variable distance; a portion of this part is often detached from the rest, the accessory parotid gland.**
- **Part of the cervical fascia in which the gland is embedded is thickened to form the stylomandibular ligament, which extends from styloid process to posterior border of ramus of mandible, and separates the parotid gland from the submandibular gland.**


Parotid duct
Accessory parotid duct
Parotid gland

Surfaces of the Gland

1. Lateral (superficial) surface

Is covered by skin and fascia, which contains superficial parotid lymph nodes.

2. Anteromedial surface

- Is grooved by the posterior border of the ramus of the mandible and extends anteriorly over the masseter and medially to the T.M (temporomandibular) joint.
- The branches of the facial nerve emerge from the anterior border of this surface.

3. Posteromedial surface

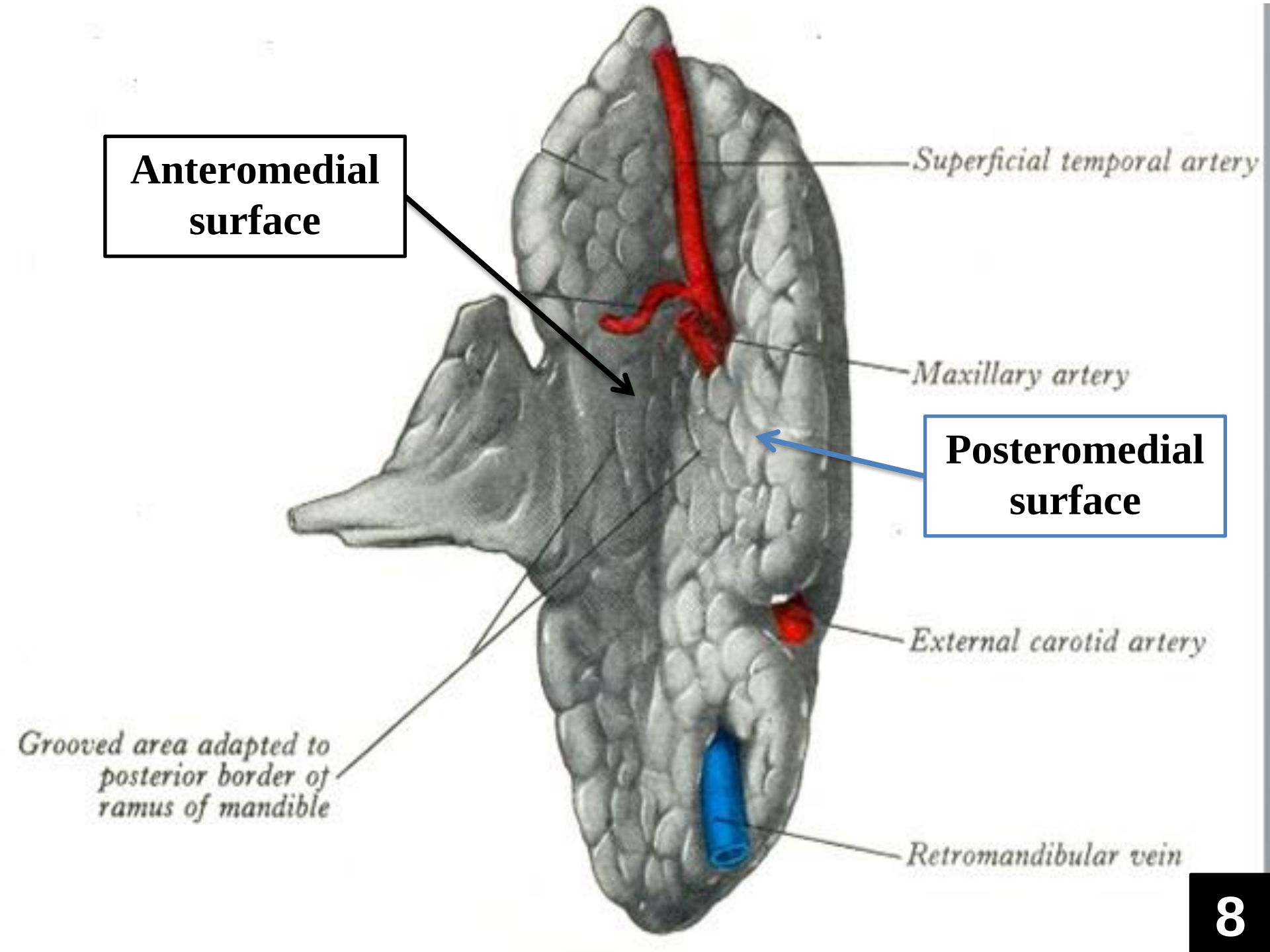
- **Is moulded to the mastoid process, sternocleidomastoid, posterior belly of digastrics, and styloid process and styloid apparatus.**

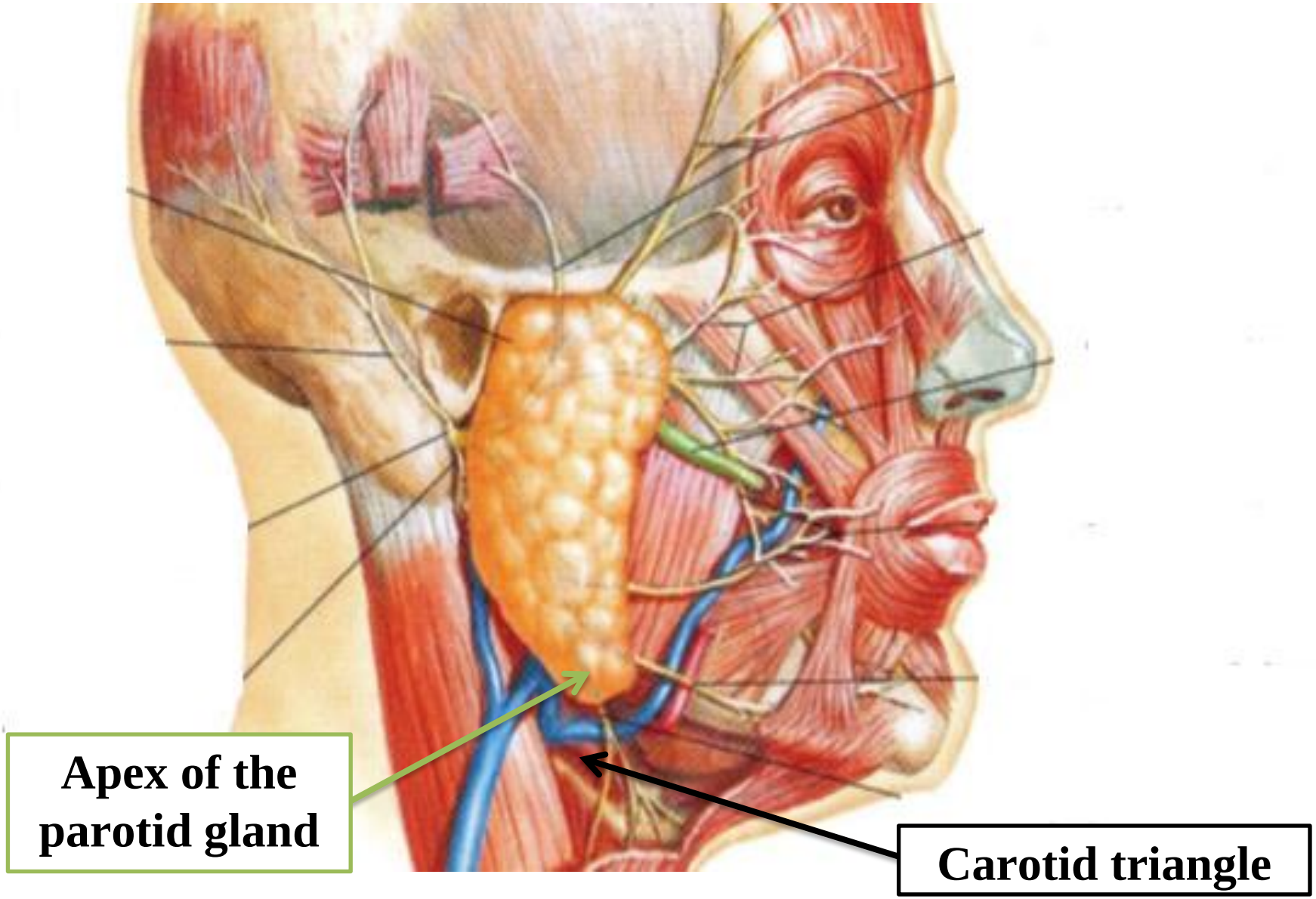
4. Superior surface

Is in contact with the cartilaginous part of external acoustic meatus.

Apex of the gland

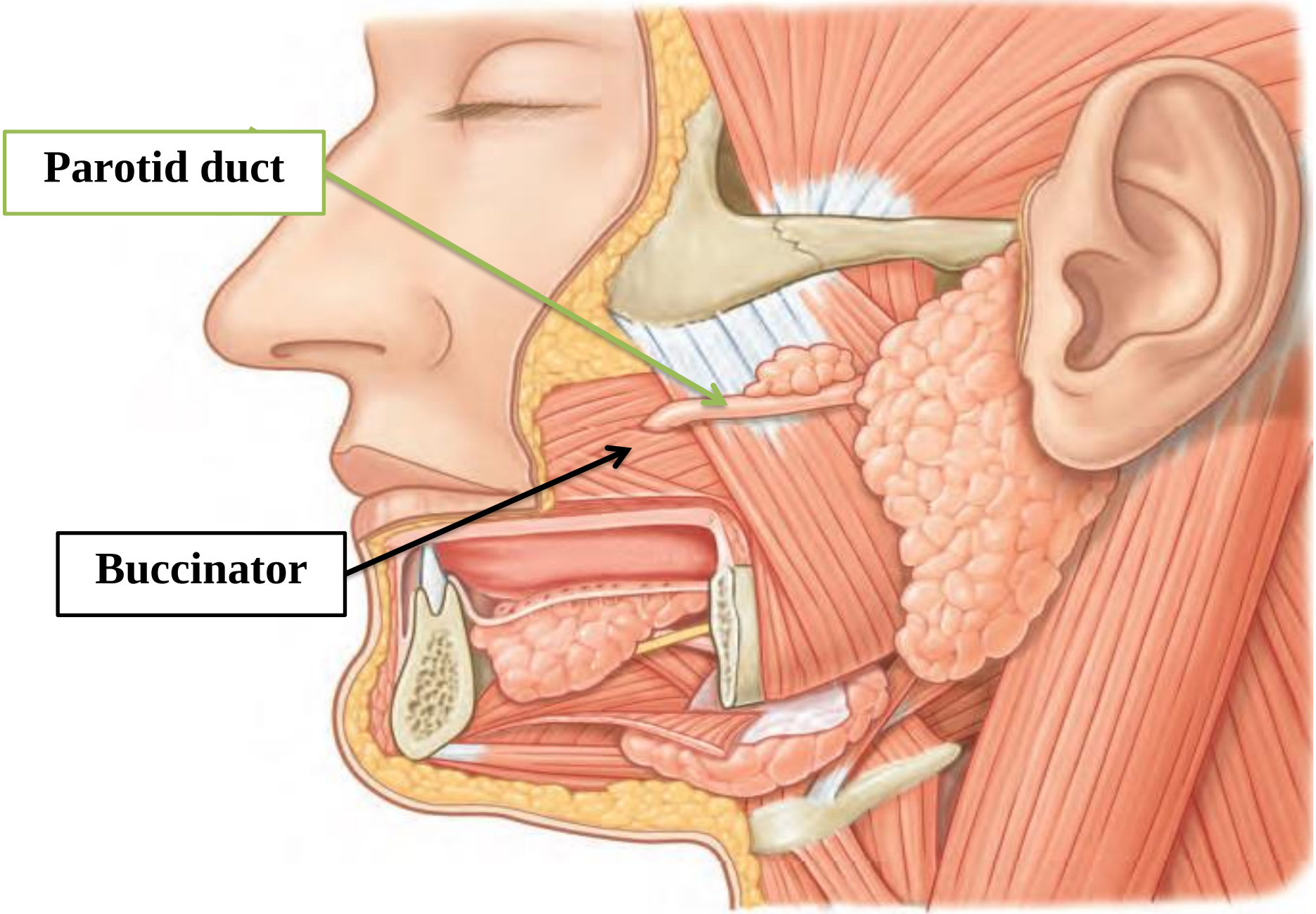
Overlaps the carotid triangle.


