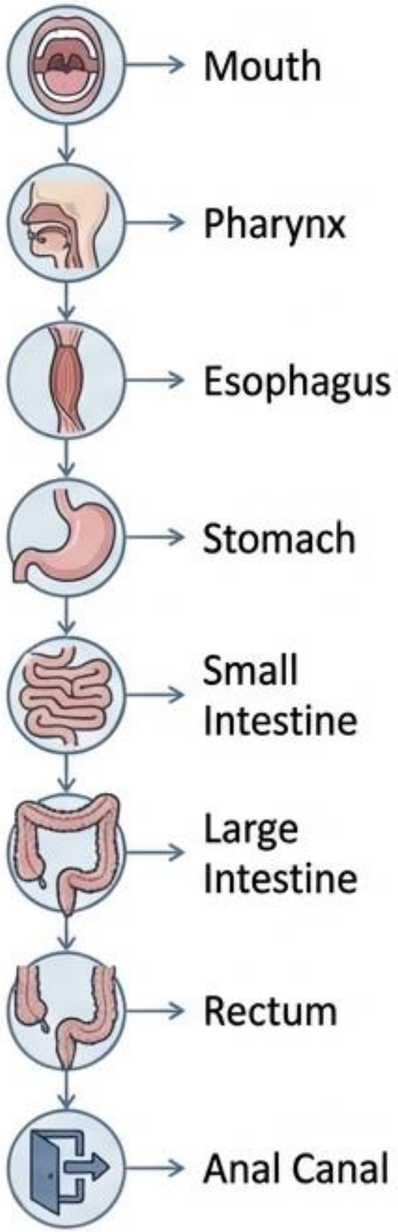
L (1) - The digestive system in the head and neck. 1

The Anatomical Atlas Dashboard



1- INTRODUCTION – GI Divisions

The digestive system is divided into three parts:

1- Head and Neck region: mouth, salivary gland, pharynx, palate & tongue.

2- Abdominal part (Alimentary Canal /Digestive Tube):

A tube that starts at the **oral cavity and ends at the anal canal.**

- mouth (oral cavity)
- pharynx
- esophagus
- stomach
- small intestine
- large intestine
- rectum
- anal canal

3- Accessory (Associated) Organs:

1- salivary glands
2- gallbladder
3- liver
4- pancreas
5- spleen

all of them has a duct that opens into the alimentary tract. 2

2- INTRODUCTION – GI Function

Functions of the Gastrointestinal (GI) System:

1. **Digestion:** breakdown of complex food substances into simple absorbable forms. **[polymers into monomers]**
   - ➢ e.g.,: Carbohydrates → Glucose,
     Fats → Fatty acids,
     Proteins → Amino acids.
2. **Absorption:** transfer of digested nutrients into the bloodstream. Nutrients include glucose, amino acids, fatty acids, vitamins, and other small molecules are transported to the liver via the ***portal circulation.**

Role of the Liver (The Central Metabolic Organ)

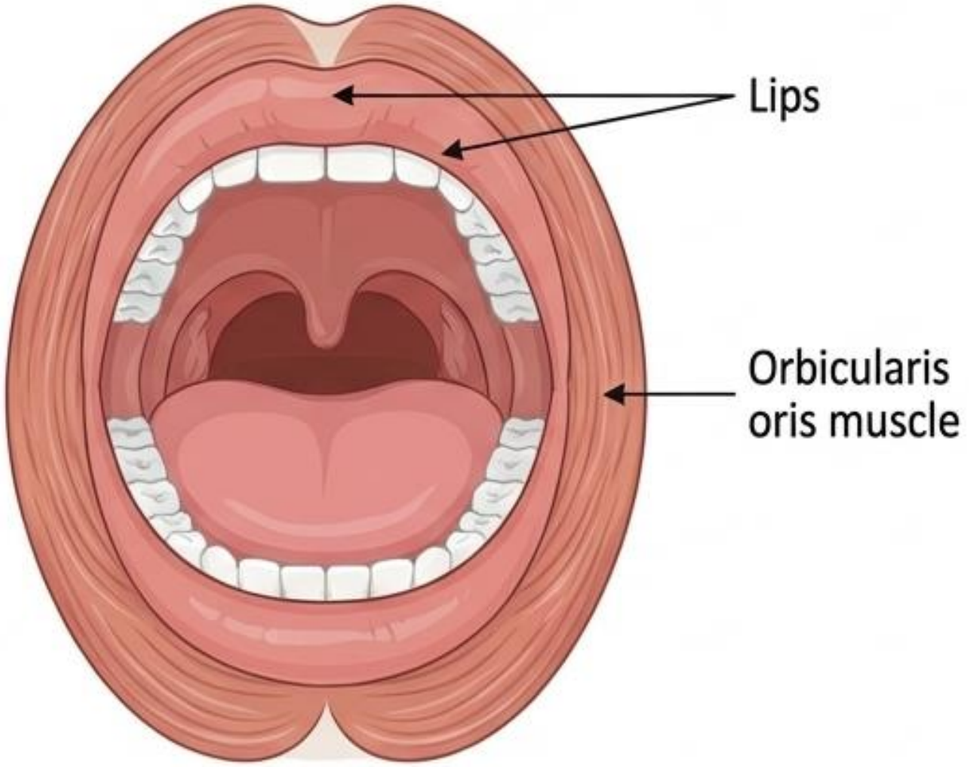
The liver is the most important organ in the abdomen due to its vital functions:

1. **Metabolism** of absorbed nutrients.
2. **Synthesis:** Produces bile and bile salts (important for fat digestion and absorption). & essential enzymes and hormones, including those for blood coagulation.
3. **Detoxification:** Detoxifies drugs & harmful byproducts from digestion. Waste is drained into the *hepatic vein → inferior vena cava → heart for oxygenation.
4. **Storage:** Stores glycogen, a form of glucose. When energy is needed, glycogen is broken down into glucose and released into the bloodstream. 3

3- The Mouth (Oral Cavity) - Anterior opening

The mouth (oral cavity) has two openings:

* **Anterior opening**: Between the upper and lower lips, bounded by the orbicularis oris muscle.
* **Posterior opening**: The oropharyngeal isthmus or fauces, which leads into the pharynx (oropharynx).
* **Slide 81- Lips**
* The **lips** are two fleshy folds surrounding the oral orifice.
* Externally covered by skin, internally lined with mucous membrane.
* Essential for speech articulation, especially bilabial sounds like "p" and "m".
* Additional muscles radiate from the lips into the face.
* Contains labial blood vessels, nerves, connective tissue, and many small salivary glands.



⚠ Clinical Warning

2- Orbicularis oris muscle

* A circular striated muscle that acts as a sphincter, allowing actions like closing the mouth & whistling.
* Supplied by the facial nerve. Thus, ⚠ Injury to the facial nerve results in:
  1- Inability to whistle (due to paralysis of orbicularis oris).
  2- Flattened buccinator muscle, making it hard to blow (not functional anymore).
  3- Drooling of saliva at the angle of the mouth during chewing due to lack of lip control.

Embryology Zone

3- The Mouth (Oral Cavity)

➢ **Relate to EMBRYOLOGY**

* The **upper lip** forms from: the fusion of First maxillary prominence and the medial nasal prominence.
* Fusion occurs at the junction between the lateral 2/3 and medial 1/3 of the lip.
* ⚠ In **cleft lip,** the fusion is incomplete → leads to a gap in the fusion site (unilateral or bilateral).

