

**scsha**

# Journey to the Peak of Clinical Excellence

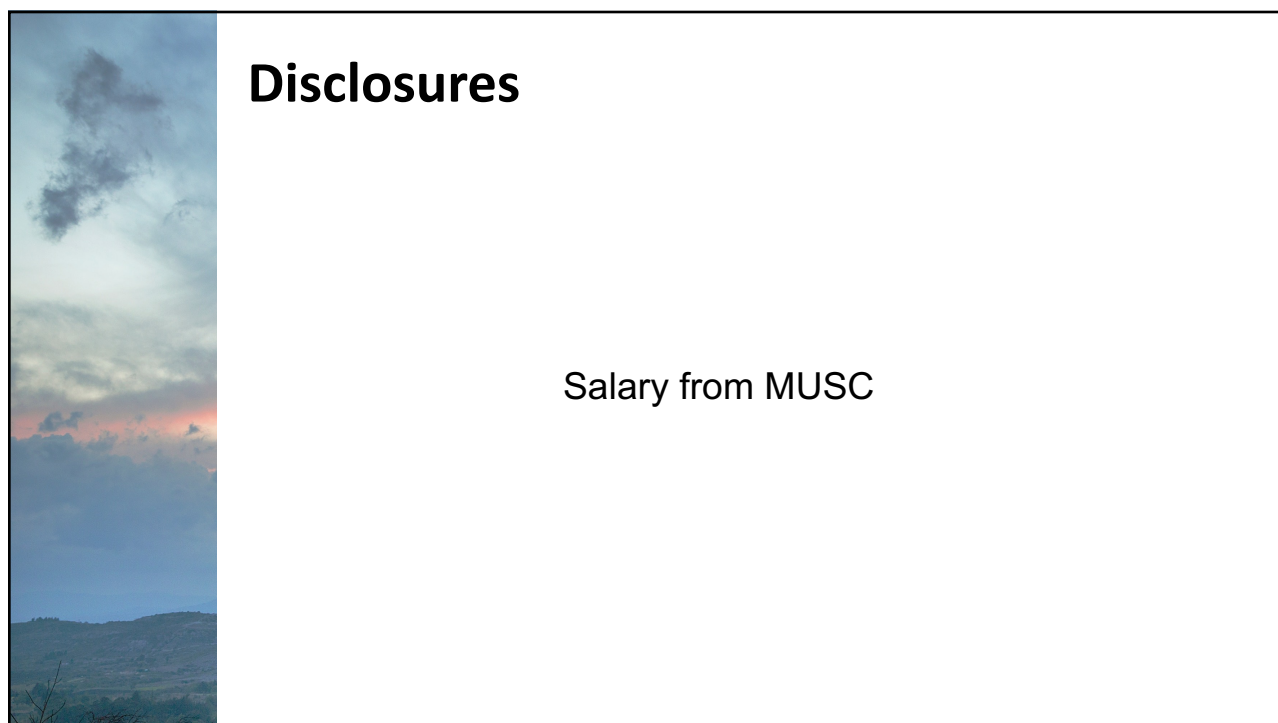
## Cranial Nerve and Musculature Review for Clinical Speech and Swallow Evaluations

*presented by:*

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#SCSHA2024

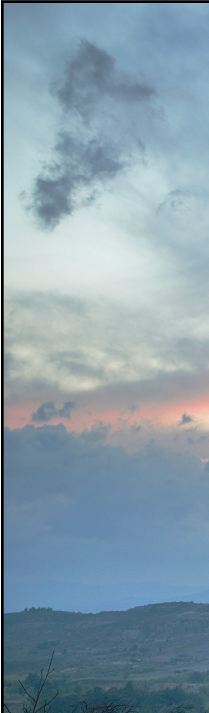
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## Disclosures

Salary from MUSC

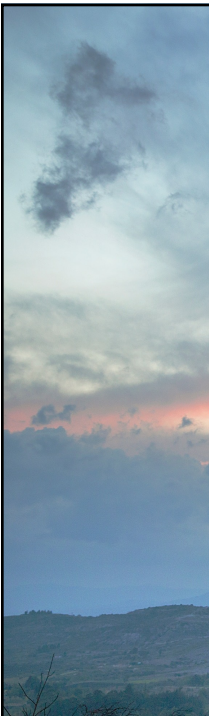
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## Objectives

- 1**  
The audience will be able to identify muscles and structures critical to speech and swallowing.
- 2**  
The audience will be able to identify innervation critical to speech and swallowing.
- 3**  
The audience will be able to state the possible impact muscular weakness, or incoordination could have on speech and swallowing

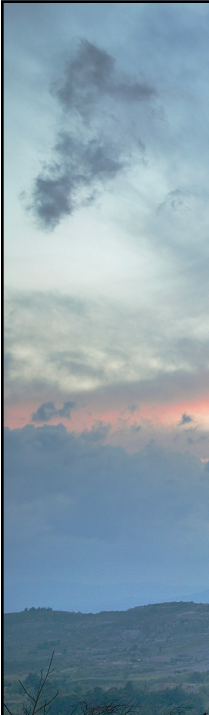
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## Background

- SLP over 35 years
- PhD after 30 years of clinical practice, swallowing
- Adult acute care
- Schools, outpatient, inpatient rehab, SNF, but primarily Acute Care