Anteromedial surface
Superficial temporal artery
Maxillary artery
Posteromedial surface
External carotid artery
Grooved area adapted to posterior border of ramus of mandible
Retromandibular vein


Apex of the parotid gland
Carotid triangle

Parotid duct

- Is a thick walled tube about 5 cm long.
- It appears at the anterior border of the gland.
- It crosses the masseter as far as the anterior border of this muscle, where it turns inwards, and pierces the buccinator.
- It then opens into the vestibule of the mouth on a small papilla opposite the 2nd upper molar tooth.


Parotid duct
Buccinator

Structure within Parotid Gland

a. The external carotid artery:

- Lies deeper than other.
- It divides within the substance of the gland into superficial temporal and maxillary arteries.

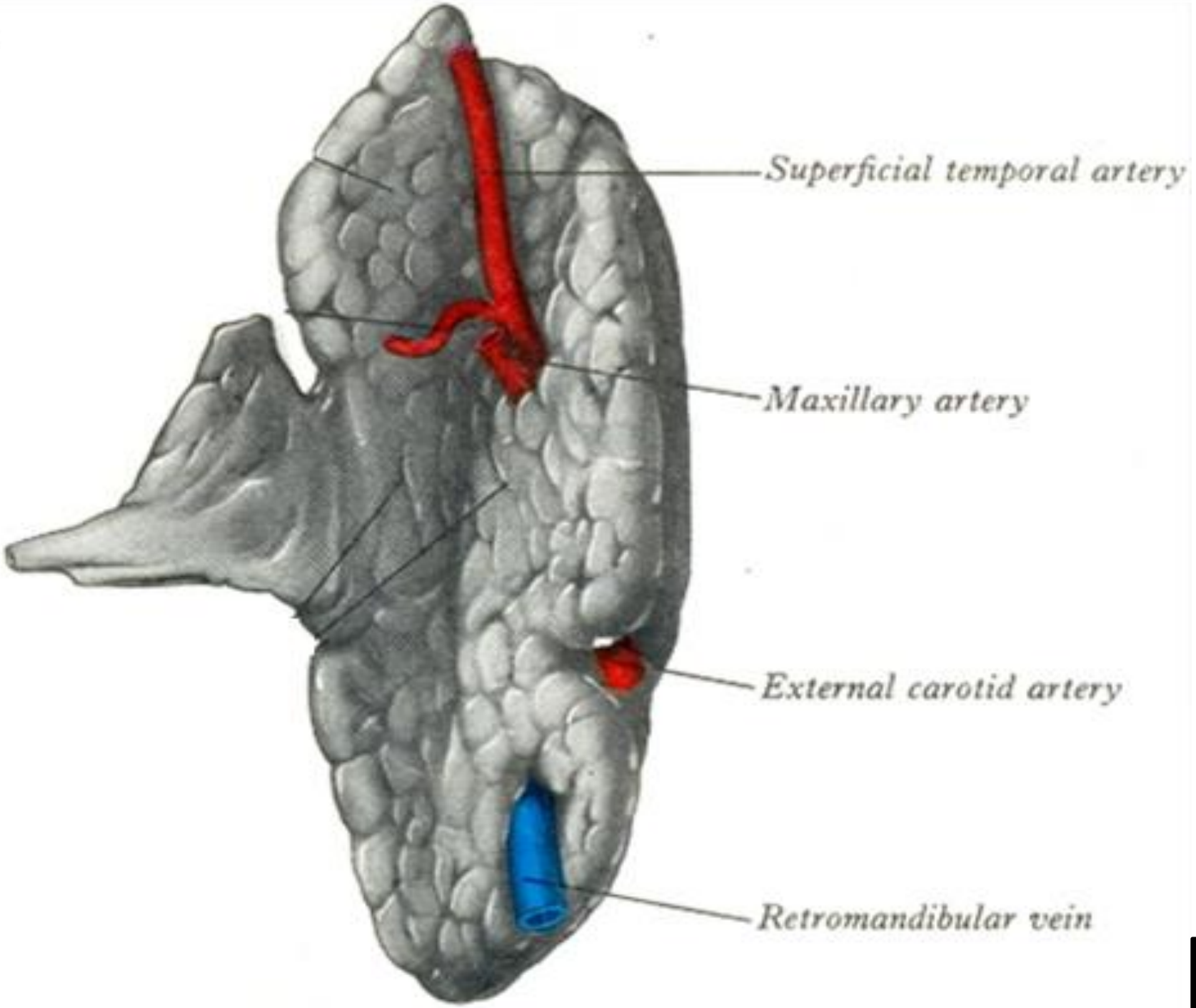
b. The retromandibular vein:

- Lies superficial to external carotid artery.
- Formed by the union of maxillary and superficial temporal veins.

c. The facial nerve:

- On a still more superficial plane the facial nerve traversed the gland.

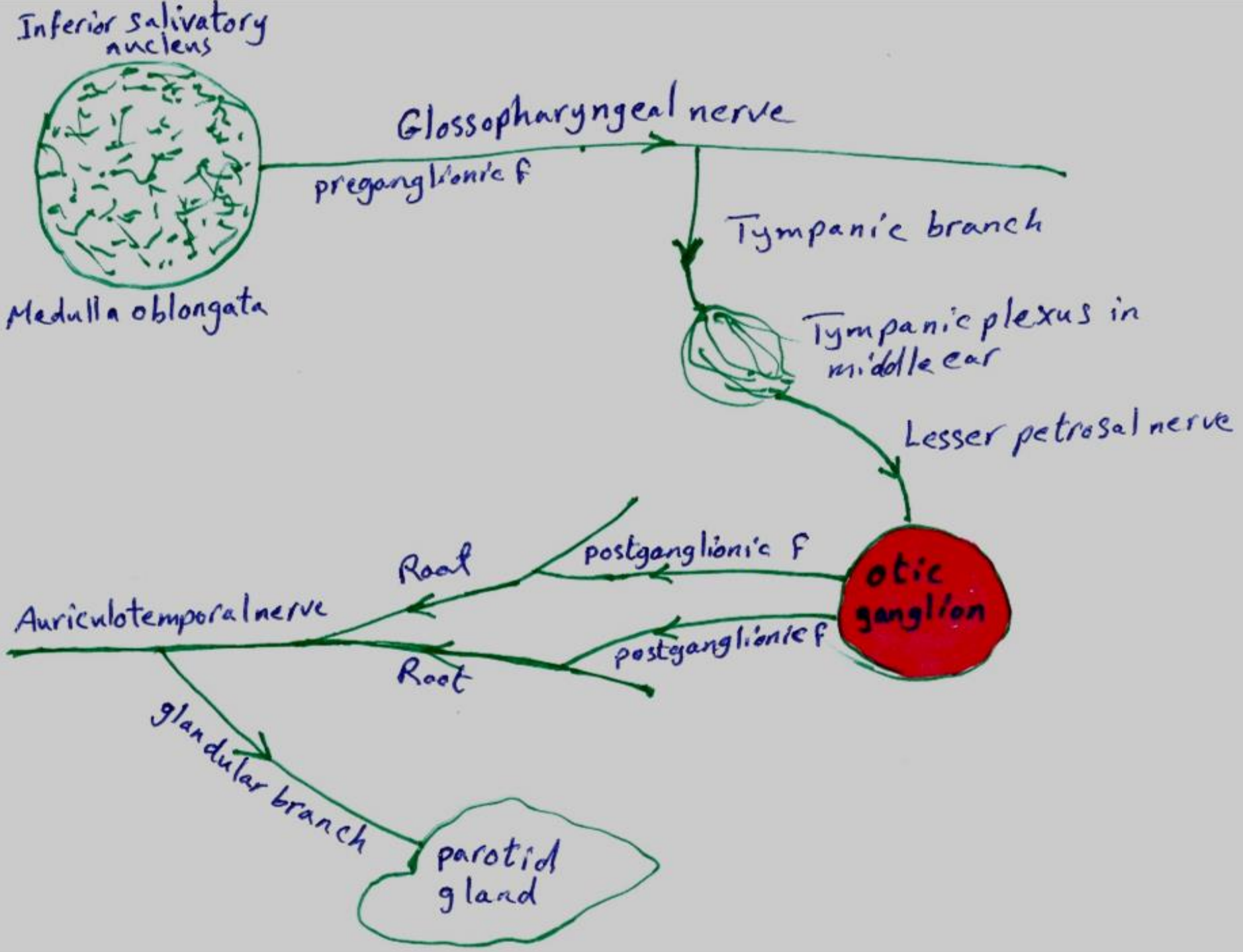
- Within the glands, the nerve divides into its five terminal branches, which leave the gland at its anterior border.


Superficial temporal artery
Maxillary artery
External carotid artery
Retromandibular vein

Nerve Supply

Parasympathetic secretomotor fibers

1. **Preganglionic fibers:** Tympanic branch of glossopharyngeal nerve, which enters the tympanic cavity, breaks up into branches that form the tympanic plexus. From this plexus, the lesser petrosal nerve arise and enters the otic ganglion.
2. Two Postganglionic fibers arise from otic ganglion, each joins the corresponding root of the auriculotemporal nerve.
3. Fibers from the latter nerve pass through ganglionic branches to supply the parotid gland.


Inferior salivatory nucleus
Medulla oblongata
Glossopharyngeal nerve
preganglionic f
Tympanic branch
Tympanic plexus in middle ear
Lesser petrosal nerve
otic ganglion
postganglionic f
Root
Auriculotemporal nerve
postganglionic f
Root
glandular branch
parotid gland

Submandibular Gland

- It is a mixed mucous and serous in type.
- It consists of a large superficial part and a small deep part, which are continuous with one another round the posterior border of the mylohyoid.

Superficial part

Lies in the digastric triangle:

Relations

Anterior relations: Anterior belly of digastric muscle.

