MEDICAL EDUCATION RESOURCE

Tongue

Introduction

According to a document from 2019, the tongue is described as a **muscular organ** in the floor of the mouth, involved in **taste, speech, chewing, swallowing, and oral cleansing**.

It contains **skeletal (voluntary) muscle**, though its automatic movements may feel involuntary in daily usage.

Dissection

The sagittal section shows the **fan-shaped genioglossus muscle**.
Dissection requires cutting **buccinator**, **superior constrictor**, and the **pterygomandibular raphe** to expose the lateral tongue.

Parts of Tongue

The tongue consists of **root, body, and tip**.

Root

Attached superiorly to **styloid process** and **soft palate**, and inferiorly to **mandible and hyoid bone**, making the tongue impossible to swallow accidentally.

Tip

Free anterior end, resting behind the upper incisors.

Body

Includes dorsum and inferior surface:

- **Dorsum** is convex; divided into:
  - **Oral (anterior 2/3):** rough, with papillae
  - **Pharyngeal (posterior 1/3):** smooth, contains **lingual tonsil**
- **Posteriormost part** attached to epiglottis through **median and lateral glossoepiglottic folds**, spaces forming **valleculae**.

Clinical Anatomy

Based on the document:

- **Glossitis** occurs with generalized stomatitis; **filiform papillae atrophy** in anaemia.
- Tongue may **swell enormously** due to loose areolar tissue and rich lymphatics.
- Undersurface is helpful for observing **jaundice**.
- In unconscious patients, tongue may **fall back and obstruct airway**; prevented by positioning or pulling tongue forward.
- **Lingual tonsil** forms part of **Waldeyer's ring**.

Papillae of the Tongue

According to the document:

1. Vallate (Circumvallate) Papillae

- 8–12 in number, 1–2 mm diameter
- Located **just anterior to sulcus terminalis**
- Surrounded by circular sulcus
- Contain **taste buds**

2. Fungiform Papillae

- Present near **tip and margins**, scattered on dorsum
- Bright red, mushroom-shaped

3. Filiform Papillae

- Most numerous, smallest
- Cover presulcal region; keratinized, giving **velvety** appearance
- Apex may form filamentous processes

4. Foliate Papillae

- Leaf-shaped
- Present at lateral borders anterior to vallate papillae

Muscles of the Tongue

The tongue is divided into two halves by a **midline fibrous septum**; each half contains **4 intrinsic and 4 extrinsic muscles**.

Intrinsic Muscles

Modify the **shape** of tongue:

1. **Superior longitudinal**
    - Elevates tip & sides; shortens tongue
2. **Inferior longitudinal**
    - Curls tip down; shortens tongue
3. **Transverse**
    - Narrows and thickens tongue
4. **Vertical**
    - Broadens the tongue

Extrinsic Muscles

Modify **position** of tongue:

- **Genioglossus**
- **Hyoglossus**
- **Styloglossus**
- **Palatoglossus**

Hypoglossal Nerve — XII Nerve

According to a document from **2019**, the hypoglossal nerve is described as the **motor nerve of the tongue** and supplies **all intrinsic and 3 extrinsic muscles** (except palatoglossus).

Course

- Leaves skull through **hypoglossal canal**.
- Lies between **internal jugular vein** and **internal carotid artery**, anterior to vagus.
- Curves forward crossing **internal & external carotid arteries**.
- Crosses loop of **lingual artery**, then lies on **hyoglossus** and enters the tongue.

Muscles supplied

- **All intrinsic muscles**.
- **Extrinsic:** Genioglossus, Hyoglossus, Styloglossus.
- **Exception:** Palatoglossus (via pharyngeal plexus).

Clinical Anatomy of XII Nerve

The same document explains:

Carcinoma of Tongue

- Common; requires removal of tongue and **block dissection of cervical nodes** due to lymphatic spread.

Sublingual Drug Absorption

- Drugs like **sorbitrate** act rapidly because of **rich blood supply** and **bypassing of portal circulation**.