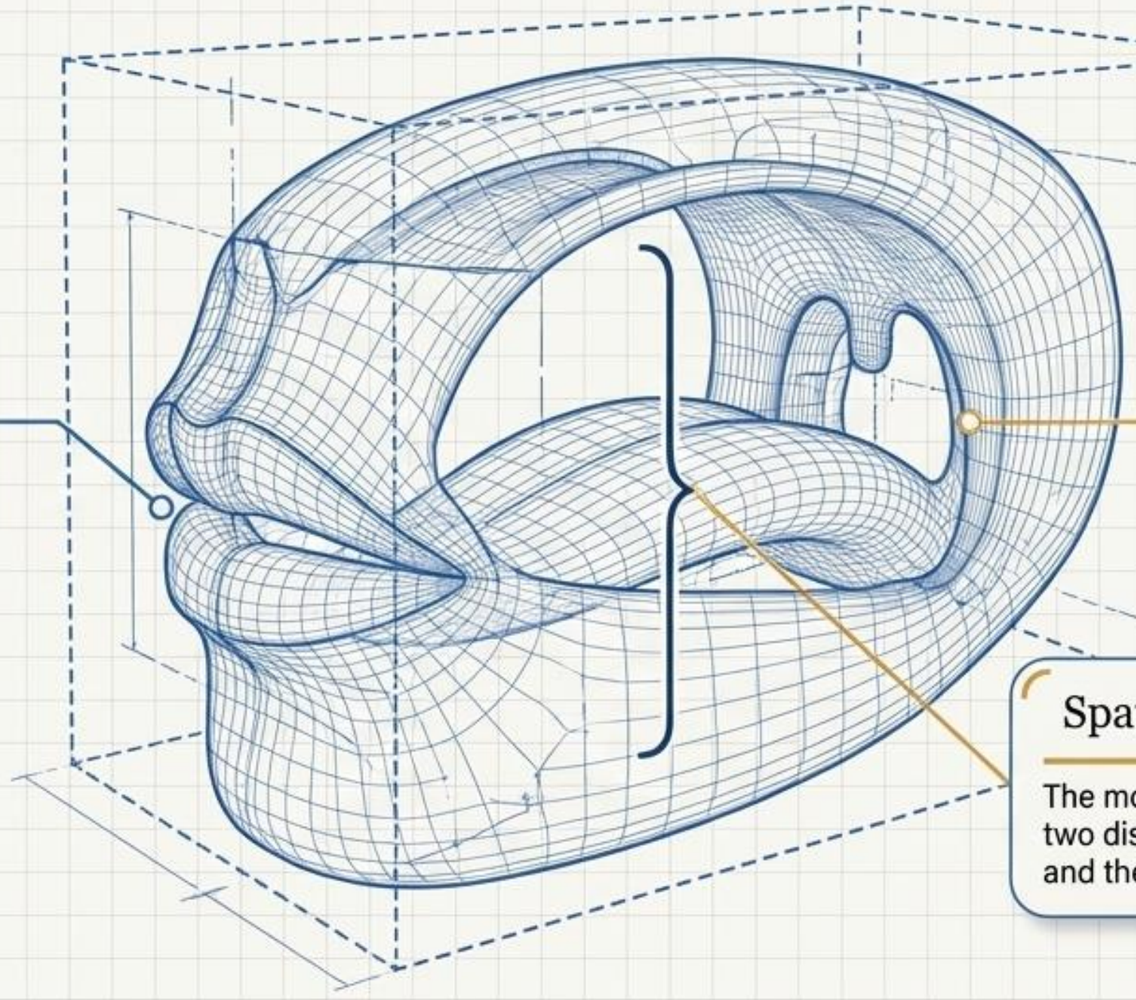
M	1	3
L	2	3

- **The philtrum**: is a shallow vertical groove in the midline of the upper lip. Formed by the fusion of the right and left medial nasal prominences on the outer surface of the upper lip.

- **Superior and Inferior Labial frenulae**: are mucosal folds that connect the inner surface of the upper/lower lips to the gums.

Bounding Boundaries: The Oral Architecture

The mouth is a bounded physical space with distinct anterior and posterior gates.



Anterior Gate
(The Lips)

Bounded by the orbicularis oris muscle.

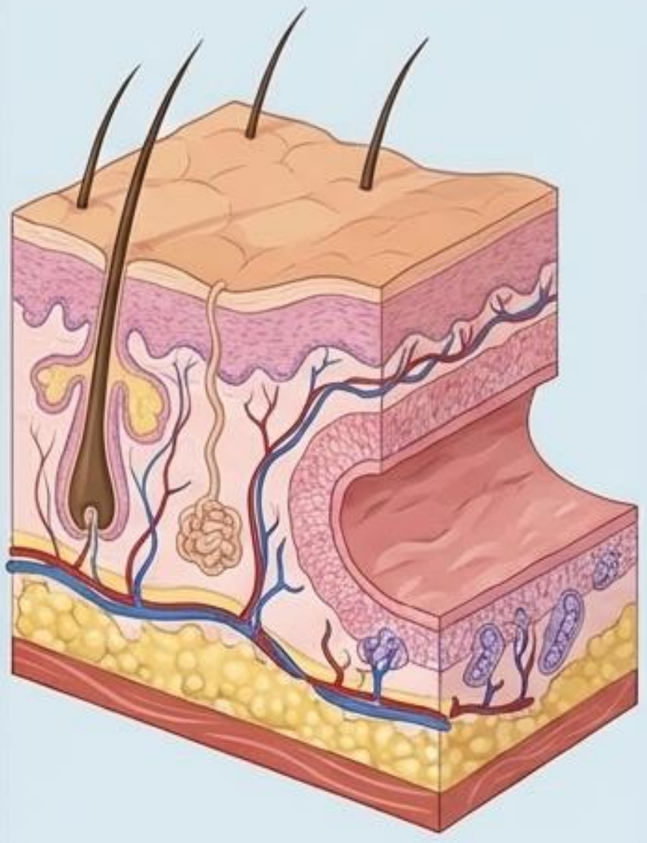
Posterior Gate
(Oropharyngeal Isthmus / Fauces)

The transition zone leading into the oropharynx.

Spatial Sub-Divisions

The mouth itself is divided into two distinct zones: the Vestibule and the Mouth Cavity Proper.

Histology Zone



3- The Mouth (Oral Cavity)

➢ **Relate to HISTOLOGY**

The Lip Consists of Three Main Zones:

1- Cutaneous (Outer) Zone

* Composed of keratinized stratified squamous epithelium (true skin).
* Contains hair follicles, sebaceous glands, and sweat glands.
* Hair is more prominent in males.

2- Mucosal (Inner) Zone

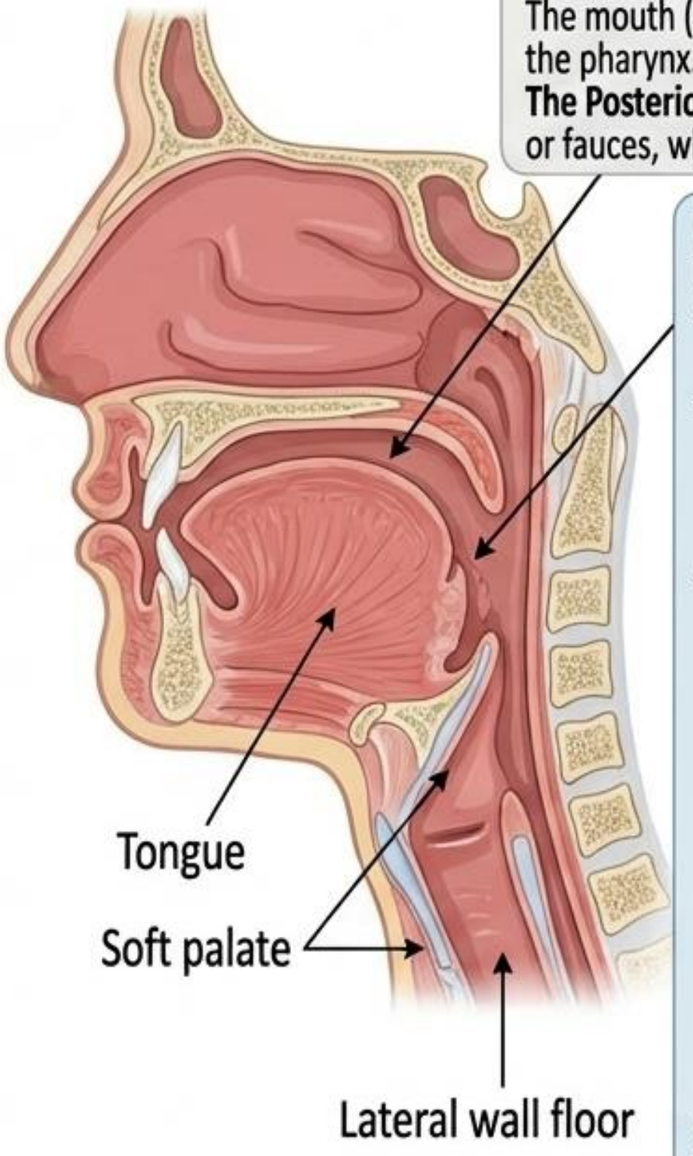
* Lined with non-keratinized stratified squamous epithelium.
* Contains **labial glands,** embedded within the mucosa and covered by the mucosal lining.

3- Red Zone (Vermilion or Transitional Zone)

* A type of modified skin (stratified squamous epithelium).
* Modified? since it **Lacks** hair follicles, sebaceous glands, and sweat glands.
* Appears **red** due to rich vascularity (blood vessels close to the surface).
* **Highly sensitive** due to the abundant nerve terminals.