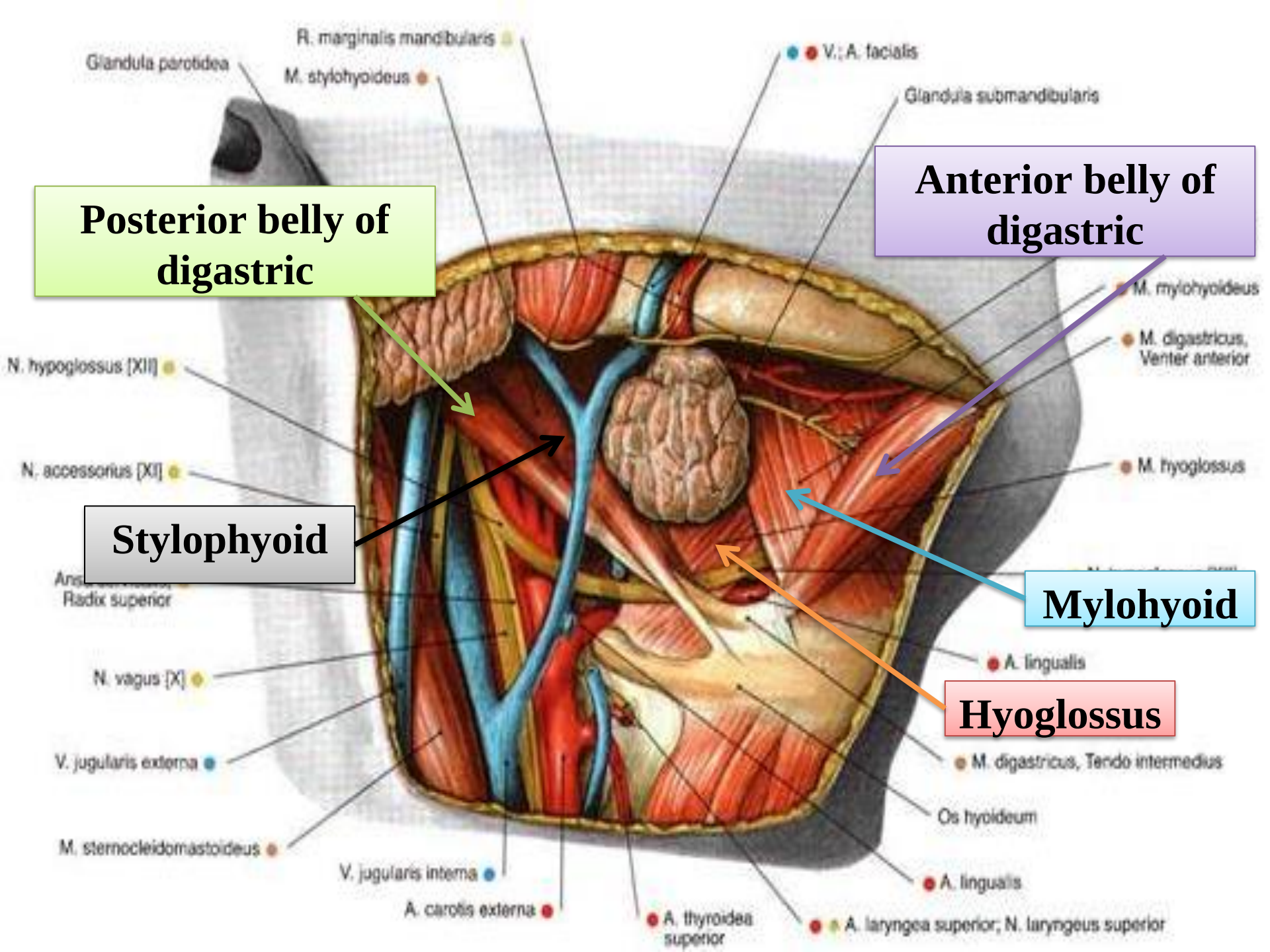
Posterior relations: Posterior belly of digastric and stylohyoid muscles, and parotid gland.

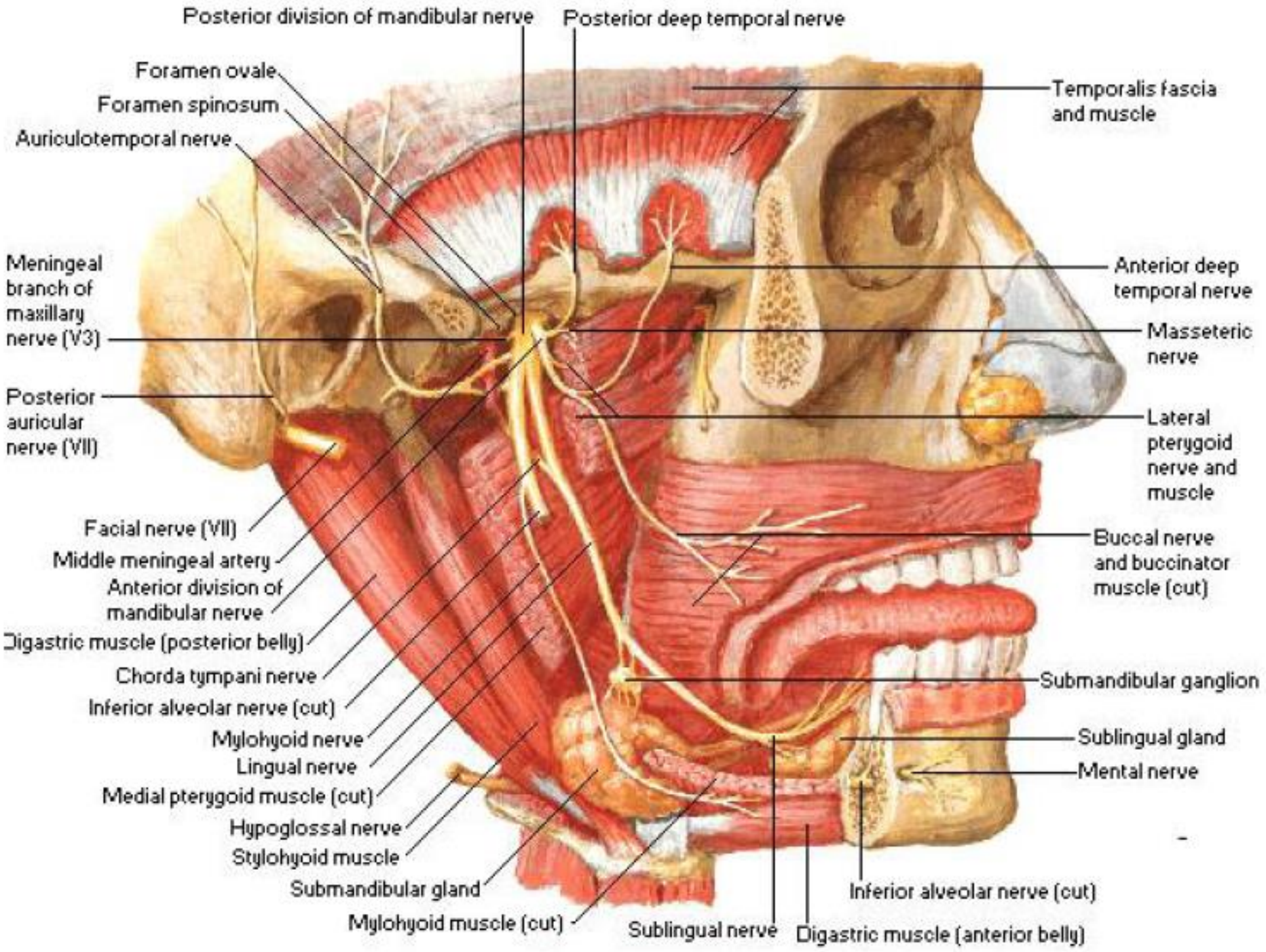
Medial relations: Mylohyoid and hyoglossus muscles, and lingual and hypoglossal nerves.

Lateral relations: It is in contact with the submandibular fossa on the medial aspect of the mandible.

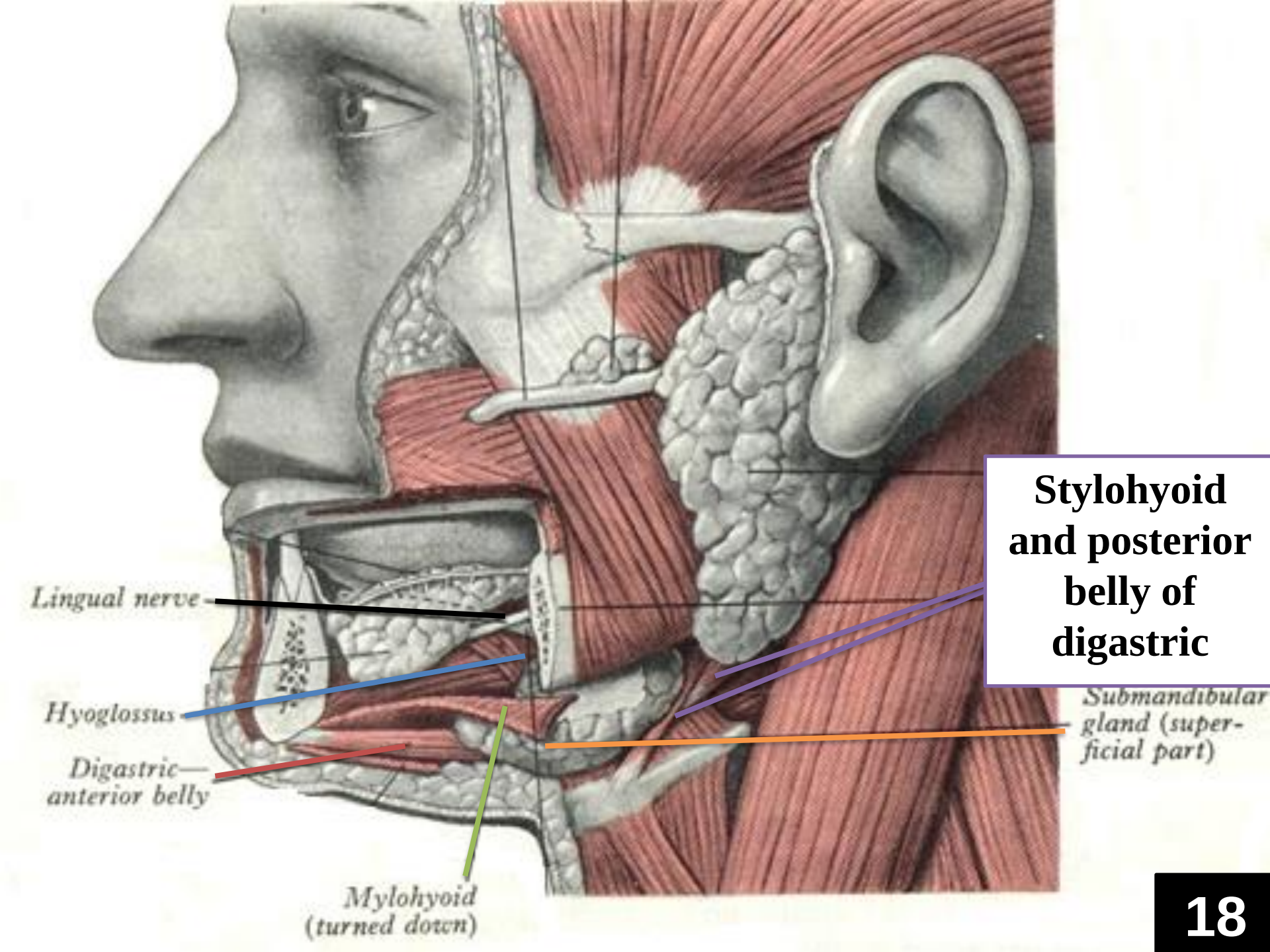
Inferolateral relations:

- It is covered by investing layer of deep cervical fascia, platysma muscle, and skin.