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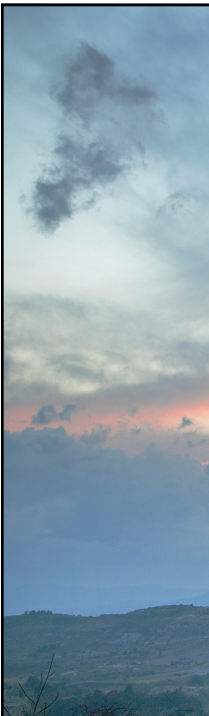


## Oral Mechanism Exam

Speech

Swallow


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## Motor pathway for cranial nerves

Volitional Movement

- Primary motor cortex
- Descends through the internal capsule
- Corticobulbar tracts
- Brainstem (Midbrain, Pons and Medulla)
- (motor and sensory nucleus)
- Cranial Nerve
- Muscle



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## Oral Mechanism Exam

FACE	
Motor: CN VII Facial (Facial expression)	
Sensory: CN V Trigeminal	
Motor CN VII	Sensory CN V
Facial symmetrical at rest	Id touch: forehead
Wrinkle forehead	cheeks, above lips
Close eyes tightly	below lips, chin
Smile, pucker	
Blow out cheeks and hold	
Maintain lip seal	

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## Oral Mechanism Exam

Facial Symmetry, Movement, and Sensation			
Motor: Cranial Nerve (CN) VII Facial, facial expression			
Sensory: CN V Trigeminal, sensation			
Motor: CN VII Facial	Muscles innervated	Sensory: CN V Trigeminal	Branch
Facial symmetrical at rest Smile, pucker Blow out cheeks and hold Maintain lip seal	orbicularis oris, zygomaticus minor/major, levator anguli oris, risorius, depressor anguli oris, depressor labii inferioris, levator labii superioris (alaequei nasi), mentalis	Id touch: forehead	Ophthalmic
Wrinkle forehead	Frontalis	Cheeks, above lips	Maxillary
Close eyes tightly	Orbicularis oculi	Below lips, chin	Mandibular

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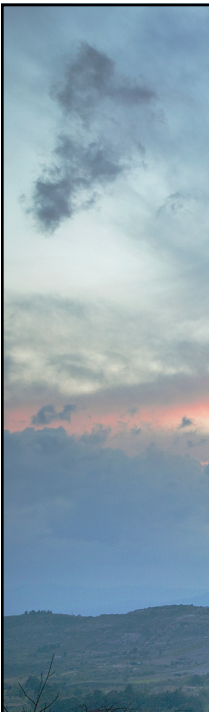


# Cranial nerve VII Facial

Motor nucleus  
Pons

DUFFY and anatomy.app

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# Cranial nerve VII Facial

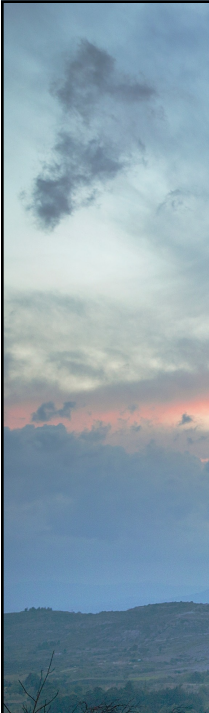
Motor

- Lip muscles: orbicularis oris, zygomaticus minor/major, levator anguli oris, risorius, depressor anuguli oris

DUFFY

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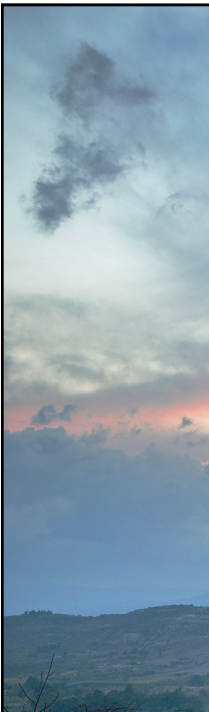
## Cranial nerve VII Facial

Motor

- **Buccinator**

DUFFY

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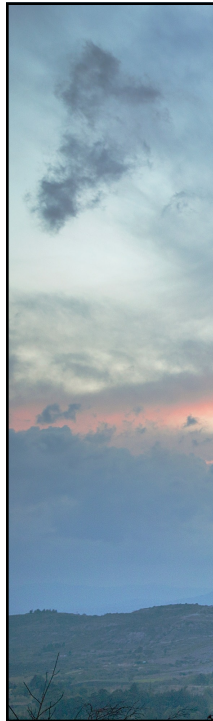
## Cranial nerve VII Facial

Motor

- **Posterior belly of digastricus (opens jaw, elevates hyoid)**

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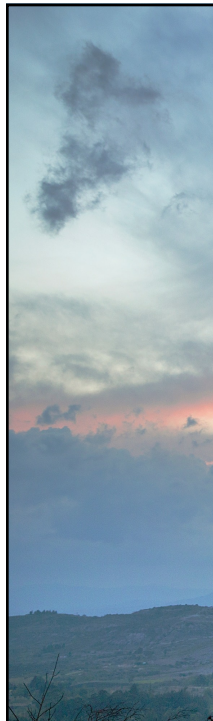
## Cranial nerve VII Facial

### Motor

- **Stylohyoid (stabilizes floor of mouth for chewing, tongue retraction, airway open during inspiration)**

DUFFY

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## Cranial nerve V Trigeminal