Genioglossus – “Safety Muscle”

- Paralysis causes **tongue to fall back**, occluding the airway.
- Used to test XII nerve: deviation **towards paralyzed side** on protrusion.

Histology of Tongue

According to the 2019 document:

1. Muscles

- Bulk formed of **striated skeletal muscle** bundles.

2. Mucous Membrane

- Stratified squamous epithelium; **thin on oral dorsum**, elevated into papillae.
- Posterior third contains **dense lymphoid follicles**.
- Inferior surface: thin, smooth epithelium.

3. Glands

- Both **mucous & serous glands** beneath mucosa.

4. Taste Buds

- Numerous around **vallate papillae**, **foliate papillae**, posterior 1/3; absent in **mid-dorsal oral tongue**.
- Composed of **supporting cells** and **gustatory cells**.

Development of Tongue

According to the 2019 document (Fig. 17.11):

Epithelium

1. **Anterior 2/3**
    - From **two lingual swellings** of **first arch**;
    - Sensory supply: **lingual nerve** (general), **chorda tympani** (taste).
2. **Posterior 1/3**
    - From **hypobranchial eminence of 3rd arch**;
    - Supplied by **glossopharyngeal nerve**.
3. **Posteriormost part**
    - From **4th arch**;
    - Supplied by **vagus (internal laryngeal)**.

Muscles

- From **occipital myotomes**, explaining hypoglossal supply.

Taste Pathway

According to the 2019 document:

Anterior 2/3 of Tongue

- Except vallate papillae
- Via **chorda tympani ? geniculate ganglion ? tractus solitarius (medulla)**.

Posterior 1/3 + Vallate Papillae

- Via **glossopharyngeal nerve ? inferior ganglion ? tractus solitarius**.

Posterior-most Tongue & Epiglottis

- Via **vagus nerve ? inferior ganglion ? tractus solitarius**.

Central Pathway

- From tractus solitarius ? **solitario-thalamic tract**
- Joins **trigeminal lemniscus**
- Projects to **VPM nucleus of thalamus** (opposite side)
- Then to **primary gustatory cortex (inferior postcentral gyrus)**.

Clinical Anatomy (Taste & Tongue)

According to the 2019 document:

- **Taste loss** can occur with lesions of facial, glossopharyngeal, or vagus pathways (implied through pathway description).

- **Taste buds** absent in mid-dorsal anterior tongue explains sparing of taste in that region during disease.

Facts to Remember

- All **four intrinsic muscles** of the tongue are supplied by the **hypoglossal nerve (XII)**.

- Of the **four extrinsic muscles**, **three** (genioglossus, hyoglossus, styloglossus) are supplied by the hypoglossal nerve; **palatoglossus** is supplied by the **pharyngeal plexus** .

- The **lingual artery** is **tortuous** because it moves with the pharynx during swallowing.

- The tongue maintains its position through the attachments of **four pairs of extrinsic muscles**.

- **Circumvallate papillae** are few (10–12) but contain the **maximum number of taste buds**; their taste sensation is carried by the **glossopharyngeal nerve (IX)**.

- **Nerve supply follows embryological development**:

    - Anterior two-thirds ? **First pharyngeal arch**, supplied by the **lingual nerve** (general sensation) and **chorda tympani** (taste).

    - Posterior one-third ? **Third arch**, supplied by the **glossopharyngeal nerve**.

    - Posteriormost part ? **Fourth arch**, supplied by the **internal laryngeal branch of the vagus nerve**.

- **Sublingual drug administration** works rapidly because venous drainage bypasses the portal circulation.

- **Genioglossus** is considered the **life-saving muscle**, as its action of protruding the tongue prevents airway obstruction.

Clinicoanatomical Problem

Case

A patient is diagnosed with **right-sided medial medullary syndrome**.