4- The Mouth Cavity – posterior opening

The mouth (oral cavity) extends from the lips to the pharynx. = two openings.
The Posterior opening: The oropharyngeal isthmus or fauces, which leads into the pharynx



Boundaries of the Oropharyngeal Isthmus:

- **Roof:** Formed by the soft palate and the uvula.
- **Floor:** Formed by the posterior third of the tongue, which contains lymphoid tissue known as the lingual tonsil (named due to its shape).
- **Lateral Walls:** Contain the palatine tonsils, which are commonly inflamed in children 😟 (tonsillitis) due to their role in filtering bacteria, viruses, and foreign bodies. These tonsils lie in a tonsillar fossa between two mucosal folds.

Roof Lateral wall

Anterior fold: The palatoglossal fold, containing the palatoglossus muscle.

Posterior fold: The palatopharyngeal fold, containing the palatopharyngeus muscle

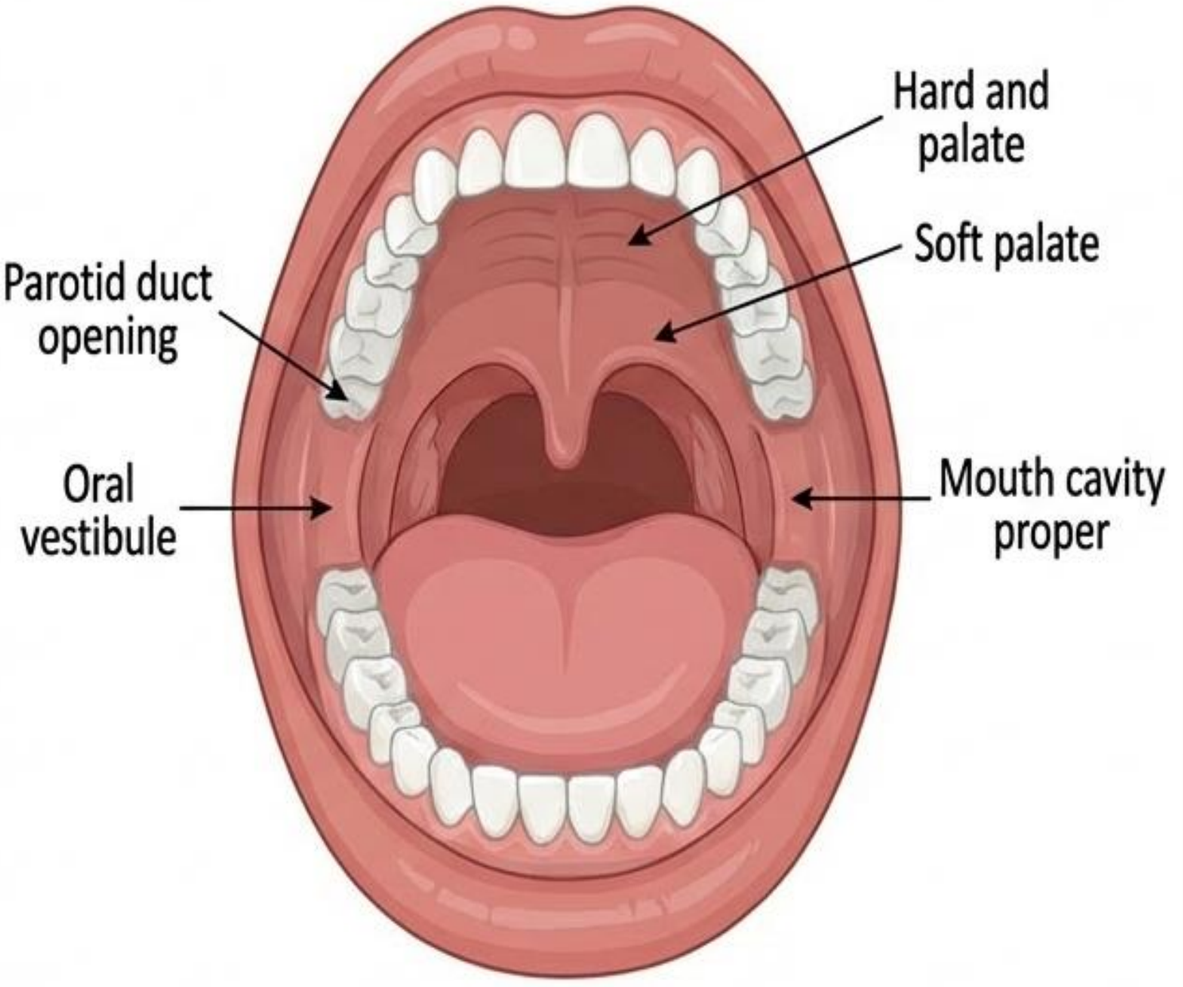
مضيق= Isthmus that separates oral cavity from pharynx

5- Mouth divisions

The mouth is divided into the vestibule and the mouth cavity proper.

Vestibule > Space outside the closed teeth

- Slit-like space located between:
  * **Anteriorly**: between the lips
  * **Laterally/ externally** : bordered by the cheeks
  * **Medially/ internally** : bordered by the gums and teeth
- **Function:**
  1- The parotid duct opens on a small papilla in the vestibule opposite the upper second molar tooth, Saliva secreted here enters the oral vestibule, then passes into the mouth proper behind the last molar.
  2- It communicates with the exterior through the oral fissure (the gap between the lips). When the jaws are closed, it still communicates with the mouth proper behind the third molar tooth on each side. **Oral fissure** mouth cavity proper. vestibule Opposite to 2nd



5- Mouth divisions

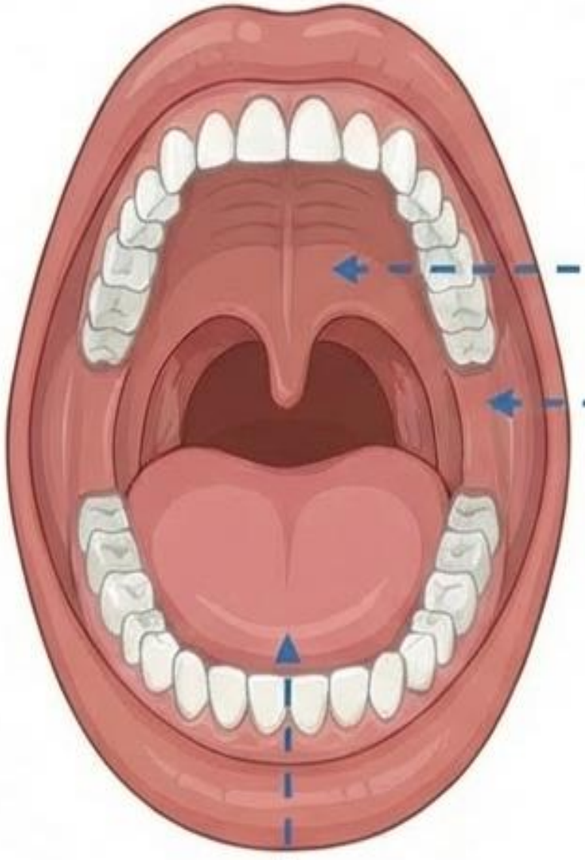
mouth cavity proper > cavity inside closed teeth

The mouth proper has a roof and a floor.

* The **roof** of the mouth is formed by the hard palate in front and the soft palate behind. bony Muscular
* The **floor** is formed largely by the anterior two thirds of the tongue
* The lateral side is formed by closed teeth.

- There are two types of mucous membranes based on their underlying connective tissue:
  1- Soft and Elastic (CT) Mucosa: Found in: Floor of the mouth & Underside of the tongue.
  2- Dense (CT) Mucosa: Found in: Hard palate, gums (gingiva), surrounding the teeth
- **Mouth blood supply:** branch of facial artery & branch of lingual Artery.