Posterior belly of digastric
Anterior belly of digastric
Stylophyoid
Mylohyoid
Hyoglossus
Glandula parotidea
R. marginalis mandibularis
M. stylohyoideus
V.; A. facialis
Glandula submandibularis
M. mylohyoideus
M. digastricus, Venter anterior
N. hypoglossus [XII]
N. accessorius [XI]
M. hyoglossus
Radix superior
N. vagus [X]
A. lingualis
V. jugularis externa
M. digastricus, Tendo intermedius
Os hyoideum
M. sternocleidomastoideus
V. jugularis interna
A. lingualis
A. carotis externa
A. thyroidea superior
A. laryngea superior; N. laryngeus superior


Posterior division of mandibular nerve
Posterior deep temporal nerve
Foramen ovale
Foramen spinosum
Auriculotemporal nerve
Temporalis fascia and muscle
Meningeal branch of maxillary nerve (V3)
Anterior deep temporal nerve
Masseteric nerve
Posterior auricular nerve (VII)
Lateral pterygoid nerve and muscle
Facial nerve (VII)
Middle meningeal artery
Anterior division of mandibular nerve
Buccal nerve and buccinator muscle (cut)
Digastric muscle (posterior belly)
Chorda tympani nerve
Submandibular ganglion
Inferior alveolar nerve (cut)
Mylohyoid nerve
Sublingual gland
Lingual nerve
Mental nerve
Medial pterygoid muscle (cut)
Hypoglossal nerve
Stylohyoid muscle
Submandibular gland
Inferior alveolar nerve (cut)
Mylohyoid muscle (cut)
Sublingual nerve
Digastric muscle (anterior belly)

- It is crossed by facial vein and cervical branch of facial nerve.
- Also the submandibular lymph nodes.

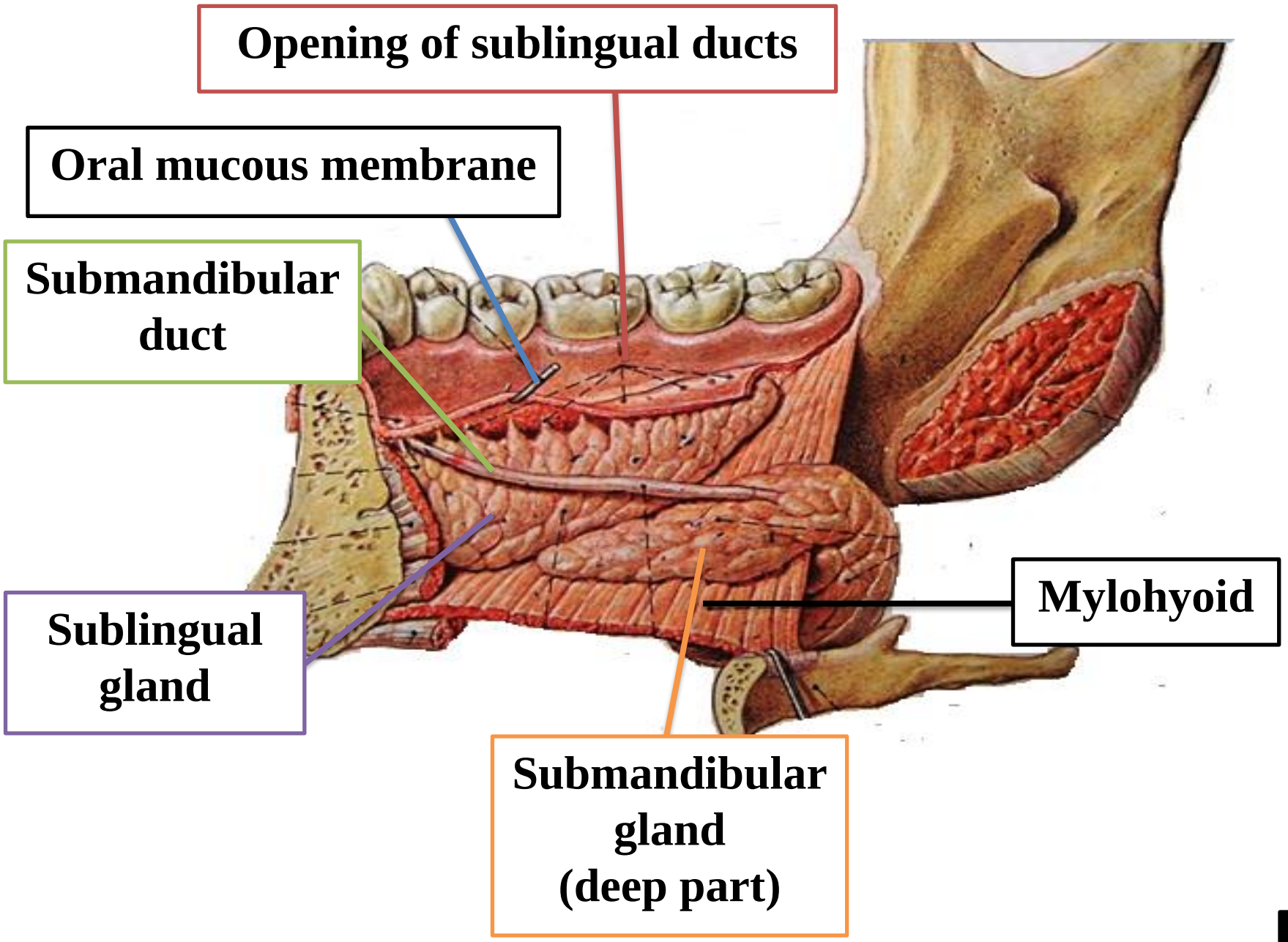


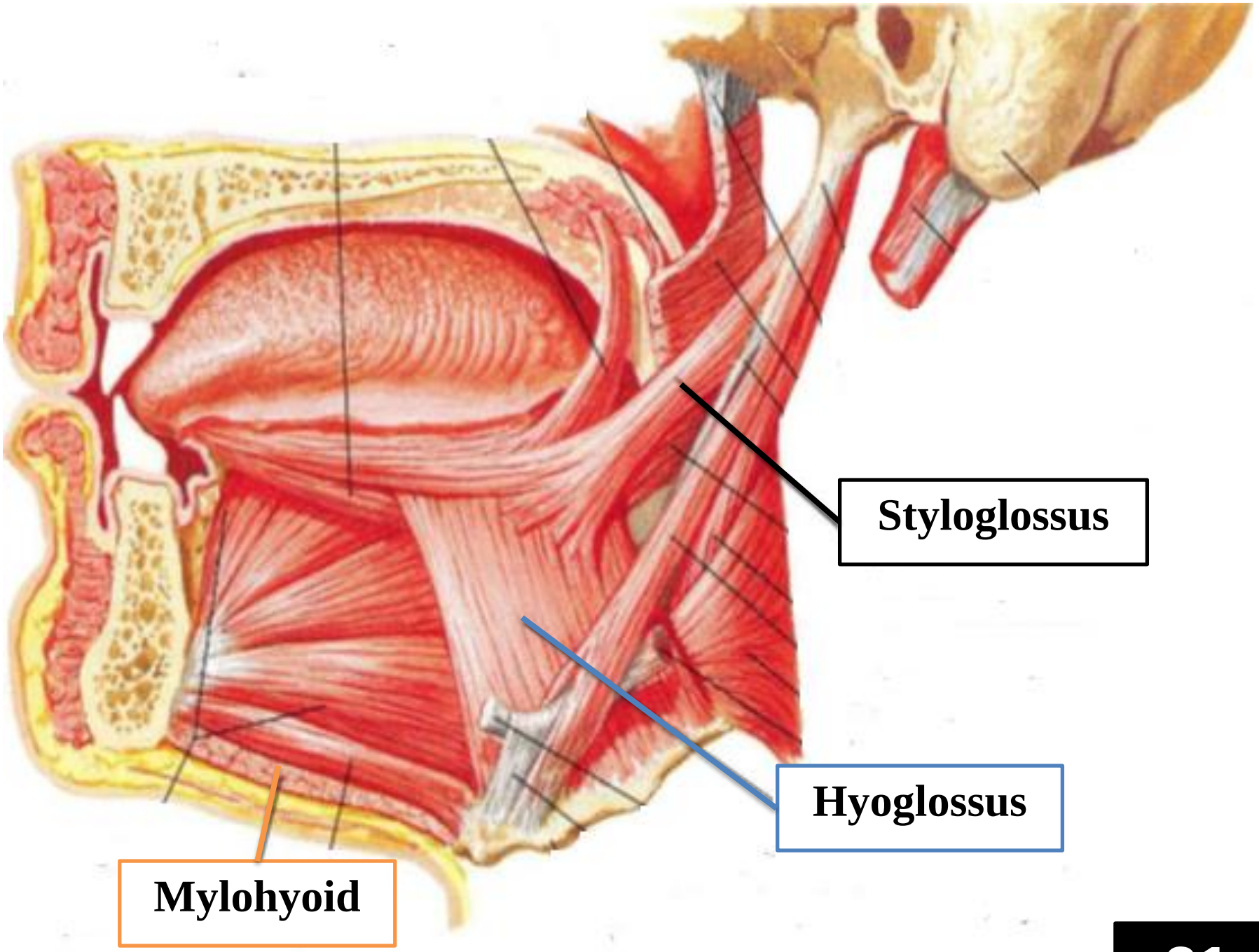
Stylohyoid and posterior belly of digastric

Deep part

- Extends forwards as far as the posterior end of the sublingual gland, between mylohyoid (below and laterally), and hyoglossus and styloglossus (medially) .

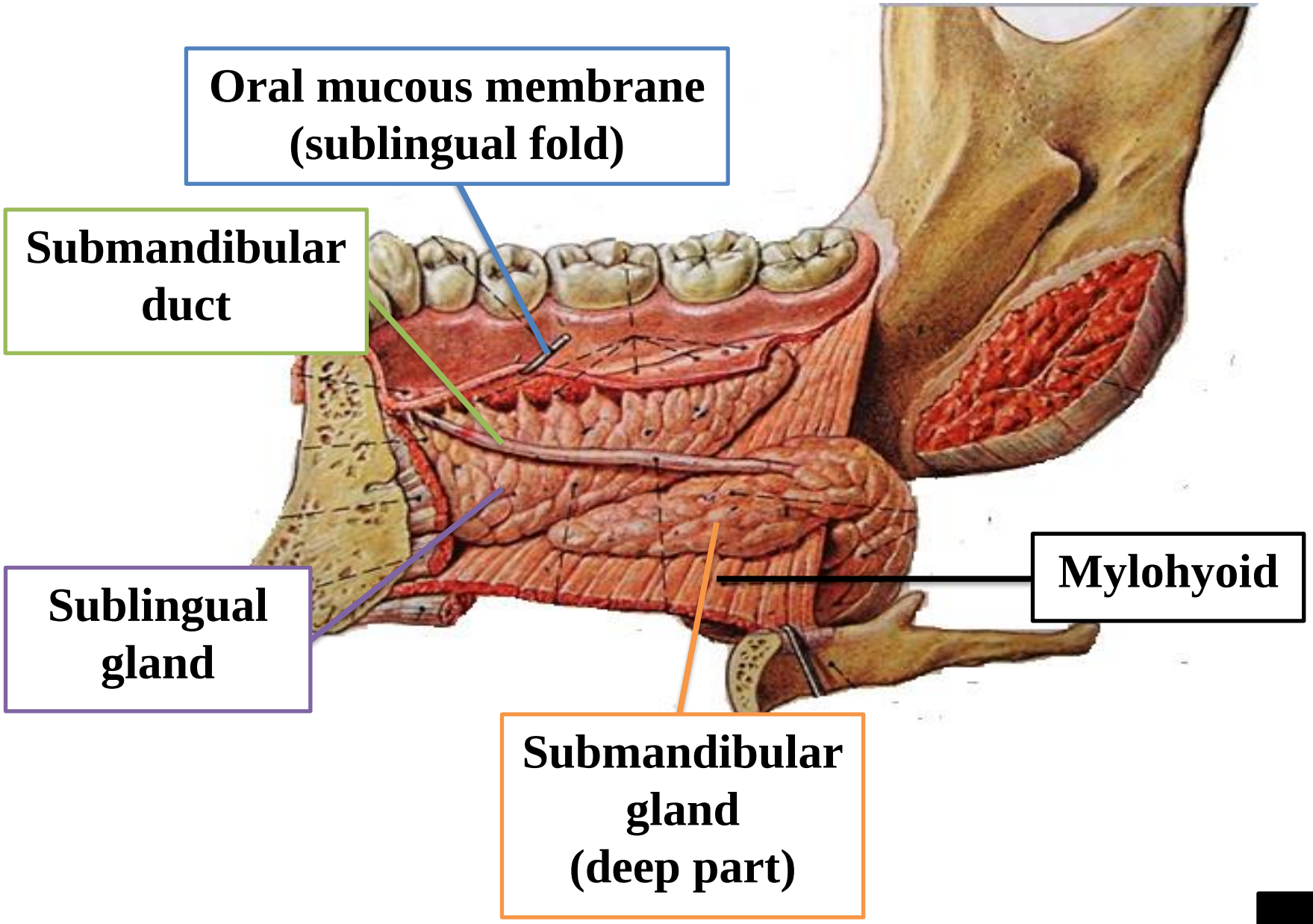
- It is related above to Lingual nerve, and below to hypoglossal nerve.