Questions

1. What happens to the tongue?

2. Which nuclear column does the hypoglossal nerve belong to?

3. What are the muscles of the tongue?

Explanation

- In medial medullary syndrome, the lesion involves the **hypoglossal nerve**, **pyramidal tract**, and **medial lemniscus** due to obstruction of the **anterior spinal artery**.

Effects

- **Tongue deviation:**
  The **tongue deviates to the right side** (side of the lesion) on protrusion because of paralysis of ipsilateral tongue muscles.

- **Nuclear column:**
  The hypoglossal nerve belongs to the **General Somatic Efferent (GSE)** column.

- **Muscles of the tongue:**
  Intrinsic muscles:
    - Superior longitudinal
    - Inferior longitudinal
    - Transverse
    - Vertical

  Extrinsic muscles:
    - Genioglossus
    - Hyoglossus
    - Styloglossus
    - Palatoglossus

Additional Clinicoanatomical Problems

Problem 1 — Hypoglossal Nerve Injury After Neck Surgery

Case

A patient undergoes surgery for a carotid endarterectomy. After the procedure, he develops **slurred speech** and **difficulty protruding the tongue**.

Explanation

- The **hypoglossal nerve** may have been injured during dissection around the **carotid arteries**.
- On protrusion, the tongue **deviates toward the injured side**.
- Loss of genioglossus action can allow the tongue to **fall backward**, risking airway obstruction.

Problem 2 — Lingual Nerve Damage After Dental Extraction

Case

A patient undergoing **third molar (wisdom tooth) extraction** experiences **loss of general sensation and taste** in the **anterior two-thirds** of the tongue.

Explanation

- The **lingual nerve** (general sensation) and fibres of **chorda tympani** (taste, parasympathetic) are vulnerable during mandibular molar surgery.
- Injury leads to:
    - Loss of touch, pain, temperature
    - Loss of taste
    - Reduced salivary secretion from **submandibular and sublingual glands**

Problem 3 — Glossopharyngeal Nerve Lesion

Case

A patient with a tumour in the **posterior tongue** presents with **loss of taste and sensation** in the **posterior one-third**.

Explanation

- The **glossopharyngeal nerve** supplies both taste and sensation to this region.
- Loss causes impaired gag reflex (afferent limb) and difficulty swallowing.

Problem 4 — Tongue Carcinoma With Nodal Spread

Case

A chronic smoker presents with a **non-healing ulcer on the lateral border** of the tongue.

Explanation

- Lateral tongue drains to **deep cervical lymph nodes**; hence early metastasis is common.
- This is why cancers on the **posterior or lateral tongue** behave more aggressively than those near the tip.

Problem 5 — Macroglossia (“Enlarged Tongue”)

Case

A child presents with an abnormally large tongue causing **speech difficulty** and **airway obstruction**.

Explanation

- Conditions like **hypothyroidism** or **lymphangioma** cause massive enlargement.
- The clinical danger arises because the tongue's **loose areolar tissue** allows rapid swelling and obstructs the airway.

Problem 6 — Taste Loss After Middle Ear Infection

Case

A patient with chronic otitis media reports **loss of taste in anterior 2/3 of tongue**.

Explanation

- The **chorda tympani** passes through the middle ear and is vulnerable during infection.
- Damage causes loss of taste, though general sensation remains intact (lingual nerve is normal).

Problem 7 — Ludwig's Angina

Case

A patient with dental infection develops **floor-of-mouth swelling**, fever, and difficulty breathing.

Explanation

- Infection spreads to the sublingual and submandibular spaces.
- Tongue is **pushed upward and backward**, risking **fatal airway obstruction**.
- Emergency airway management is crucial.

Problem 8 — Inability to Whistle

Case

A patient cannot curl or shape the tongue properly to whistle.

Explanation

- Damage to **intrinsic muscles** of the tongue affects tongue **shape control**.
- Hypoglossal nerve lesions impair both intrinsic and extrinsic functions.

Problem 9 — Loss of Gag Reflex

Case

A patient loses the gag reflex on the right side.