### Sensory to Face

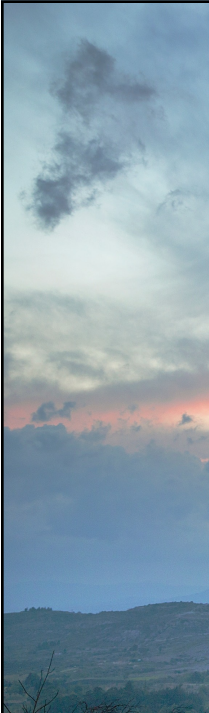
Ophthalmic – forehead and nose  
Maxillary – side of face, nose upper lip, cheeks  
Mandibular - lower lip to ears

Division of CN V (Inferior alveolar nerve)

DIV II upper teeth  
DIV III lower teeth

Duffy

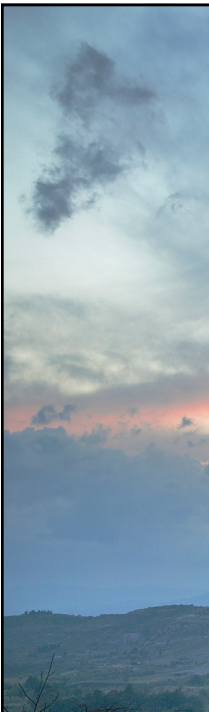
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## Cranial nerve VII Facial Deficits

- Speech
  - Imprecision of articulators
  - Rate
  - Intelligibly
- Swallow
  - Bolus placement
  - Bolus containment – lip closure
  - Lip seal for bolus transfer
  - Drooling
  - Salivary glands (Tears)

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## Cranial nerve VII Facial Deficits

- LMN
  - Ipsilateral side
  - Entire face
  - Voluntary, emotional, reflex movement
  - Facial asymmetry
- UMN
  - Contralateral
  - Lower face only
  - Voluntary movement
  - Facial asymmetry

Dulak & Naqui 2021

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## Oral Mechanism Exam

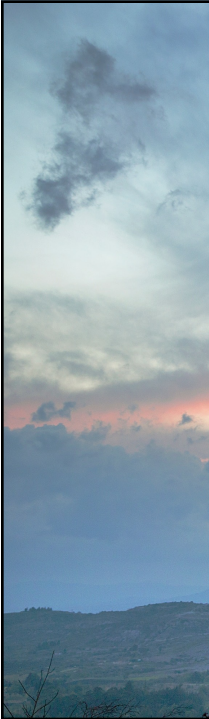
<b>Mouth (Jaw/Tongue/Oral Cavity)</b>	
Motor: Jaw – CN V Trigeminal	
Sensory: Jaw (teeth) – CN V Trigeminal	
<b>Motor</b>	<b>Sensory</b>
Jaw symmetrical at rest	Lower and upper gum (feel teeth/pain)
Open and closes jaw	
Jaw moves laterally	
Resist attempts to open/close jaw	

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## Oral Mechanism Exam

Mouth (Jaw)		
Motor: Jaw CN V – Trigeminal		
Sensory: Teeth CN V – Trigeminal		
<b>Motor: CN V – Trigeminal</b>	<b>Muscles</b>	<b>Sensory: CN V – Trigeminal</b>
Jaw symmetrical at rest Open and close jaw (with and without resistance) Lateral movement of jaw Chewing	Masseter Temporalis Pterygoids (lateral/medial)	Lower and upper teeth/gum

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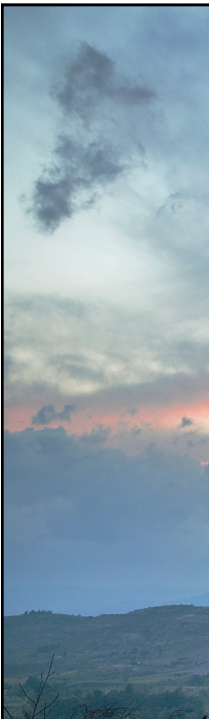


# Cranial nerve V Trigeminal

Motor nucleus in the Pons

DUFFY

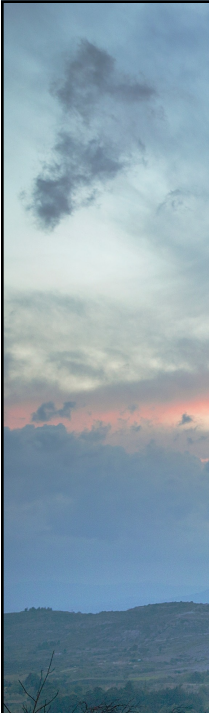
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# Cranial nerve V Trigeminal

Motor nucleus in the **Pons**  
Mandibular branch of the CN V

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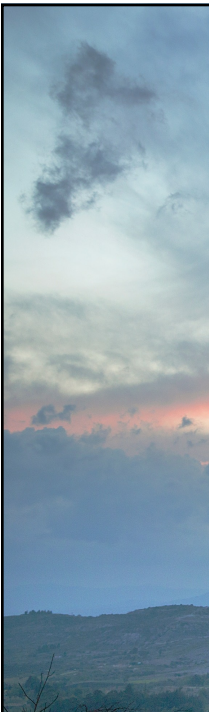


## Cranial nerve V Trigeminal

- Mandibular branch
  - Muscles of mastication
    - Temporalis
    - Masseter

Duffy

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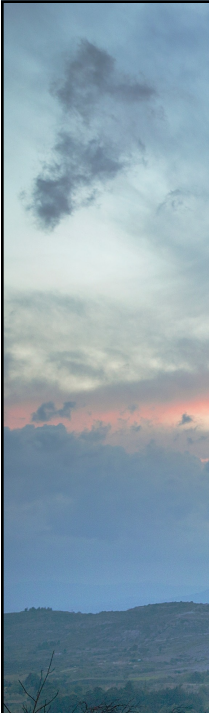