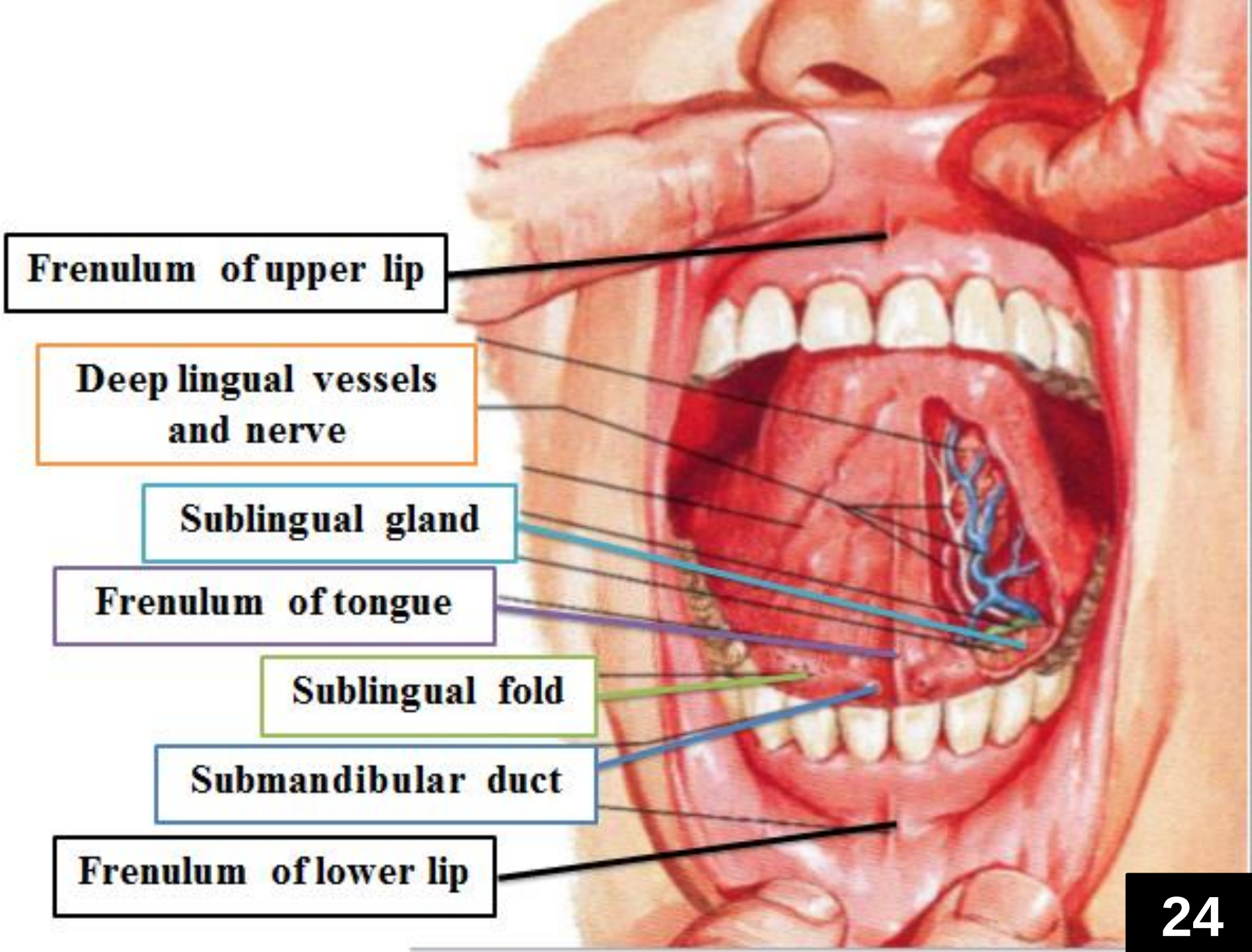

Opening of sublingual ducts
Oral mucous membrane
Submandibular duct
Sublingual gland
Mylohyoid
Submandibular gland (deep part)


Styloglossus
Hyoglossus
Mylohyoid

Submandibular duct

- Is about 5 cm long, emerges from the middle of the medial surface of the deep part of the gland.
- It runs forwards and between the sublingual gland and the genioglossus.
- Opens into floor of mouth on the sublingual papilla, which is situated at the side of the frenulum of tongue.


Oral mucous membrane (sublingual fold)
Submandibular duct
Sublingual gland
Mylohyoid
Submandibular gland (deep part)


Frenulum of upper lip
Deep lingual vessels and nerve
Sublingual gland
Frenulum of tongue
Sublingual fold
Submandibular duct
Frenulum of lower lip

Sublingual Gland

- Is the smallest of the salivary glands.
- It is mixed mucous and serous in type, the former predominating.
- It is almond-shaped, situated beneath the mucous membrane of the floor of mouth, close to the midline.

Relations

Above: to mucous membrane of mouth, which is elevated by the gland to form the sublingual fold.

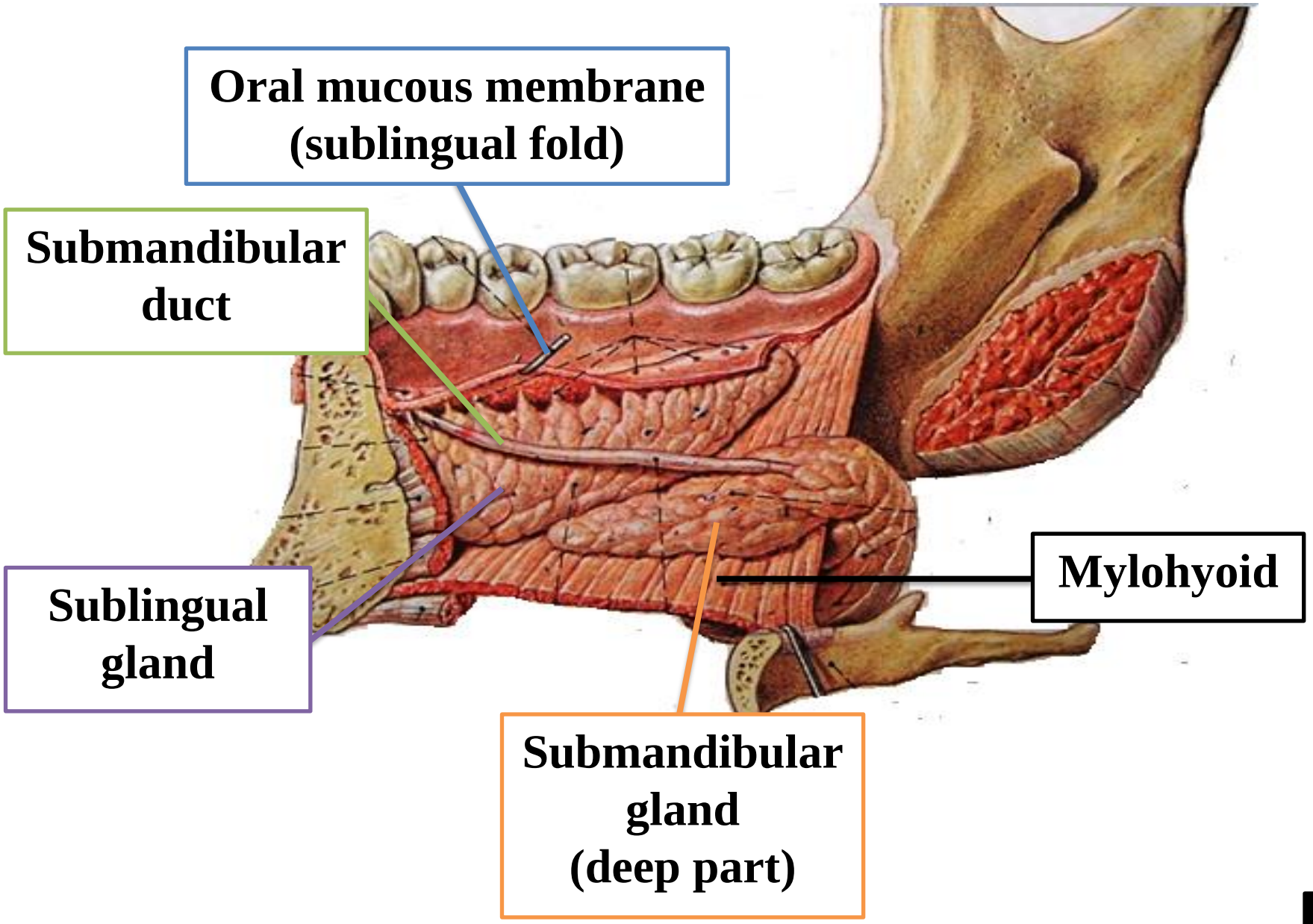
Below: to mylohyoid muscle.