Explanation

- **Afferent limb:** Glossopharyngeal nerve (posterior tongue + pharynx)
- **Efferent limb:** Vagus nerve
- Loss of sensation on the posterior tongue is an important clue.

Problem 10 — Burning Sensation of the Tongue

Case

A young woman complains of burning sensation, smooth tongue, and taste disturbances.

Explanation

- Likely due to **atrophy of filiform papillae** in **iron-deficiency anaemia**.
- The tongue appears **glossy and smooth**

Frequently Asked Questions — Tongue

1. What are the parts of the tongue?

- Anterior two-thirds (oral part)
- Posterior one-third (pharyngeal part)
- Small posteriormost part near epiglottis

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2. What are the subdivisions of the dorsum of the tongue?

- Oral (papillary) part
- Pharyngeal (lymphoid) part
- Separated by **sulcus terminalis**

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3. How many types of papillae are present and which have the most taste buds?

There are **four types** of papillae:

- Vallate

- Fungiform
- Filiform
- Foliate

Vallate papillae contain the **maximum taste buds**.

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4. Name the extrinsic muscles of the tongue with nerve supply.

- **Genioglossus** — Hypoglossal nerve
- **Hyoglossus** — Hypoglossal nerve
- **Styloglossus** — Hypoglossal nerve
- **Palatoglossus** — Pharyngeal plexus

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5. Name the intrinsic muscles with their nerve supply.

- Superior longitudinal
- Inferior longitudinal
- Transverse
- Vertical
  All supplied by **hypoglossal nerve**.

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6. What is the lymph node of the tongue?

- **Deep cervical lymph nodes** (especially jugulodigastric & jugulo-omohyoid)

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7. What is the importance of the genioglossus muscle? What is its other name?

- Protrudes the tongue forward
- Prevents airway obstruction
- Also called the **"life-saving muscle"**

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8. How does the tongue develop?

- Anterior two-thirds from **first pharyngeal arch**
- Posterior one-third from **third arch**
- Posteriormost part from **fourth arch**

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9. What nerves supply general and special sensations to different parts?

- Anterior 2/3:
  - General: **Lingual nerve**
  - Taste: **Chorda tympani**
- Posterior 1/3:
  - Both general & taste: **Glossopharyngeal nerve**
- Posteriormost part + epiglottis:

- Taste: **Internal laryngeal branch of vagus**

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10. In injury to the right hypoglossal nerve, which way does the tongue deviate? Why?

- Deviates **to the right side**
- Because the right genioglossus is paralysed

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11. Trace taste fibres from circumvallate papillae to the cerebrum.

- Circumvallate ? **Glossopharyngeal nerve**
- ? Inferior ganglion
- ? Tractus solitarius
- ? Solitario-thalamic tract
- ? VPM nucleus of thalamus
- ? Lower part of postcentral gyrus

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12. Which drug is administered sublingually during angina and why?

- **Sorbitrate**
- Rapid absorption due to rich vascularity and bypassing portal circulation

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13. What is the clinical importance of the colour and roughness of the tongue?

- Colour helps detect diseases such as **jaundice**
- Roughness depends on papillae; loss (e.g., iron deficiency) makes tongue smooth

Multiple Choice Questions — Tongue

1. The nerve supplying taste buds of the circumvallate papillae is:

a. Lingual nerve
b. Chorda tympani
c. Glossopharyngeal nerve
d. Internal laryngeal nerve

Correct answer: c. Glossopharyngeal nerve

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2. All intrinsic muscles of the tongue are supplied by:

a. Vagus nerve
b. Glossopharyngeal nerve
c. Hypoglossal nerve
d. Facial nerve

Correct answer: c. Hypoglossal nerve

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3. Palatoglossus is supplied by:

a. Hypoglossal nerve
b. Facial nerve
c. Pharyngeal plexus
d. Glossopharyngeal nerve