## Cranial nerve V Trigeminal

- Mandibular branch
  - Muscles of mastication
    - Pterygoids
      - Lateral
      - Medial

Duffy

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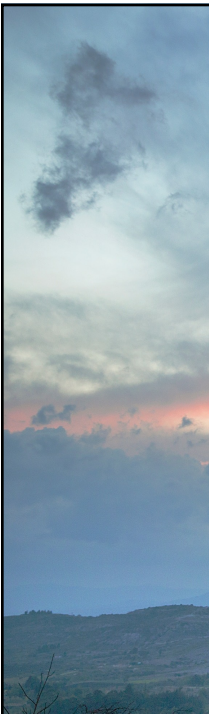


## Cranial nerve V Trigeminal

Anterior belly of digastric	Mylohyoid	Tensor Veli Palatini
<ul style="list-style-type: none"> <li>• Jaw opening</li> <li>• Jaw movement for chewing</li> <li>• Stabilizes hyoid during swallow</li> </ul>	<ul style="list-style-type: none"> <li>• Elevates Hyoid Bone</li> <li>• Reinforces floor of mouth</li> </ul>	<ul style="list-style-type: none"> <li>• Tenses soft palate</li> <li>• Assists in elevation soft palate</li> </ul>

Duffy

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## Cranial nerve V Trigeminal Deficits

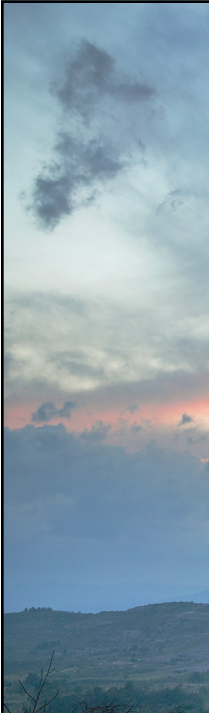
Unilateral lesion – minimal deficits

Bilateral lesion – significant deficits

Duffy

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## Cranial nerve V Trigeminal Deficits



Speech

Jaw opening, Jaw closing

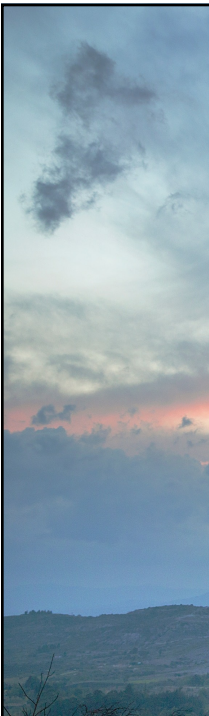
Speech production

Swallow

Mastication

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## Cranial nerve V Trigeminal Deficits



Anterior belly of digastric	Mylohyoid	Tensor Veli Palatini
<ul style="list-style-type: none"> <li>• Speech Articulation</li> <li>• Opening jaw to accept bolus</li> <li>• Chewing</li> <li>• Hyoid bone movement</li> <li>• Epiglottic movement</li> <li>• PES opening</li> </ul>	<ul style="list-style-type: none"> <li>• Jaw opening</li> <li>• Lingual motion</li> <li>• Hyoid movement</li> <li>• Floor of mouth</li> <li>• PES opening</li> </ul>	<ul style="list-style-type: none"> <li>• Bolus hold in oral cavity</li> <li>• Nasal invasion of the bolus</li> <li>• Resonance</li> </ul>

Duffy

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## Oral Mechanism Exam

Mouth (Jaw/Tongue/Oral Cavity)	
Motor: CN XII HYPOGLOSSAL	
Sensory: Taste – CN VII FACIAL anterior 2/3, CN IX GLOSSOPHARYNGEAL (posterior 1/3),	
General Sensation: CN V TRIGEMINAL anterior 2/3, CN IX GLOSSOPHARYNGEAL posterior 1/3	
<b>Motor CN XII</b>	<b>Sensory V, VII, IX</b>
Tongue any movement at rest (fasciculations)	Taste Anterior 2/3 of tongue
Tongue protrusion, deviates	Taste posterior 1/3 of tongue
Move tongue side to side (against resistance)	General sensation
Retract tongue	
Lick lips, sweep teeth	

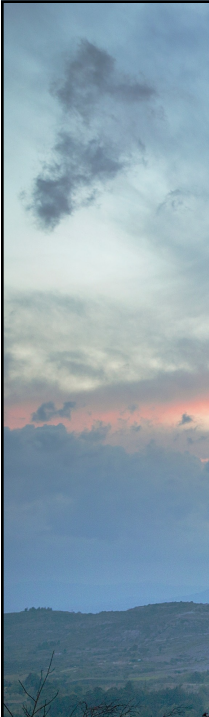
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## Oral Mechanism Exam

Mouth (Tongue)			
Motor: CN XII Hypoglossal (muscle wasting and deviates to damage side LMN, UMN deviates away from damaged side)			
Sensory: Taste – CN VII Facial (taste anterior 2/3), CN IX Glossopharyngeal (taste posterior 1/3)			
General – V Trigeminal, IX Glossopharyngeal			
<b>Motor: CN XII</b>	<b>Muscles</b>	<b>Sensory: Taste VII, IX</b>	<b>Sensory: V, IX</b>
Tongue symmetry Tongue shaping	Intrinsic tongue muscles	Taste: anterior 2/3, posterior 1/3	General sensation
Protrusion, lateralization, Tip elevation	Extrinsic tongue muscle Genioglossus Hyoglossus Styloglossus		
Posterior elevation	Palatoglossus CN X		