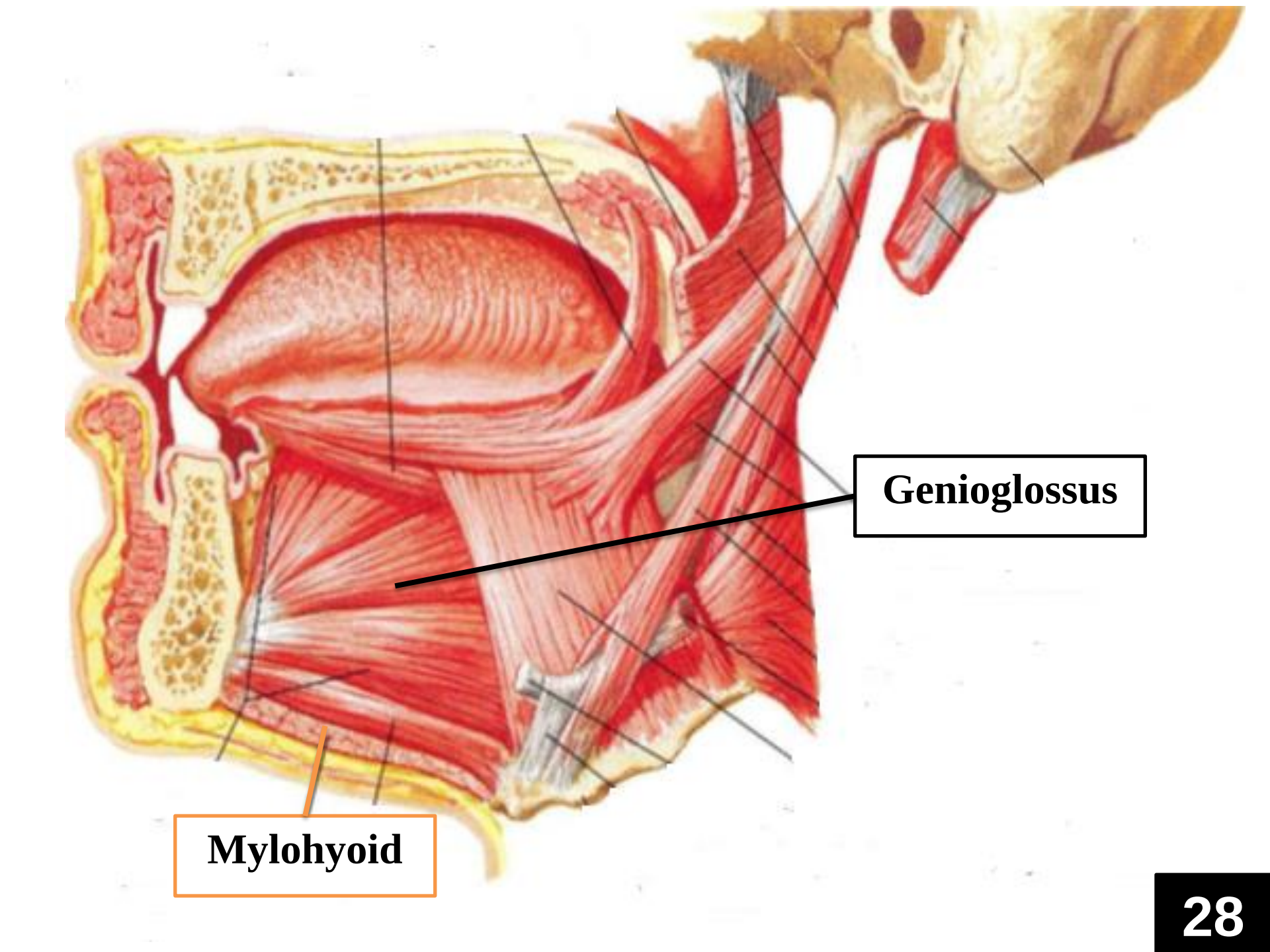
Medially: to genioglossus, lingual nerve, and submandibular duct.

Laterally: to sublingual fossa of mandible.

Anteriorly: to the gland of opposite side.

Posteriorly: to deep part of submandibular gland.


Oral mucous membrane (sublingual fold)
Submandibular duct
Sublingual gland
Mylohyoid
Submandibular gland (deep part)

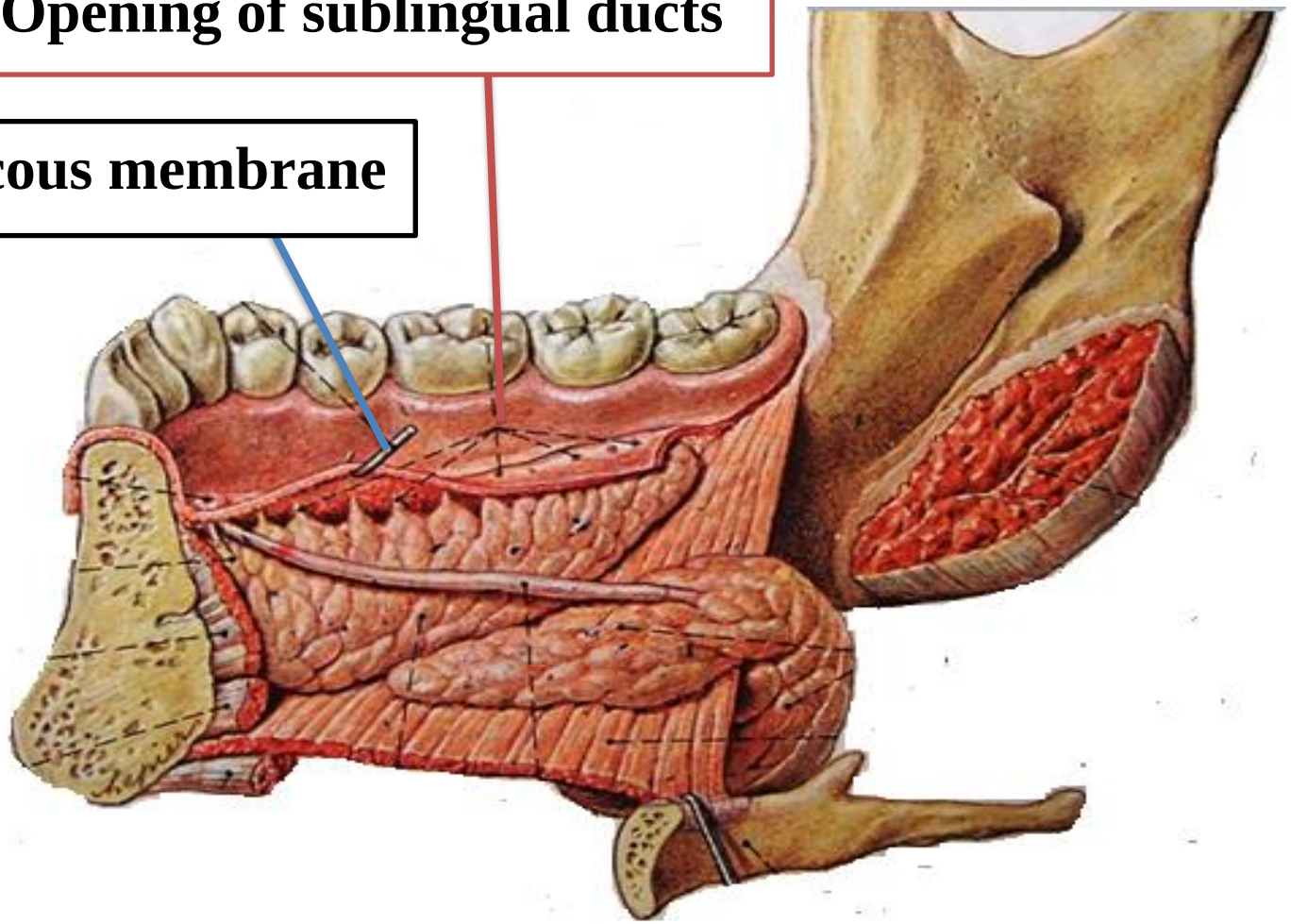

Genioglossus
Mylohyoid

Sublingual ducts

- Are 8 – 20 in number.
- Most open separately on the sublingual fold.
- Few may open directly into the submandibular duct.

Opening of sublingual ducts

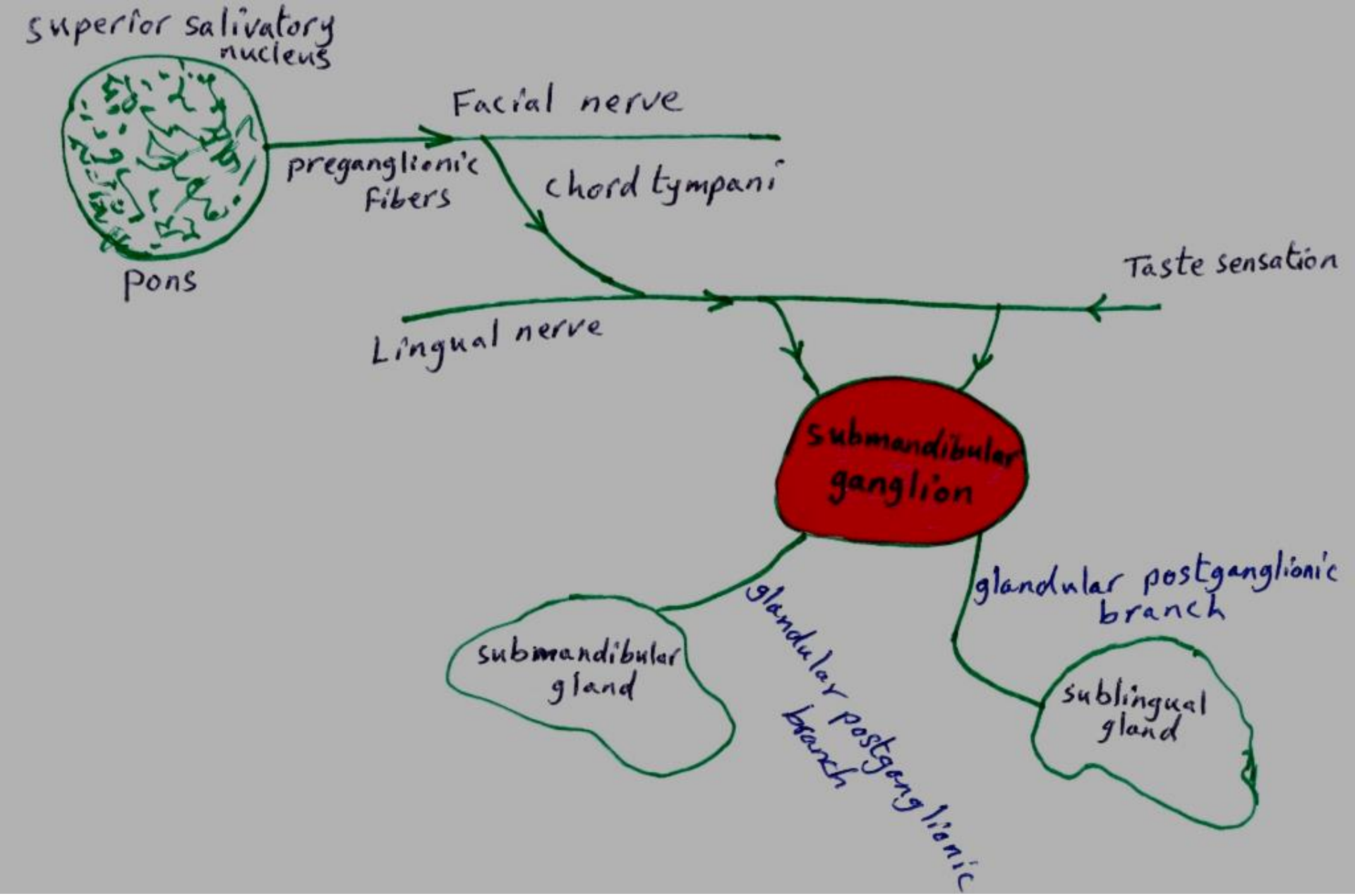
Oral mucous membrane



Nerve Supply of Submandibular and Sublingual Glands

Parasympathetic secretomotor fibers

1. **Preganglionic fibers leave the facial nerve through its chorda tympani nerve, which joins the lingual nerve. Fibers from the latter nerve pass through branches that join the submandibular ganglion.**
2. **Postganglionic fibers leave the ganglion to supply both the submandibular and sublingual glands.**


superior salivatory nucleus
Facial nerve
preganglionic fibers
chord tympani
Pons
Taste sensation
Lingual nerve
submandibular ganglion
glandular postganglionic branch
submandibular gland
glandular postganglionic branch
sublingual gland

Histology of Salivary Glands

- The three major salivary glands (parotid, submandibular, and sublingual), each is surrounded by a fibrous capsule rich in collagene fibers.
- Each salivary glands secrete saliva, which is a complex fluid that has digestive, lubricating, and protective function.