6- Sensory Innervation of the Mouth



Roof of the Mouth (Hard Palate)
- Greater palatine nerve
- Nasopalatine nerve

(Both are branches of the **maxillary** division of the trigeminal nerve - CN V2)

Cheek Sensory (Outer Surface (Skin) and Inner Mucosa)
- Buccal nerve (Sensory branch of the mandibular division of the trigeminal nerve - CN V3)

Motor (Buccinator muscle)
- Buccal branch of the facial nerve

Floor of the Mouth: General Sensation (touch, temperature, pain)
- Lingual nerve (Branch of the mandibular division of the trigeminal nerve - CN V3)

Special Sensation (Taste)
- Chorda tympani nerve (Branch of the facial nerve)
  These fibers carry taste sensations from taste buds located on the dorsum of the tongue

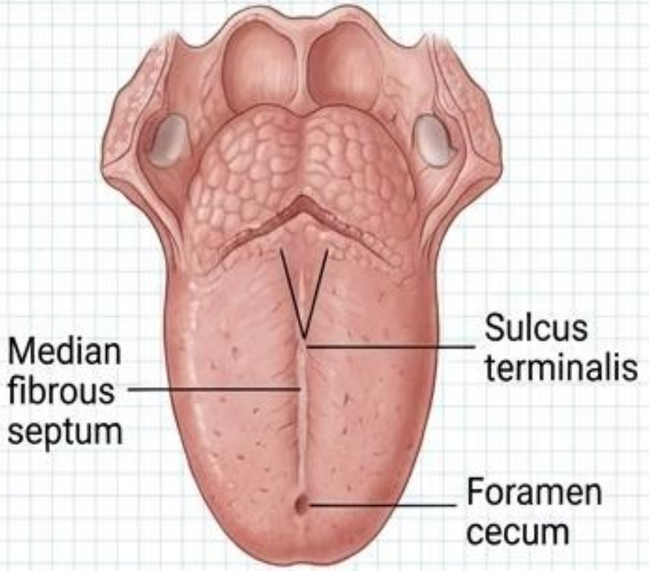
7- The teeth

* The **gingivae** (gum) are specialized regions of the oral mucosa that surround the teeth.
* They are surrounded by dense connective tissue. طواحين ضواحك أنياب قواطع [13]

7- The teeth			
		Deciduous Teeth (Milk Teeth)	**Permanent Teeth**
1	**### number**	 20 teeth ; 10 in each jaw.	 32 teeth ; 16 in each jaw.
2	**Types per jaw**	(4) Incisors  , (2) Canines  & (4) Molars 	(4) Incisors  , (2) Canines  , (4) premolars  & (6) Molars 
3	**Eruption timeline**	Begins around 6 months of age, all 20 teeth typically erupt by 2 years of age.	Begin to erupt at the age of 6 and continue until around 12 years. The third molar, Aka *wisdom tooth, is the last to erupt and typically appears between the ages of 17 and 30.
4	**Eruption Order**	Lower jaw teeth usually erupt before the upper jaw teeth.	

Notes

*They're called "wisdom teeth" because they appear later in life. Their eruption can be associated with various issues. In many cases, they may remain unerupted (impacted) and can sometimes lead to infection.[14]



8- The tongue

- The tongue is a **muscular organ** made of **striated "muscle"** covered by **"mucous membrane"** .
- A **median fibrous septum** divides the tongue into **symmetrical right** and **left halves**, each with **paired muscles.**
  - This division is significant as it allows for the coordinated action of the intrinsic and extrinsic muscles (muscular imp.)
- The tongue is also anatomically divided into an **anterior two-thirds** and a **posterior one-third** by the **sulcus terminalis** and the **foramen cecum.**
  - division is significant as it corresponds to different types of mucous membrane lining the tongue (mucous membrane importance) 1/3 post. ½ right & left 2/3 Ant..

15

Histology Zone

9- Mucous membrane of the tongue

- The tongue is a **muscular organ made of striated muscle covered by "mucous membrane"** .

➢ **Relate to HISTOLOGY**

- The mucous membrane of the tongue is divided into two parts: the dorsal (upper) surface and the ventral (lower) surface.

- **The upper (dorsal) surface of the tongue:**

* lined with **stratified squamous para-keratinized epithelium.**

* It was originally **keratinized,** but due to digestion and secretion, it becomes injured and changes to **para- keratinized.**

- **The lower (ventral) surface**

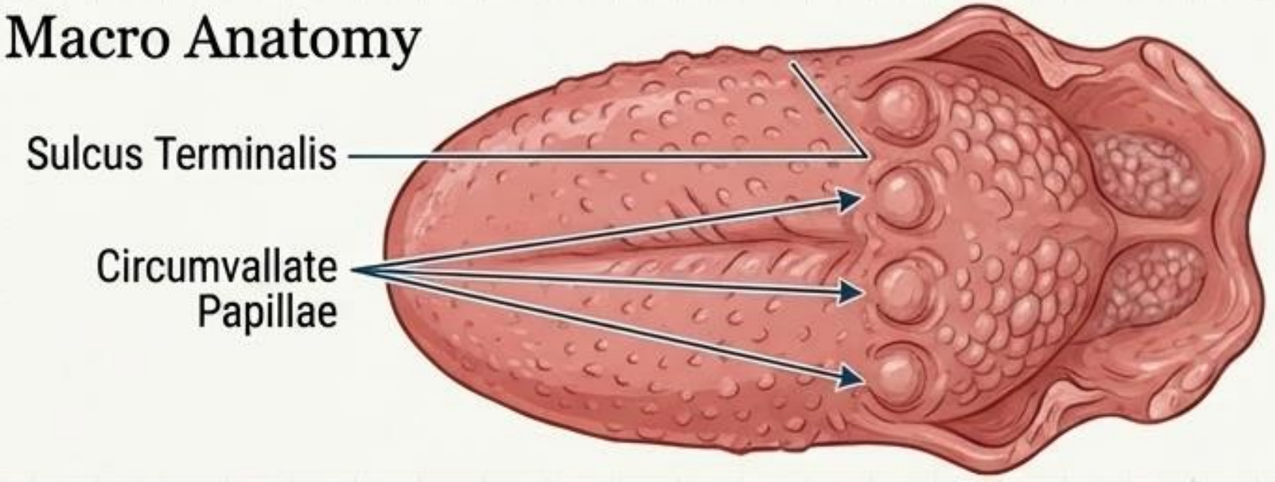
* Covered by **stratified squamous non-keratinized epithelium.**

The mucous membrane of the upper surface of the tongue can be divided into anterior and posterior parts, by a V-shaped sulcus called "sulcus terminalis" . Where the apex of the sulcus projects backward and is marked by a small pit, called "foramen cecum" .

16

Tongue Surface: Histology & Innervation Quirks

Macro Anatomy



The Embryological Quirk (Circumvallate Papillae)

Located on the anterior part, but embryologically belong to the posterior 1/3.

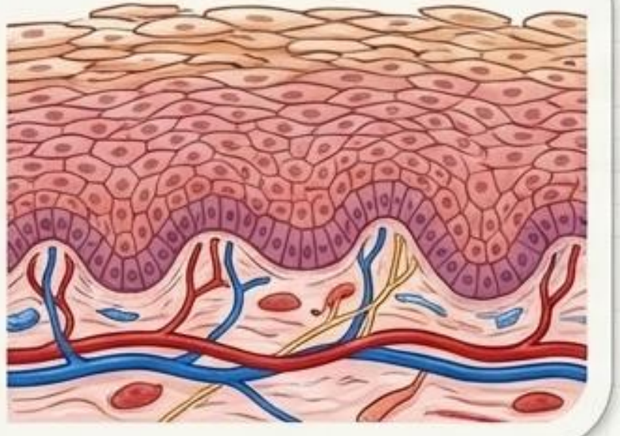
Result: Innervated by the **Glossopharyngeal nerve (CN IX)**, unlike the rest of the anterior 2/3 (Chorda tympani).

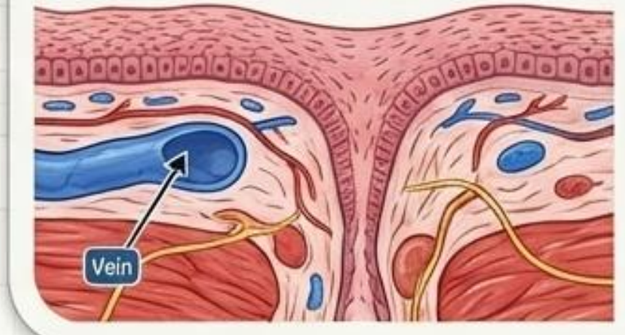
Note: The posterior 1/3 is mostly lymphoid tissue (lingual tonsil) and lacks taste buds, but circumvallate papillae detect taste.

Micro Histology

Dorsal (Upper) Surface

Stratified squamous **para**-keratinized epithelium. Injured by digestion/secretion, shifting from original keratinized state.





Ventral (Lower) Surface

Stratified squamous **non**-keratinized. Connects to the floor via the frenulum. The deep lingual vein is visible laterally.

9- Mucous membrane of the tongue

1- upper surface of the tongue — **Anterior 2/3 posterior 1/3**

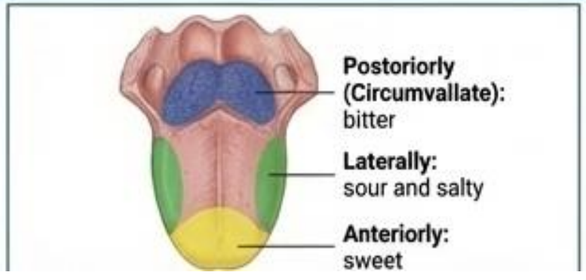
Filled with taste buds, AKA lingual papillae, including filiform, fungiform, and foliate & caused by the papillae. Where filiform are the presence of underlying lymphoid tissue (**lingual tonsil / follicle.**

Devoid of papillae but has an vallate irregular surface caused most abundant.