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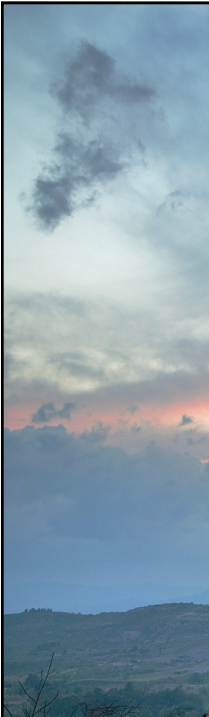


# Cranial nerve XII Hypoglossal

Motor nucleus in the **Medulla**

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# Cranial nerve XII Hypoglossal

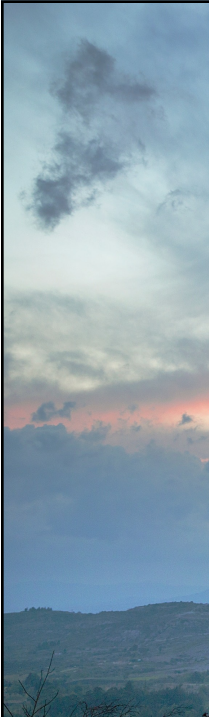
Motor  
protrude tongue,  
retract, depress  
and change shape

Intrinsic muscles of  
the tongue

Extrinsic muscles of the  
tongue (except  
palatoglossus CV X)

Kim & Naqvi 2021

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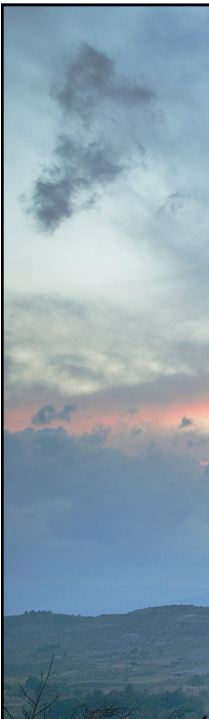
## Cranial nerve XII Hypoglossal

Extrinsic muscles of the Tongue

- Genioglossus – tongue
- Hyoglossus – retracts and depressed tongue
- Styloglossus – tongue upward
- Palatoglossus CV X – elevates posterior tongue

Kim & Naqvi 2021

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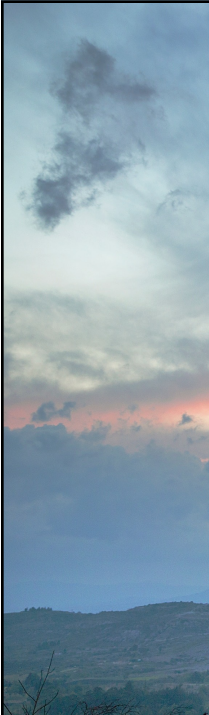


## Cranial nerve XII Hypoglossal

Sensory Taste:  
Anterior 2/3 CN VII Facial  
Posterior 1/3 CN IX  
Glossopharyngeal

General sensation:  
Anterior 2/3 CN V  
Trigeminal  
Posterior 1/3 CN IX  
Glossopharyngeal

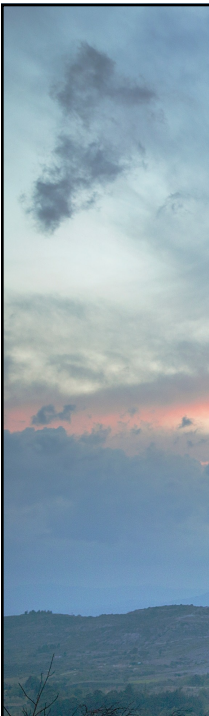
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## Cranial nerve X Vagus

Palatoglossus  
tongue retraction  
posterior tongue elevation

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## Cranial nerve XII Hypoglossal Deficits

Speech  
Manner and precision of articulation

Swallow  
Bolus hold  
Lingual movement  
Mastication  
Oral residue  
Tongue base retraction  
Pharyngeal residue

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## Cranial nerve XII Hypoglossal Deficits

LMN  
Motor nucleus in the brainstem  
and nerve)

UMN  
Above the brainstem nucleus

Paralysis on side of lesion  
Fasciculations  
Atrophy  
Deviate toward the side of the  
lesion (due to overaction of intact  
genioglossus muscle on the  
opposite side)

Less weakness  
More transient in-nature  
Deviate toward the opposite side  
of lesion

Duffy

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## Oral Mechanism Exam

Mouth (Jaw/Tongue/**Oral Cavity**)

Motor: Palate/uvula CN V TRIGEMINAL and CN X VAGUS

Sensory: Gag CN IX GLOSSOPHARYNGEAL and CN X VAGUS

Motor		Sensory
Symmetry of palate/uvula mvmt (say "ah")		Palatal mvmt to touch
Gag		Touch to faucial arches, gag
Changes in salivation	Moist Dry Mouth	
Structures: Teeth	Native Sparce	
Dentures	Upper Lower	