- The parenchyma of the salivary glands consists of a secretory portions and branching duct system arranged in lobules.

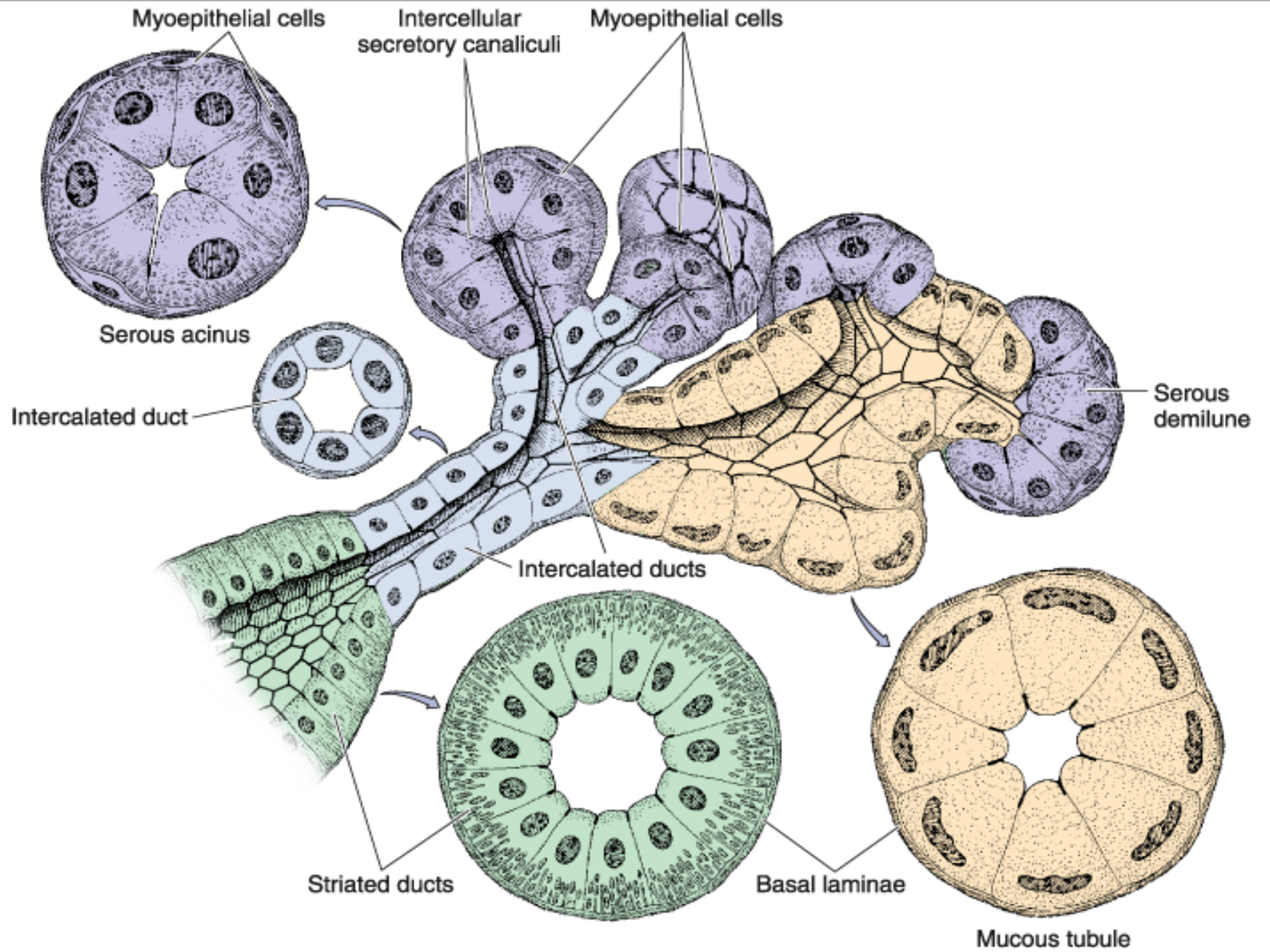
- These ducts conduct saliva secreted by the secretory portion into the oral cavity.

- Each gland consists of Lobules, separated from each other by connective tissue septa originating from the fibrous capsule.

- The secretory portions contain serous and/or mucous cells.

- In human submandibular and sublingual glands, the secretory portion of the glands contains serous and mucous cells.

- Secretory cells form acini.
- Mucous cells form tubules. The end of these tubules is cupped by serous cells, which constitute the serous demilunes.


Myoepithelial cells
Intercellular secretory canaliculi
Myoepithelial cells
Serous acinus
Intercalated duct
Serous demilune
Intercalated ducts
Striated ducts
Basal laminae
Mucous tubule

- In addition to the secretory cells, the secretory portion contains myoepithelial cells.
- The latter cells are found between the basal lamina and the basal surface of the secretory cells, thus they surround the secretory portions.

Myoepithelial cells

- Are found between the basal lamina and the basal surface of the secretory cells, thus they surround the secretory portions, usually 2 – 3 cells per secretory unit.
- They are well developed and branched, and are frequently known as basket cells.
- In the intercalated ducts they lie parallel to the length of the duct.

- Their shapes in these ducts are spindle and present the characteristics of smooth muscle cells, including contractily.
- In addition to the acceleration of the evacuation of the saliva, myoepithelial cells play an important function in prevention of end piece distention during secretion due to the increase in intraluminal pressure.
- The secretory portions empty into short intercalated ducts.

- These ducts are lined by cuboidal epithelial cells, which have the ability to divide and differentiate into secretory or ductal cells.
- Many of these intercalated ducts join to form striated ducts.
- Intercalated ducts and striated ducts are also known as intralobular ducts since they are located within the lobule.
- Striated ducts drain into interlobular or excretory ducts located within the connective tissue septa separating lobules.

- **Proximally, the interlobular ducts are lined by stratified cuboidal epithelium, but more distally the epithelial lining is converted into stratified columnar containing few mucous secretory cells.**

- **The main duct of each salivary gland opens into the oral cavity and is lined by nonkeratinized stratified squamous epithelium.**

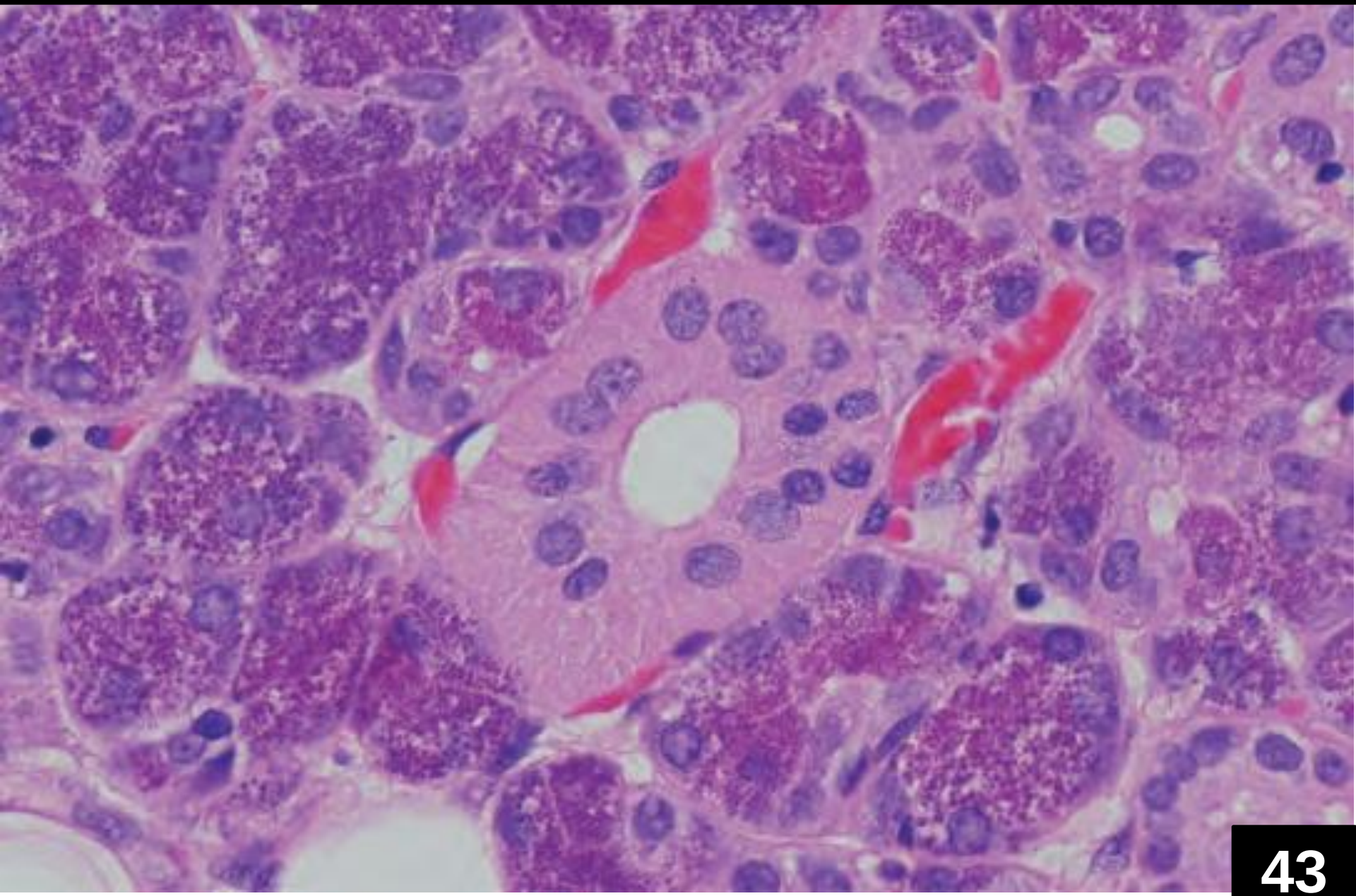
Parotid Gland

- It is a branched acinar gland.
- Its excretory portion is composed exclusively of serous cells.
- Serous cells contain secretory granules that are rich in protein and have a high amylase activity.
- This activity is responsible for hydrolysis of most of the ingested carbohydrates.

- The digestion begins in the mouth and continues for a short time in the stomach, before the gastric juice acidifies the food and thus decreases amylase activity considerably.
- As in other large salivary glands, the connective tissue contains many plasma cells and lymphocytes.
- The plasma cells secrete IgA, which form a complex with a secretory component synthesized by the serous acinar, intercalated duct, and striated duct cells.

- The IgA rich secretory complex release into the saliva is resistant to enzymatic digestion and constitutes an immunological defense mechanism against pathogens in the oral cavity.