Correct answer: c. Pharyngeal plexus

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4. The anterior two-thirds of the tongue develops from which arch?

a. Second
b. First
c. Third
d. Fourth

Correct answer: b. First

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5. Deviation of the tongue to one side on protrusion indicates injury to:

a. Glossopharyngeal nerve
b. Hypoglossal nerve
c. Lingual nerve
d. Internal laryngeal nerve

Correct answer: b. Hypoglossal nerve

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6. Which papillae contain the maximum number of taste buds?

a. Filiform
b. Fungiform
c. Foliate
d. Vallate

Correct answer: d. Vallate

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7. The lymphatic drainage of the tip of the tongue is primarily to:

a. Jugulo-omohyoid node
b. Jugulodigastric node
c. Submental node
d. Parotid node

Correct answer: c. Submental node
(From anatomical correlation, consistent with text where tongue lymphatics are discussed.)

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8. Sublingual placement of sorbitrate is effective because:

a. It has slow absorption
b. It is digested by salivary enzymes
c. It bypasses the portal circulation
d. It requires lymphatic transport

Correct answer: c. It bypasses the portal circulation

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9. Taste from the posteriormost part of the tongue is carried by:

a. Lingual nerve
b. Chorda tympani
c. Glossopharyngeal nerve
d. Vagus nerve

Correct answer: d. Vagus nerve

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10. The “life-saving muscle” of the tongue is:

a. Styloglossus
b. Hyoglossus
c. Genioglossus
d. Palatoglossus

Correct answer: c. Genioglossus

Additional MCQs — Tongue

1. General sensation from the anterior two-thirds of the tongue is carried by:

a. Chorda tympani
b. Glossopharyngeal nerve
c. Lingual nerve
d. Vagus nerve

Correct answer: c. Lingual nerve

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2. Taste fibres from the anterior two-thirds of the tongue reach the brainstem via:

a. Lingual nerve ? Geniculate ganglion
b. Lingual nerve ? Trigeminal ganglion
c. Chorda tympani ? Otic ganglion
d. Chorda tympani ? Inferior ganglion of IX

Correct answer: a. Lingual nerve ? Geniculate ganglion (via chorda tympani)

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3. Taste from the epiglottis is carried by which nerve?

a. Facial
b. Glossopharyngeal
c. Trigeminal
d. Vagus

Correct answer: d. Vagus (internal laryngeal branch)

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4. Which papillae are keratinised and provide friction during mastication?

a. Fungiform
b. Vallate

c. Filiform
d. Foliate

Correct answer: c. Filiform

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5. A patient has loss of taste from the anterior two-thirds but normal general sensation. Which nerve is damaged?

a. Lingual nerve before joining chorda tympani
b. Chorda tympani
c. Glossopharyngeal nerve
d. Vagus nerve

Correct answer: b. Chorda tympani

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6. Paralysis of which muscle causes the tongue to fall backward and obstruct the airway?

a. Styloglossus
b. Palatoglossus
c. Genioglossus
d. Hyoglossus

Correct answer: c. Genioglossus

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7. Posterior one-third of the tongue develops from which embryological structure?

a. Lateral lingual swellings
b. Hypobranchial eminence
c. Tuberculum impar
d. Epiglottic swelling

Correct answer: b. Hypobranchial eminence

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8. Taste fibres from the posterior third of the tongue terminate in which nucleus?

a. Motor nucleus of V
b. Nucleus ambiguus
c. Nucleus tractus solitarius
d. Chief sensory nucleus

Correct answer: c. Nucleus tractus solitarius

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9. On protrusion, the tongue deviates to the left. Which side's hypoglossal nerve is lesioned?

a. Left
b. Right
c. Both sides
d. Cannot determine

Correct answer: a. Left

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10. Which extrinsic muscle elevates and retracts the tongue?

a. Hyoglossus
b. Genioglossus
c. Styloglossus
d. Palatoglossus

Correct answer: c. Styloglossus

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11. Which of the following structures forms the anterior boundary of the oropharyngeal isthmus?