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## Oral Mechanism Exam

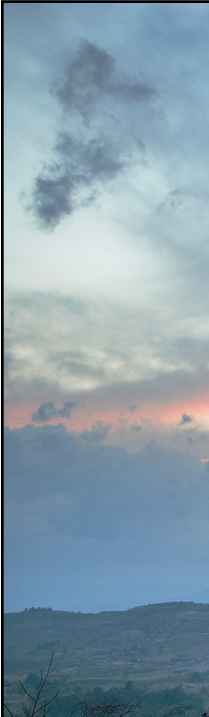
Mouth (Oral Cavity)		
Motor: Palate/uvula CN V Trigeminal and CN X Vagus		
Sensory: Gag CN IX Glossopharyngeal and CN X Vagus		
Motor: CN V Trigeminal	Muscles	Sensory: CN IX and CN X
Tenses soft palate	Tensor Veli Palatini	Gag
Motor: CN X Vagus		Swallow initiation
Elevates soft palate	Elevator Veli Palatini	Salivary glands CN VII, CN IX
Retracts palate	Musculus uvulae	

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## Oral Mechanism Exam

Voice/Larynx			
Motor: CN X VAGUS			
Sensory: CN X VAGUS (above TVC, below TVC)			
Motor: CN X Vagus	Muscles	Sensory: CN X Vagus	
Phonation	Laryngeal muscles (RLN) Pitch cricothyroid (SLN)	Above TVC	SLN: laryngeal above TVC, laryngeal vestibule, epiglottis, BOT, aryepiglottic folds
Swallow (pharyngeal and laryngeal elevation)	Pharyngeal constrictors Pharyngeal long muscles	Below TVC	RLN: Below TVC

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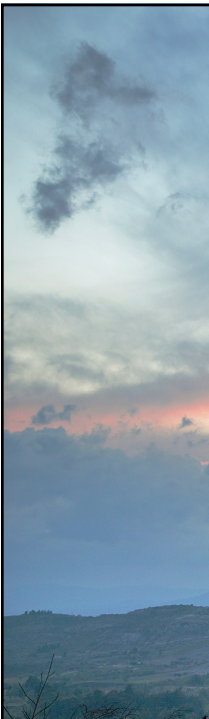


# Cranial nerve IX Glossopharyngeal

Motor nucleus in the **Medulla**  
Nucleus Ambiguus

Duffy

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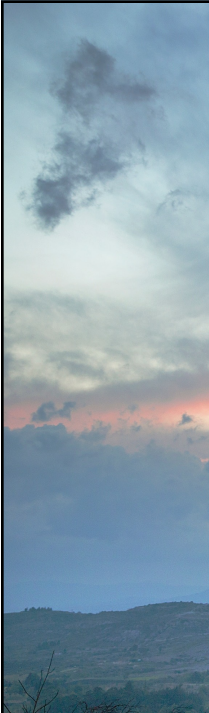
# Cranial nerve IX Glossopharyngeal

Sensory in the **Medulla**  
Tractus Solitarius  
Nucleus Solitarius

Duffy

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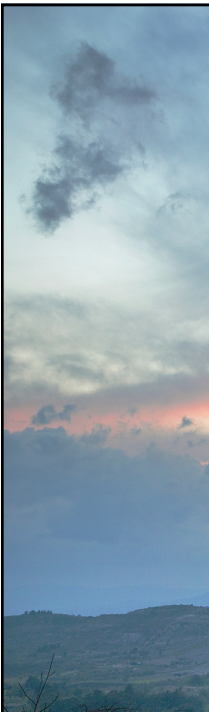


## Cranial nerve IX Glossopharyngeal

- Multiple branches
- Stylopharyngeus nerve – to stylopharyngeus muscle
- Lingual – posterior tongue
- Pharyngeal branch – pharynx

Duffy

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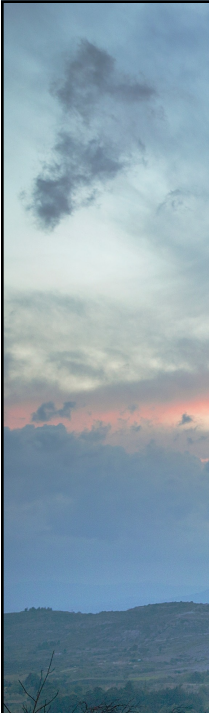


## Cranial nerve IX Glossopharyngeal

Stylopharyngeus  
Elevates  
Larynx and Pharynx

Duffy

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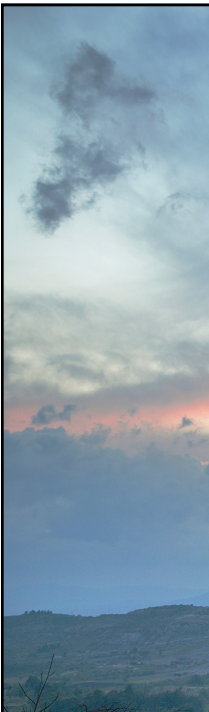


# Cranial nerve X Vagus

Motor nucleus in the **Medulla**  
Nucleus ambiguus  
Sensory Pons/Medulla

Duffy

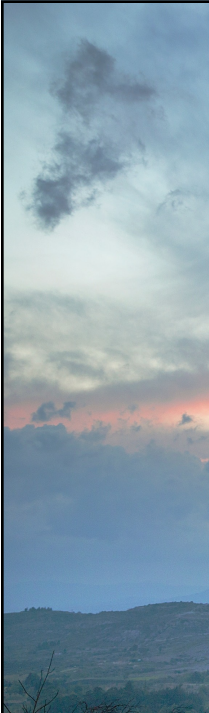
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# Cranial nerve X Vagus

- Multiple branches
- Pharyngeal branch
- Superior laryngeal nerve
- Recurrent laryngeal nerve