2- inferior surface of the tongue

- The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth.
- In the midline anteriorly, the undersurface of the tongue is connected to the floor of the mouth by a fold of mucous membrane: **frenulum of the tongue.**
- On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane. The lingual artery and lingual nerve lie deeper and more medially, and are not typically visible, but they run in close relation to the vein beneath the mucosa.

9- Mucous membrane of the tongue



❑ Taste areas

- Posteriorly (Circumvallate): bitter
- Laterally: sour and salty
- Anteriorly : sweet

❑ Taste buds

Taste buds are specialized sensory structures found mostly on the dorsal (upper) surface of the tongue. They are responsible for detecting different taste sensations like sweet, salty, sour, bitter, and umami (savory).

- **Fungiform Papillae**
  Scattered across the anterior part of the tongue.
- **Foliate Papillae**
  Lateral edges of the posterior part of the anterior two-thirds.
- **Circumvallate (Vallate) Papillae**
  Arranged in a V-shape just anterior to the sulcus terminalis.
  Note: exception! they sit anteriorly but are innervated posteriorly due to their embryological origin. - Refer to slide (25).
- **Filiform Papillae**
  Most numerous. Do NOT contain taste buds. Function more for tactile sensation (touch/texture). Foliate

10- Muscles of the tongue

❑ The tongue is a muscular organ made of striated "muscle" covered by mucous membrane. It has both

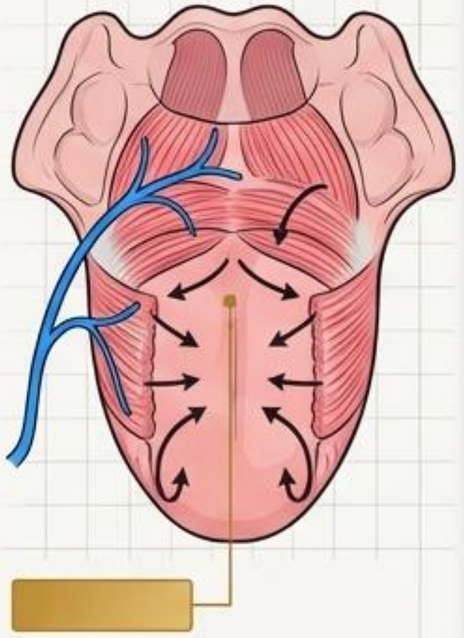
	* intrinsic muscles	extrinsic muscles
Consists of:	Consists of: longitudinal, transverse, & oblique fibers	styloglossus, genioglossus, palatoglossus, & hyoglossus muscles)
Attachment	They are confined to the tongue and are not attached to bone	muscles are attached to bones and the soft palate
Action	control & alter tongue shape	control its movement and connect it to surrounding structures like the styloid process, soft palate, mandible, and hyoid bone.
Nerve supply	Hypoglossal nerve except palatoglossus supplied by cranial accessory of vagus nerve. [19]	

11- Extrinsic muscles of the tongue

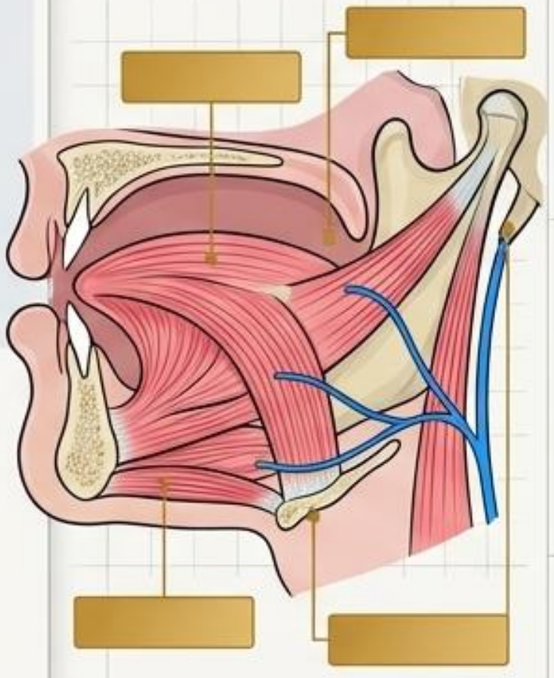
* Origin	Insertion		Action	Nerve supply
styloglossus	Styloid process of temporal bone	base of the tongue posteriorly	Draws tongue upward and backward	Hypoglossal nerve (Cranial Nerve XII) Except palatoglossus supplied by cranial part of the accessory nerve (CN XI) via the vagus nerve (CN X).
genioglossus	Superior genial (tubercle) of the spine of mandible	base of the tongue posteriorly	the ONLY muscle that protrudes the tongue out of the mouth.	
hyoglossus	hyoid bone	base of the tongue	Depresses tongue	
palatoglossus	Palatine aponeurosis	Side of tongue	Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus	

Notice how the muscles attach the tongue to the styloid process and the soft palate above and to the mandible and the hyoid bone below. *

Functional Architecture: Tongue Musculature Matrix



Category	Attachment	Action	Nerve Supply
Intrinsic Muscles (Longitudinal, transverse, oblique)	Confined to tongue (not attached to bone)	Alter tongue shape	Supplied by the **Hypoglossal nerve** (CN XII)
Extrinsic Muscles (Styloglossus, genioglossus, palatoglossus, hyoglossus)	Attached to bones (mandible, hyoid, styloid) and soft palate	Control tongue movement (depression, retraction, elevation)	**Hypoglossal nerve** (CN XII) EXCEPT the palatoglossus (supplied by cranial accessory of vagus nerve)



12- Movements of the Tongue

→ **Protrusion** (Sticking the tongue out)
Muscle involved: Genioglossus (both sides working together)
Normally: tongue remains straight when protruded outside the mouth because both genioglossus muscles (on the right and left sides) contract symmetrically. Thus ⚠
Injury to the hypoglossal nerve results in ipsilateral tongue paralysis and deviation toward the affected side.

← **- Retraction** (Pulling the tongue back)
Muscles involved: Styloglossus & Hyoglossus(both sides acting together)

↓ **- Depression** (Lowering the tongue)
Muscle involved: Hyoglossus (both sides working)

↖ **- Retraction and Elevation of the Posterior Third**
Muscles involved: Styloglossus & Palatoglossus (both sides acting together).
Function: Pulls the back of the tongue up and back, important during swallowing 22

⚠ Clinical Warning

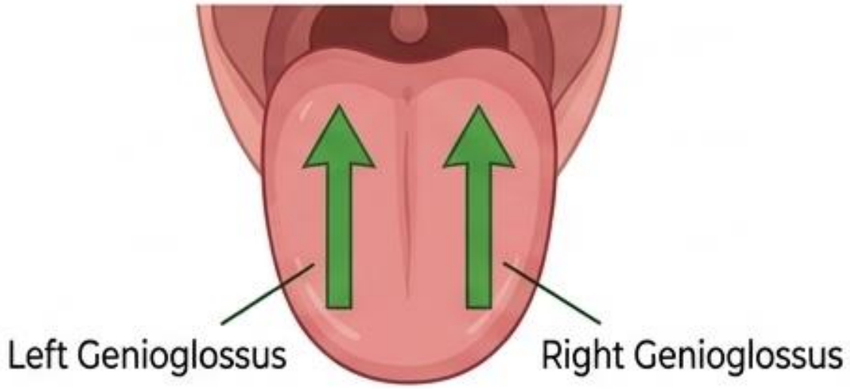
(Extra slide) NOT REQUIRED: **Injury to the hypoglossal nerve***

Normally: (R) (L) **Injury: upper motor neuron lesions * CNS**

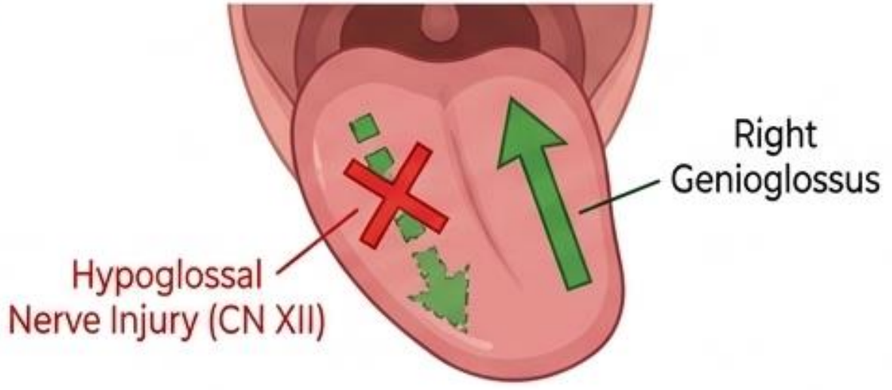
The genioglossus muscle on each side pulls the tongue forward and slightly toward the opposite side.
The right genioglossus pulls **the tongue forward and to the left. The left genioglossus pulls the tongue forward and to the right.**
So, when both genioglossus muscles contract with equal strength Their opposite directional forces cancel each other out. As a result, **tongue is protruded straight forward, staying in the midline. CROSSING OCCURS!**

Our case is lower motor neuron lesions (injury to the hypoglossal nerve), **the tongue deviates the same side as the lesion.** Example: right genioglossus muscle is paralyzed. The left genioglossus works normally and pushes the tongue forward and slightly to the right. → **Deviation occurs due to unopposed action.** 23

Clinical Correlate: The Deviated Tongue



Symmetrical Genioglossus Pull: Straight Protrusion



Unilateral Paralysis: Deviation to Affected Side (Left)

The Mechanics of Movement:

- **Depression:** Hyoglossus (both sides).
- **Retraction & Elevation (Post. 1/3):** Styloglossus & Palatoglossus (pulls back/up for swallowing).