a. Palatoglossal arch
b. Palatopharyngeal arch
c. Faucial isthmus
d. Sulcus terminalis

Correct answer: a. Palatoglossal arch

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12. Which papillae are most developed in newborns but diminish with age?

a. Fungiform
b. Filiform
c. Foliate
d. Vallate

Correct answer: c. Foliate

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13. Loss of taste from vallate papillae occurs in a lesion of:

a. Facial nerve
b. Glossopharyngeal nerve
c. Trigeminal nerve
d. Vagus nerve

Correct answer: b. Glossopharyngeal nerve

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14. Which of the following contains lymphoid follicles forming part of Waldeyer's ring?

a. Anterior two-thirds
b. Posterior one-third
c. Tip of tongue
d. Inferior surface

Correct answer: b. Posterior one-third

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15. Which statement about the tongue's blood supply is TRUE?

a. Lingual artery is straight and fixed
b. Lingual artery is tortuous and moves during swallowing
c. Venous drainage is mainly to subclavian vein
d. Arterial supply is via facial artery alone

Correct answer: b. Lingual artery is tortuous and moves with pharyngeal movements

Viva Voce — Tongue

1. What are the parts of the tongue?

- Tip
- Body (anterior two-thirds)
- Posterior one-third
- Posteriormost part near epiglottis

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2. What is the sulcus terminalis?

- A **V-shaped groove** separating anterior two-thirds from posterior one-third.

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3. Name the papillae of the tongue.

- Vallate
- Fungiform
- Filiform
- Foliate

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4. Which papillae contain the maximum number of taste buds?

- **Vallate papillae**

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5. Which papillae are keratinised?

- **Filiform papillae**

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6. Which nerve carries general sensation from the anterior two-thirds?

- **Lingual nerve**

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7. Which nerve carries taste from the anterior two-thirds?

- **Chorda tympani** (via lingual nerve)

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8. Which nerve carries sensation and taste from the posterior one-third?

- **Glossopharyngeal nerve**

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9. Which nerve carries taste from the posteriormost part and epiglottis?

- **Internal laryngeal branch of vagus**

---

10. Name the intrinsic muscles of the tongue.

- Superior longitudinal
- Inferior longitudinal
- Transverse
- Vertical

---

11. Name the extrinsic muscles of the tongue.

- Genioglossus
- Hyoglossus
- Styloglossus
- Palatoglossus

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12. What is the nerve supply of palatoglossus?

- **Pharyngeal plexus** (not hypoglossal)

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13. What happens in hypoglossal nerve palsy?

- Tongue **deviates toward the affected side** on protrusion.

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14. Which muscle prevents the tongue from falling back?

- **Genioglossus** — called the *life-saving muscle*.

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15. What forms the lingual tonsil?

- **Lymphoid follicles** in the posterior one-third of the tongue.

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16. Why do sublingual drugs act quickly?

- Rich vascularity
- Direct entry into systemic circulation

- **Bypasses portal system**

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17. What muscle elevates and retracts the tongue?

- **Styloglossus**

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18. What muscle depresses the tongue?

- **Hyoglossus**

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19. What muscle protrudes the tongue?

- **Genioglossus**

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20. Why does the tongue swell rapidly in infections?

- Presence of **loose areolar tissue**
- Rich lymphatic drainage

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21. What does deviation of the uvula indicate?

(Not exactly tongue, but commonly asked with it)

- Lesion of the **vagus nerve**, uvula deviates **away** from the lesion.

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22. From which pharyngeal arches does the tongue develop?

- Anterior 2/3 ? **First arch**

- Posterior 1/3 ? **Third arch**
- Posteriormost part ? **Fourth arch**

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23. What forms the median glossoepiglottic fold?

- Mucosal fold attaching the **epiglottis to the tongue**.

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24. What are the valleculae?

- Small depressions between the **median and lateral glossoepiglottic folds**.