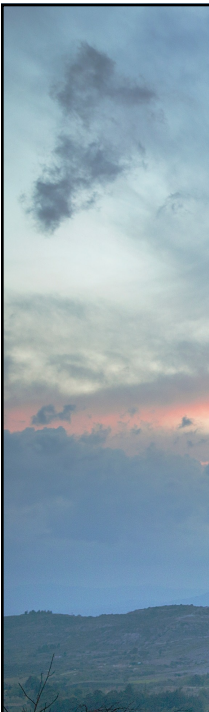
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## Cranial nerve X Vagus Pharyngeal branch

- Pharyngeal branch
- Sensory and Motor
- Pharyngeal muscles
- Palatal muscles

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## Cranial nerve X Vagus Pharyngeal branch

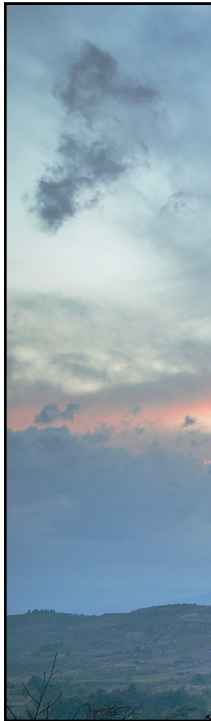
Pharyngeal Constrictors

- Superior
- Middle
- Inferior

Pharyngeal long muscles

- Salpingopharyngeus
- Palatopharyngeus
- Stylopharyngeus

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## Cranial nerve X Vagus Pharyngeal branch

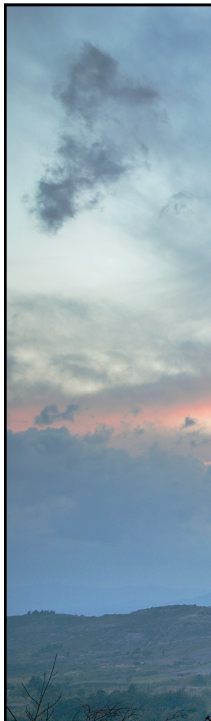
### Pharyngeal Constrictors

Constricts pharynx to move bolus to the esophagus

### Pharyngeal long muscles

Elevates and shortens the pharynx  
Assists in elevating larynx

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## Cranial nerve X Vagus – Superior Laryngeal

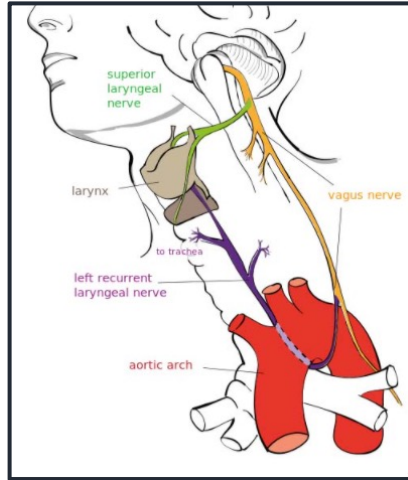
### Superior laryngeal nerve

Internal: Sensory  
Larynx (above TVC)  
Epiglottis  
Base of tongue  
Aryepiglottic folds

External: Motor innervation  
Cricothyroid muscle (raises pitch)

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## Cranial nerve X Vagus – Recurrent



**Recurrent laryngeal nerve**

Motor to all laryngeal muscles (except cricothyroid)

Sensation below the TVC

Slideshare.com

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## Cranial nerve X Vagus – Recurrent

Recurrent laryngeal nerve

Motor to all laryngeal muscles  
(except cricothyroid which increases pitch)

Thyroarytenoid  
length/tension of TVC (lowers pitch)

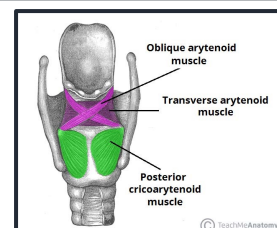
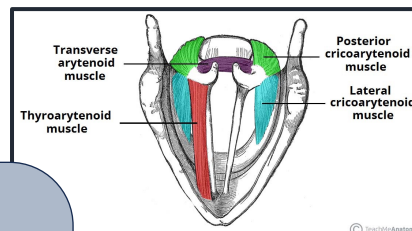
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## Cranial nerve X Vagus – Recurrent

Recurrent laryngeal nerve

Laryngeal muscles

- Transverse arytenoid –adducts arytenoids (closes)
- Oblique arytenoid – adducts arytenoids
- Lateral cricoarytenoid - adducts the TVC
- Posterior cricoarytenoid - abducts the TVC



TeachMeAnatomy

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## Cranial nerve X Vagus – RLN Deficits

Speech  
Primary voice and phonation

Swallow  
Swallow initiation  
Base of tongue retraction  
Pharyngeal Clearance -residue  
Laryngeal penetration/aspiration  
Sensation  
TVC closure  
Laryngeal vestibular closures  
PES opening

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## Cranial nerve IX Glossopharyngeal Deficits