The Clinical Root Cause:

- Normally, the tongue remains straight during protrusion because the right and left genioglossus muscles contract symmetrically.
- **Hypoglossal Nerve Injury:** Results in ipsilateral tongue paralysis. Without the counterbalance, the tongue deviates toward the affected side.

13- Sensory innervation of the tongue

➢ **Relate to EMBRYOLOGY**

During embryological development, the anterior two-thirds of the tongue arises from the first pharyngeal arch, while the posterior third comes from the third pharyngeal arch. arch
As a result, their nerve supply differs:

- The posterior third is innervated by the glossopharyngeal nerve (CN IX) for both general sensation and taste.
- The anterior two-thirds of the tongue receives:
  - General sensation from the lingual nerve.
  - Taste sensation from the chorda tympani. [24]

13- Sensory innervation of the tongue

➢ **Relate to EMBRYOLOGY**

- Recall: The circumvallate papillae, which are responsible for sensing bitter taste, are located near the sulcus terminalis.– slide 18
- Embryologically, these papillae belong to the posterior one-third of the tongue, even though anatomically they appear in the anterior part.
- Because of their embryological origin, they are innervated by the **glossopharyngeal nerve**. This differs from the rest of the anterior 2/3 of the tongue, which is innervated by the chorda tympani.
- The posterior one-third of the tongue is largely made of lymphoid tissue **(lingual tonsil)**, and normally **lacks taste buds**, but the **circumvallate papillae still provide taste sensation** in this region.

14- Blood supply & Lymphatics of the tongue

- **Blood Supply of the Tongue**
  The tongue receives arterial blood from branches of the external carotid artery, including:
  - Lingual artery (main supply)
  - Tonsillar branch of the facial artery
  - Ascending pharyngeal artery
- **Venous Drainage** The veins of the tongue drain into the internal jugular vein.

- **Lymphatic Drainage**
  - **Tip** of the tongue drains into the **submental lymph nodes.**
  - **"Others"** drains into **submandibular.**
  - All lymph from these nodes eventually drains into the **deep cervical lymph nodes.**
  - **OTHERS?** → should be Lateral anterior two-thirds of the tongue.

15- Salivary glands – introduction [27]

Types	Major Salivary Glands	Minor Salivary Glands	Innervation of Salivary Glands
	• **Parotid gland:** Has serous secretion and two capsules. • **Submandibular gland:** Has mixed secretion (serous + mucous) and one capsule. • **Sublingual gland:** Has mostly mucous secretion and one capsule.	• **Labial glands** (within the lips) • **Lingual glands** (in the tongue) • **Palatal glands** (in the palate) Numerous and mostly mucous glands.	**Sensory** (for general sensation) **Sympathetic** (for*vasoconstriction of blood vessels) **Parasympathetic** (for *secretomotor function) ***Parasympathetic:** Directly stimulates saliva secretion. ***Sympathetic:** Does not directly inhibit secretion but indirectly reduces it by vasoconstricting the blood vessels → leading to less blood supply, which affects secretion.

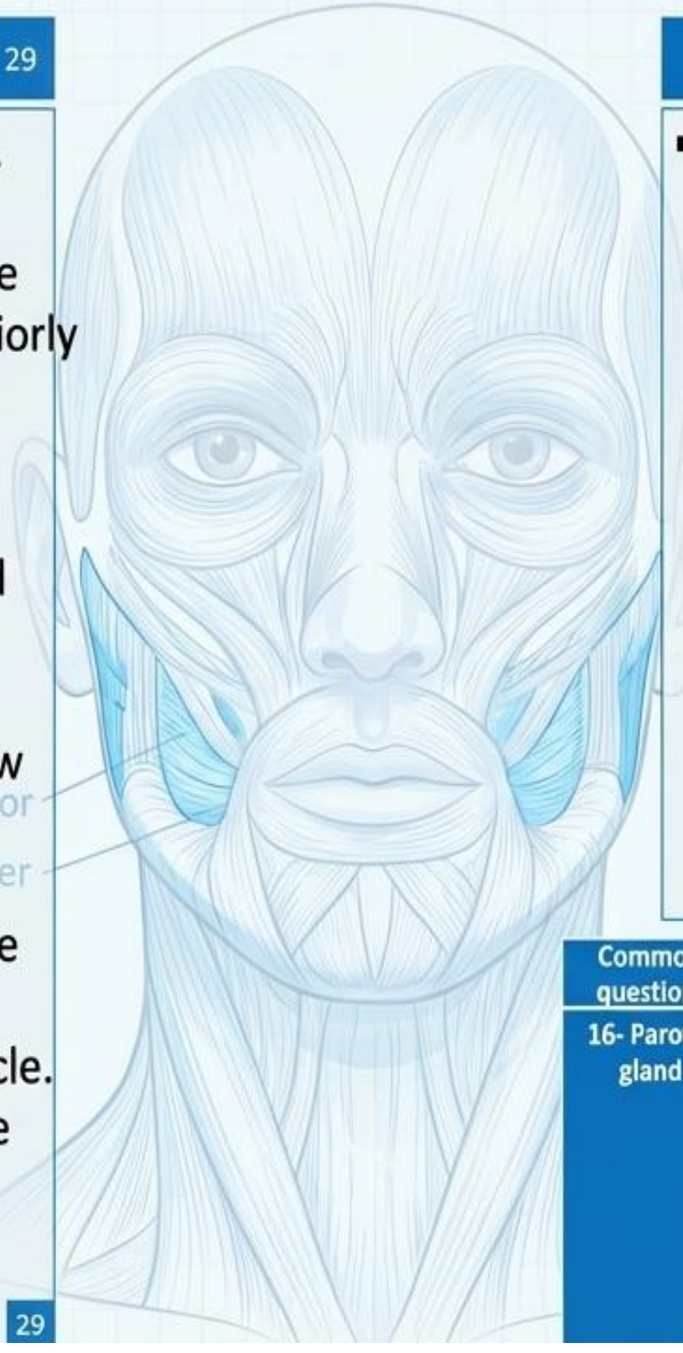
(Extra slide) NOT REQUIRED :

Feature	Serous Acini	Mucous Acini
Cell Shape	Pyramidal cells forming round acini	Columnar or cuboidal cells forming tubular or oval acini
Nucleus Position	Round, centrally or basally placed	Flat, basally compressed by mucin granules
Cytoplasm Appearance (H&E)	Darkly stained (basophilic), due to abundant rough ER	Pale, foamy or clear due to mucin (poor H&E staining)
Lumen Size	Narrow	Wide and often distorted
Secretory Product	Watery, protein-rich (enzymes like amylase, lysozyme)	Thick, viscous mucus rich in glycoproteins (mucins)
Function	Digestion (especially starch), antibacterial action	Lubrication, protection of mucosa, food bolus formation
Special Features	May show serous demilunes (esp. in mixed glands)	No demilunes; form the core of demilunes in mixed acini

16- Parotid gland

- Largest salivary gland, Mostly serous acini. Consists of 1- glandular part & 2- ductal system. The parotid duct emerges from the anterior border of the gland → runs anteriorly over the external surface of the masseter muscle → turns medially, pierces the buccinator muscle, → opens into the oral cavity adjacent to the crown of the second upper molar tooth.

* It is approximately 4 cm long.
* Surface anatomy: one fingerbreadth below the zygomatic arch.



- The parotid gland is located anterior to the ear, and it overlies both the masseter muscle and the sternocleidomastoid muscle.