Parotid Gland



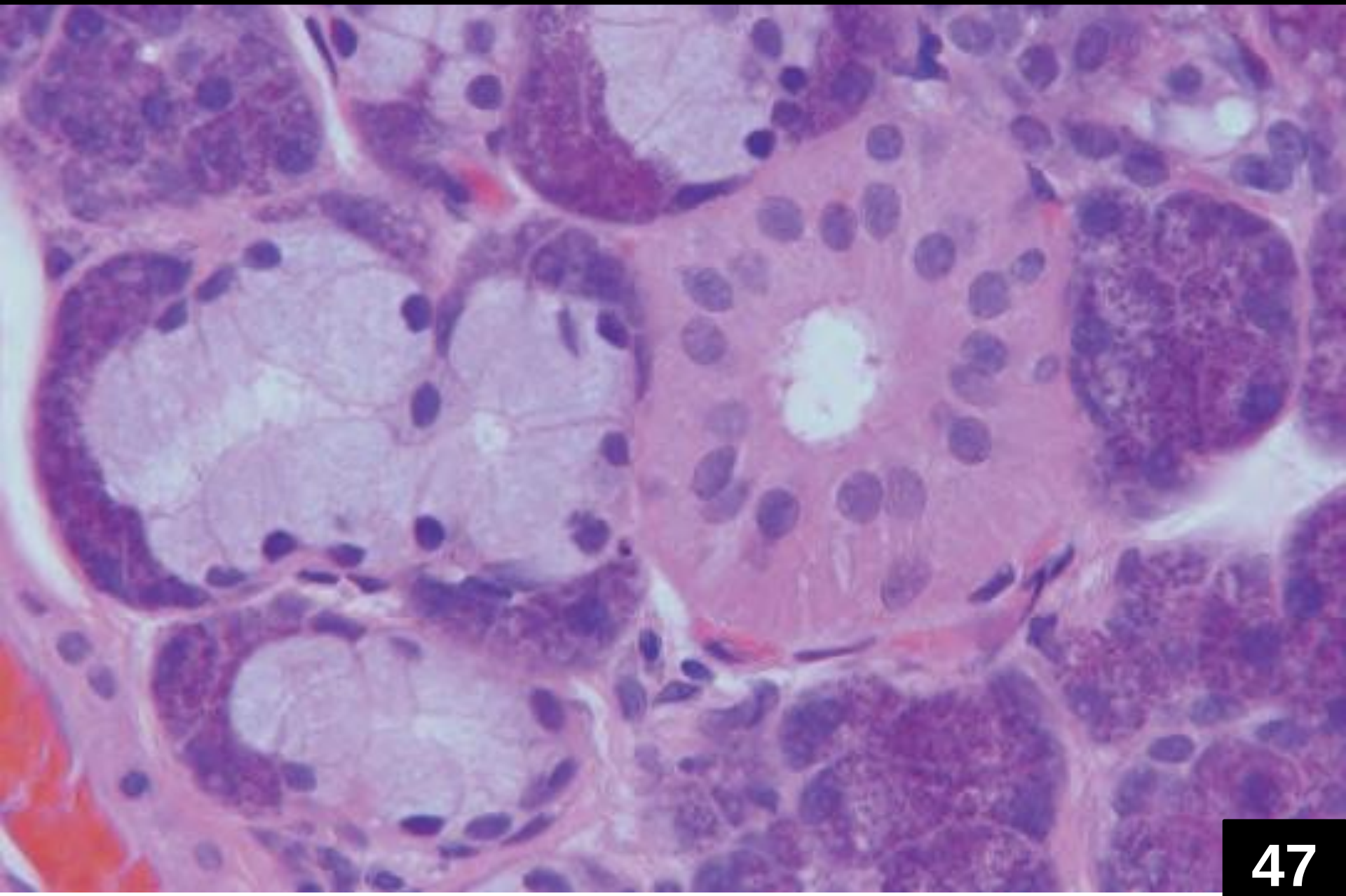
Submandibular Gland

- It is a branched tubuloacinar gland.
- Its secretory portion contains both mucous and serous cells.
- The serous cells are the main component of this gland.
- Serous cells are responsible for the weak amylolytic activity present in this gland and its saliva.

- Mucous cells contain glycoproteins (most of which are called mucins) important for the moistening and lubricating functions of the saliva.
- Mucous cells are most often organized as tubules.
- The cells that form the serous demilunes in the submandibular gland secrete the lysozyme, whose main activity is to hydrolyze the walls of certain bacteria.

- Some acinar and intercalated duct cells in large salivary glands also secrete lactoferrin, which binds iron, a nutrient necessary for bacterial growth.

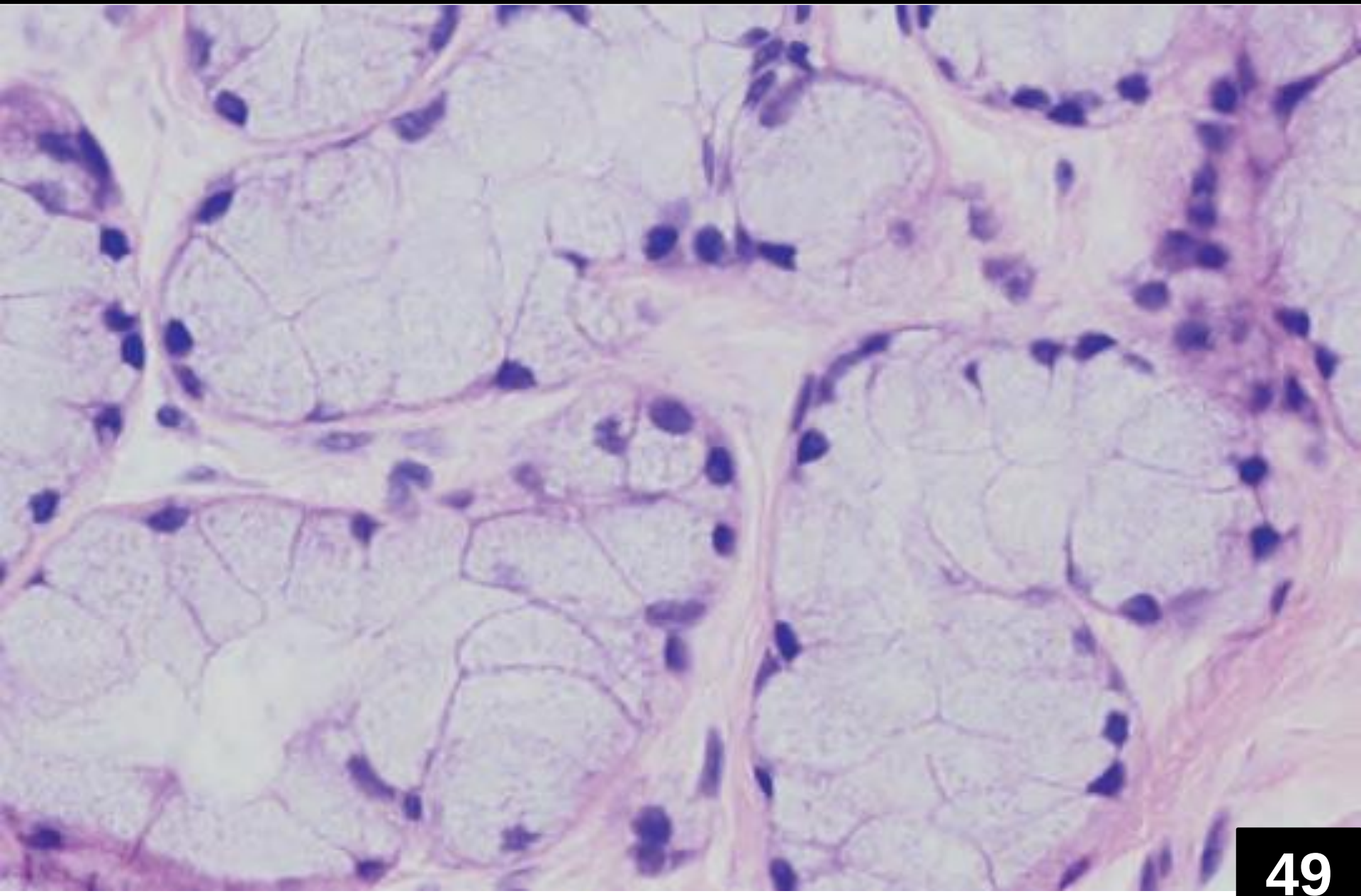
Submandibular Gland

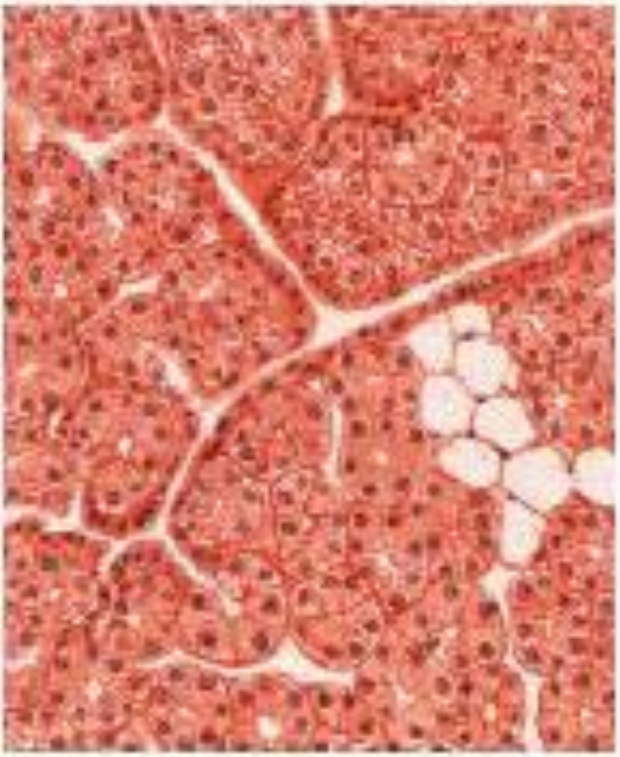


Sublingual Gland

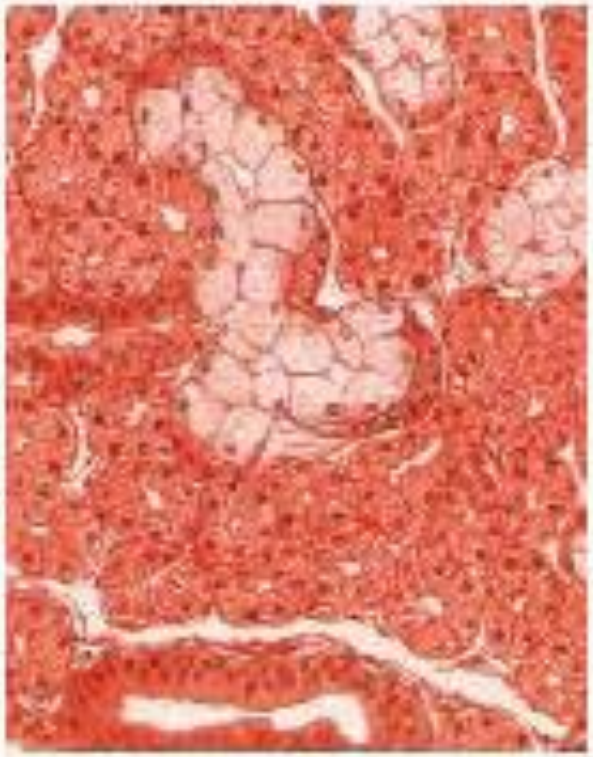
- Like the submandibular gland, it is a branched tubuloacinar gland formed of serous and mucous cells.
- Mucous cells predominate in this gland.
- As in the submandibular gland, cells that form the serous demlunes in this gland secrete lysozyme.

Sublingual Gland





Parotid gland: totally serous



Submandibular gland: mostly serous, partially mucous

Sublingual gland: almost completely mucous