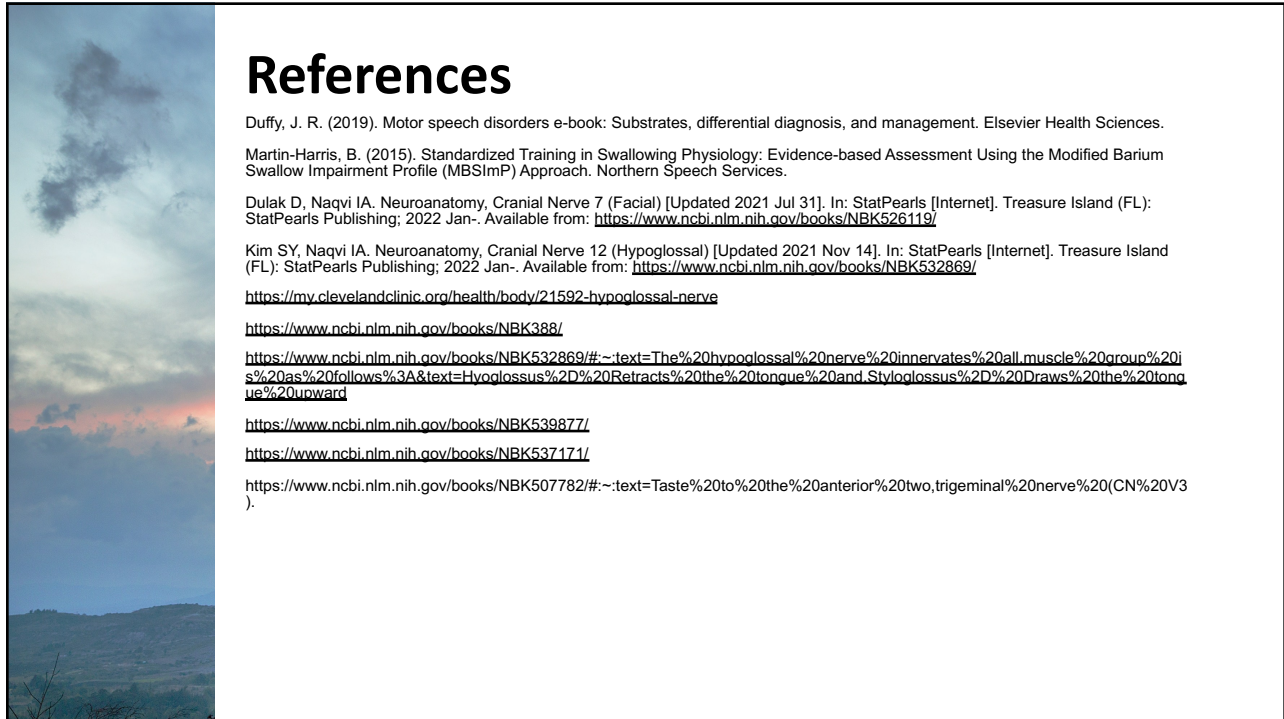
- Speech
- Minimal deficits
- Swallow
- Swallow initiation
- Gag reflex
- Decreased saliva production
- Decreased taste

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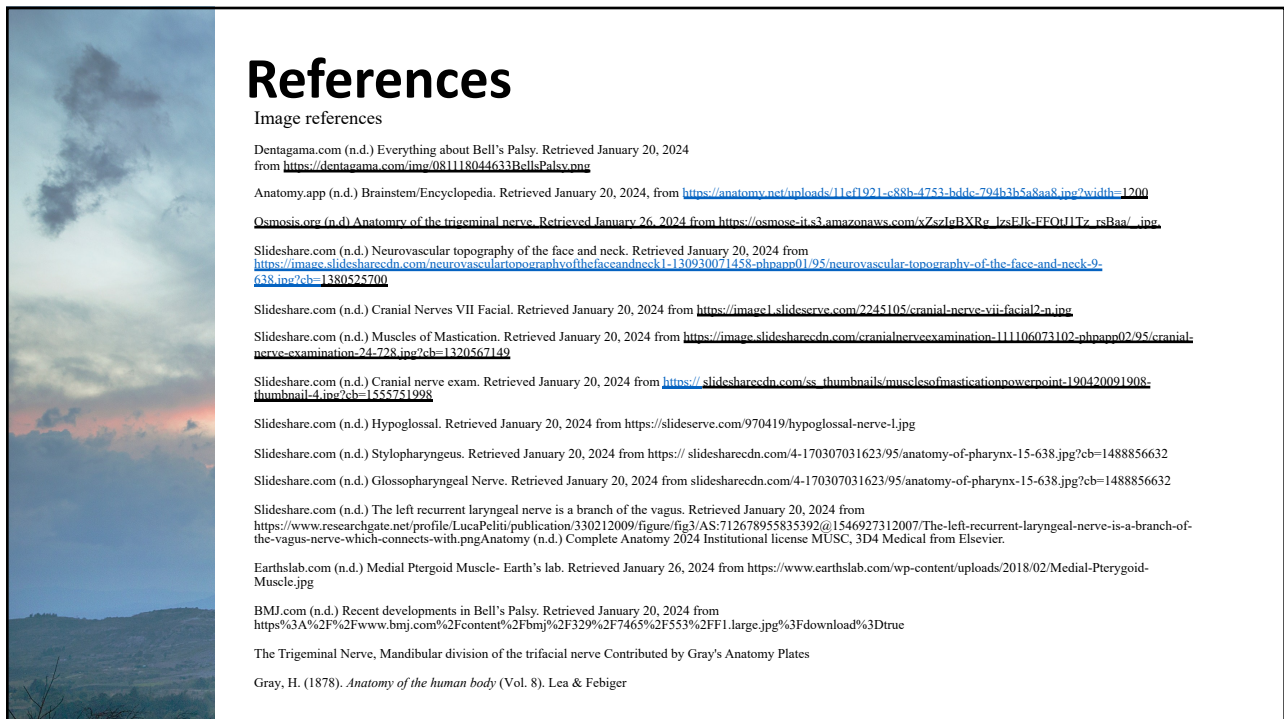
hopkinth@musc.edu

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# References

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