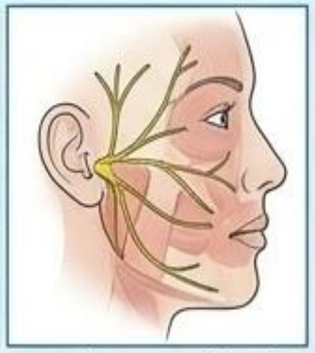
* The base of the gland lies just beneath the skin, while the apex points toward the pharynx.

16- Parotid gland

- The parotid gland lies in the "parotoid bed" (anatomical space upon which the gland rests).
  - which is anatomically bounded by:
    1. Posteriorly: sternocleidomastoid muscle.
    2. Anteriorly : ramus of the mandible.
    3. Superiorly : external acoustic meatus & posterior part of the zygomatic arch.
  - Additionally, the parotid bed includes several other structures that the gland rests upon:
    4. The styloid process of the temporal bone.
    5. Muscles attached to the styloid process, such as the stylohyoid muscle.
    6. The posterior belly of the digastric muscle.
    7. The deep cervical fascia.
    8. The last four cranial nerves (CN IX–XII).

Common question:	Main structure	Others
16- Parotid gland	1- Facial nerve (CN VII) "extra cranial part" (most superficial)	parotid gland overlies major blood vessels: * Internal jugular vein. * Common carotid artery which bifurcates into the external (does supply the gland) & internal carotid arteries (doesn't supply the gland)
	2- Retromandibular Vein (intermediate)	
	3- external carotid artery (deepest)	
	4- Parotoid lymph nodes	
	5-Auriculotemporal Nerve	

16- Facial Nerve in the parotoid gland



* The most superficial structure within the parotid gland is the facial nerve & its five terminal branches, they pass through the gland but do not supply it functionally!.
* The main trunk of the facial nerve enters the parotid gland and divides it into superficial & deep lobes.
* Whereas the branches arise within the gland and fan out to innervate the muscles of facial expression:
  1. Temporal branch → innervates the orbicularis oculi
  2. Zygomatic branch 3. Buccal branch
  4. Marginal mandibular branch → innervates muscles near the mandible
  5. Cervical branch → innervates the platysma

Clinical Warning ☹

During ⚠ parotid gland surgery (e.g. tumor removal), the facial nerve is at risk of injury. This is a primary surgical concern.
Thus, On the first day after surgery, the doctor typically assesses facial nerve function by asking the patient to perform actions function by asking the patient to perform actions involving facial muscles:
Close the eyes → tests the temporal branch (orbicularis oculi)
Blow out the cheeks Recall slide 5
Check for drooling of saliva

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16- Structures with the parotoid gland

- The **retromandibular vein**, lies deep to the facial nerve, formed by the union of the superficial temporal and maxillary veins within the parotid gland.
- The **external carotid artery**, along with its terminal branches (superficial temporal and maxillary arteries), lies deeper within the gland and provides the arterial supply to the region. = **preauricular lymph nodes**
- The parotid gland contains intraglandular lymph nodes, commonly referred to as the parotid lymph nodes. [33]

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16- Parotoid gland

* **Recall:** The parotid gland has 2 capsules.
* The parotid gland is divided into lobes and lobules.
* The lobes are larger sections of the gland, while the lobules are smaller subunits within the lobes. They are separated by connective tissue septa, which extend inward from the inner capsule of the gland.
* Within each lobule, there are secretory acini, which are small glandular structures that produce saliva. These acini drain into small interlobular ducts, which are smaller tubes that collect the secretions from multiple acini. These interlobular ducts then merge to form the main parotid duct, which is the primary duct responsible for transporting saliva from the gland to the oral cavity.
* The outer capsule of the parotid gland is made of parotid fascia, a type of connective tissue that surrounds the gland. This fascia is derived from the deep cervical fascia

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Pathology ⚠

- ⚠ Mumps is a viral infection that primarily affects the parotid gland. The virus causes inflammation and swelling of the gland, which can lead to discomfort and pain. The fibrous capsule of the parotid gland, which is tough and not very elastic, restricts the gland's ability to expand. This limitation results in severe pain due to the pressure buildup inside the gland as it swells

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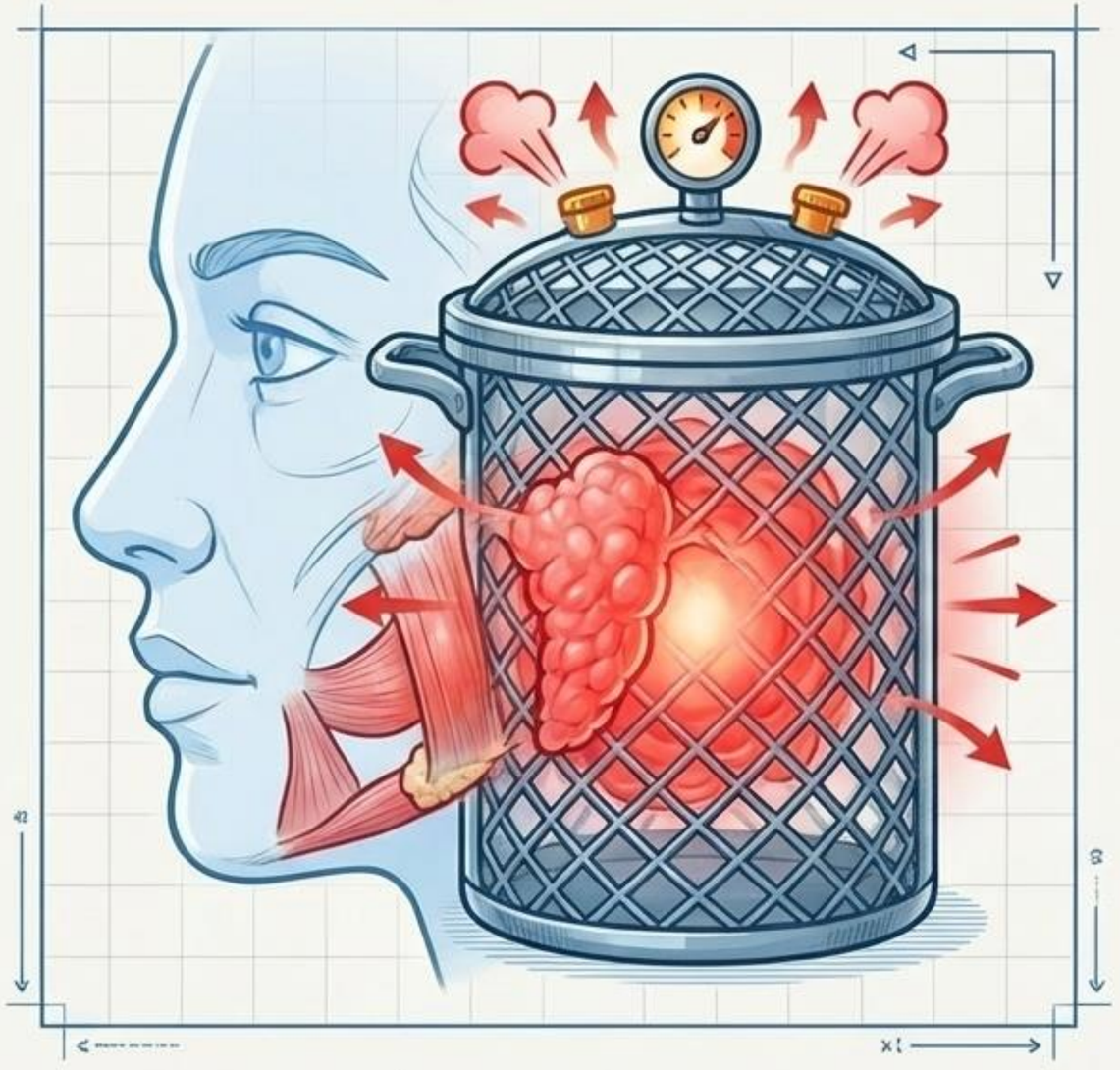
The Parotid Gland & The “Pressure Cooker” Effect



Gland Anatomy & Facial Nerve (CN VII)

- **CN VII** is the most superficial structure, passing through the gland to divide it into superficial and deep lobes, but it does not supply it functionally.
- **5 Terminal Branches** exit the gland: Temporal (orbicularis oculi), Zygomatic, Buccal, Marginal mandibular (mandible muscles), Cervical.

Clinical Highlight: The Mumps Pressure Cooker

- The gland is encased in **parotid fascia** (from deep cervical fascia).
- **Mumps** (viral infection) causes internal swelling.
- Because the fibrous capsule is tough and inelastic, it cannot expand. This pressure buildup causes severe pain.

16- Parotoid gland Innervation

The parasympathetic innervation of the parotid gland originates from: inferior salivatory nucleus in the medulla oblongata.

The glossopharyngeal nerve (cranial nerve IX) emerges from this nucleus and gives rise to the tympanic nerve.

which branches into the lesser petrosal nerve at the tympanic membrane.

The lesser petrosal nerve carries preganglionic parasympathetic fibers to the otic ganglion, located just below the foramen ovale.

The postganglionic parasympathetic fibers then travel via the auriculotemporal nerve to reach and innervate the parotid gland and provides sensory innervation to the gland.

- Preganglionic parasympathetic
- Postganglionic parasympathetic and sensory

Note: Postganglionic sympathetic fibers originates from the superior cervical ganglion in the neck and reach the gland via a plexus around the external carotid artery.

Parasympathetic secretomotor supply arises from

The Anatomical Atlas Dashboard

17- Submandibular gland

- **Recall**: A mixed salivary gland, composed of both serous and mucous acini. Consists of **1- glandular part & 2- ductal system**. (Wharton's Duct)
- Arises from the anterior end of the deep part of the gland.
- It travels forward in the floor of the mouth and opens at the base of the tongue, on a small papilla at the side of the lingual frenulum (the submandibular papilla).
- It is located beneath the lower border of the body of the mandible, occupying the submandibular (digastric) triangle, which is bounded by the anterior and posterior bellies of the digastric muscle.
- The gland is divided into two parts by the mylohyoid muscle:
  * **Superficial part**: Lies superficial (inferior) to the mylohyoid.
  * **Deep part**: Lies deep (superior) to the mylohyoid, beneath the mucous membrane of the floor of the mouth and adjacent to the side of the tongue.
  * The two parts are continuous around the posterior border of the mylohyoid muscle.

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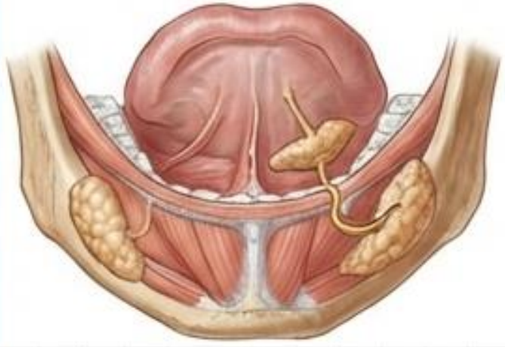

18- Sublingual gland

- It is the smallest major salivary gland, enclosed in a thin mucosal capsule.
- It contains both serous and mucous acini, but mucous acini predominate.
- The sublingual gland lies beneath the tongue, embedded in the floor of the mouth, specifically under the mucous membrane of the sublingual fold, and is located close to the lingual frenulum.
- It has 8–20 small ducts that open into the mouth on the summit of the sublingual fold, and in some cases, some ducts join the submandibular duct.
- Medially related to the *lingual nerve, submandibular duct, and genioglossus muscle.

Sublingual ducts

- Because the secretion is viscous (thick mucus), the gland needs multiple small ducts (unlike the parotid or submandibular glands) to drain efficiently without clogging or pooling. This way, the secretion is evenly spread into the floor of the mouth — especially helpful during speaking, chewing, and swallowing!

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Submandibular & sublingual glands

* Origin of Mylohyoid muscle separates the submandibular gland from the sublingual gland

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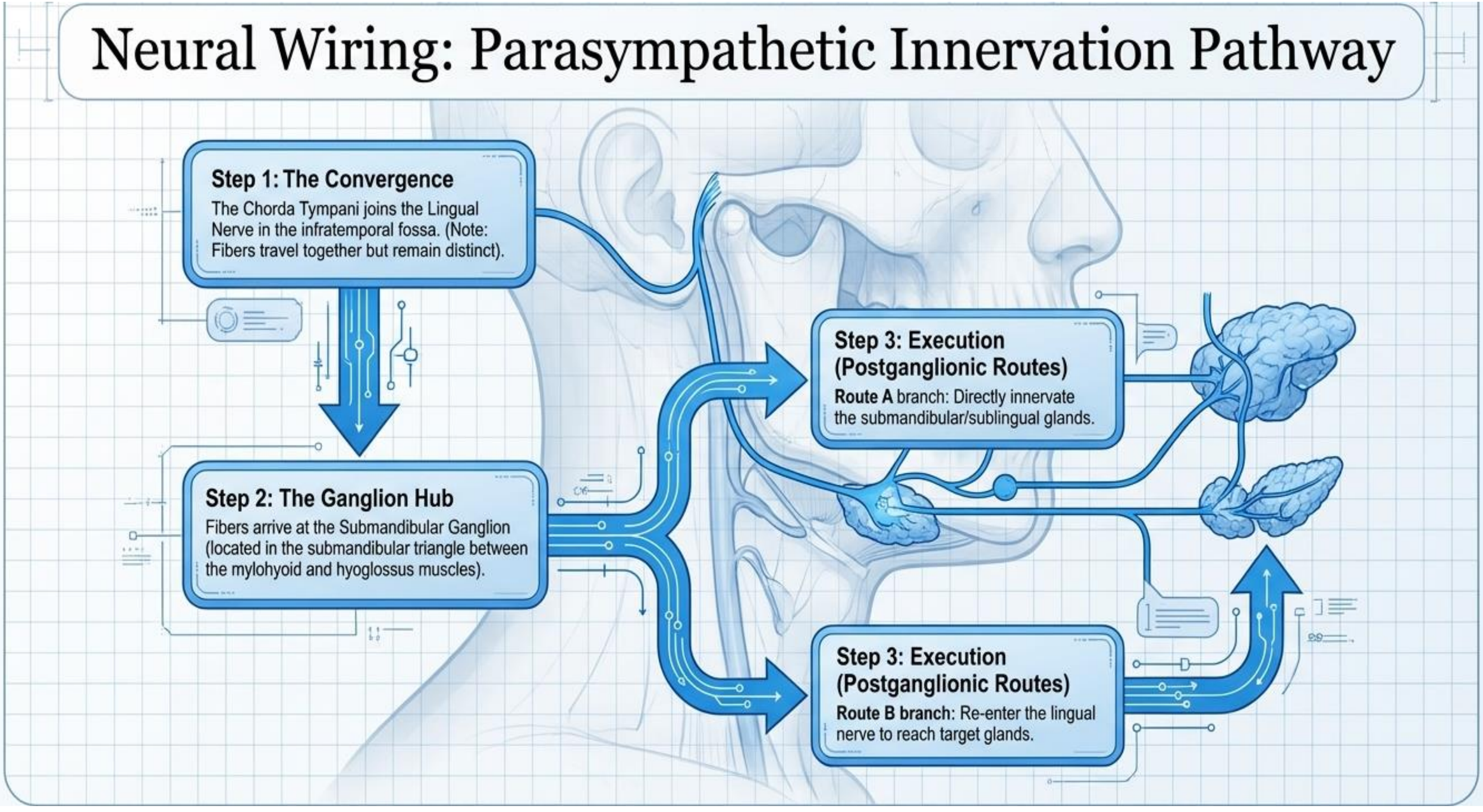
Neural Wiring: Parasympathetic Innervation Pathway



19- Submandibular & Sublingual gland Innervation

1. Parasympathetic & Sensory Innervation

Pre-Ganglionic Phase

- Originates from the superior salivatory nucleus in the medulla oblongata, carried by the facial nerve.

- The facial nerve gives rise to the chorda tympani nerve, which carries preganglionic parasympathetic fibers as well as taste fibers from the anterior two-thirds of the tongue.

- The chorda tympani joins the lingual nerve in the infratemporal fossa.

Synapse

- At: submandibular ganglion, which is located within the submandibular triangle, between the mylohyoid and the hyoglossus muscles.

* **Note:** The cherda tympani fibers travel with the lingual nerve to reach the ganglion; they do not run independently, But their fibers remain distinct. post-Gangl.

post-Gangl.

- Postganglionic parasympathetic fibers either directly innervate the submandibular and sublingual glands or re- enter the lingual nerve to reach their target glands.

* The lingual nerve provides general sensory fibers. It also carries parasympathetic fibers & taste fibers from the chorda tympani to the submandibular gland.

- **Preganglionic parasympathetic:** chorda tympani
- **Sensory and taste fibers:** lingual nerve

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19- Submandibular & Sublingual gland Innervation

1. Sensory Innervation – comp.

- The lingual nerve has a triple relation to the submandibular duct it passes lateral, then inferior, and finally medial to it.

2. Sympathetic Innervation

- Postganglionic sympathetic fibers: arise from the superior cervical ganglion and reach the glands via a plexus around the lingual artery.

SUM UP: 40

Summary Dashboard

Parotoid gland **20- Salivary glands – To sum up:** Parotoid duct Sublingual gland Submandibular gland **Mylohyoid muscle.**

- separates the superficial part of the submandibular gland from its deep part.
- It also separates the submandibular gland from the sublingual gland.

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