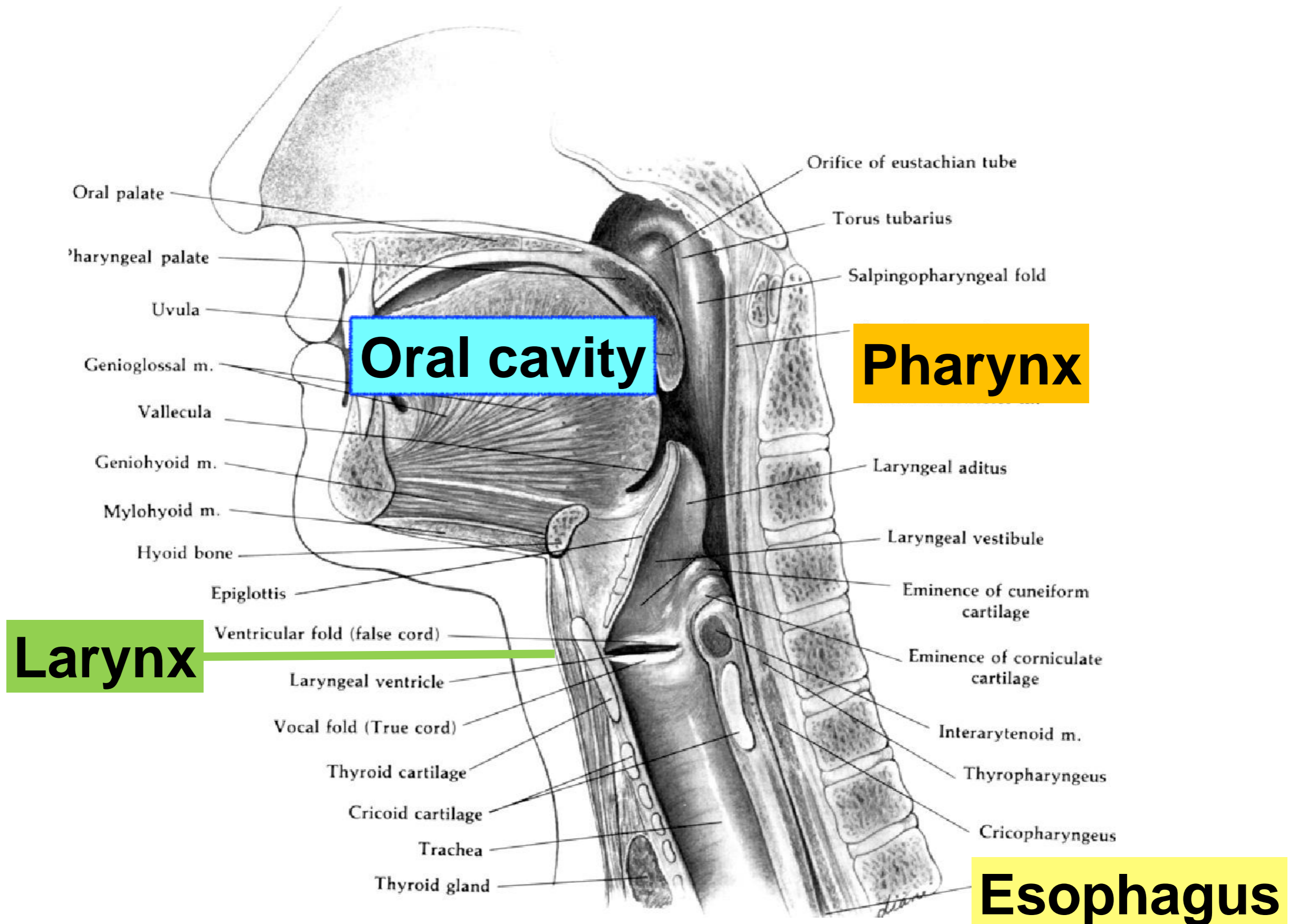


咀嚼與吞嚥相關解剖構造

余權航

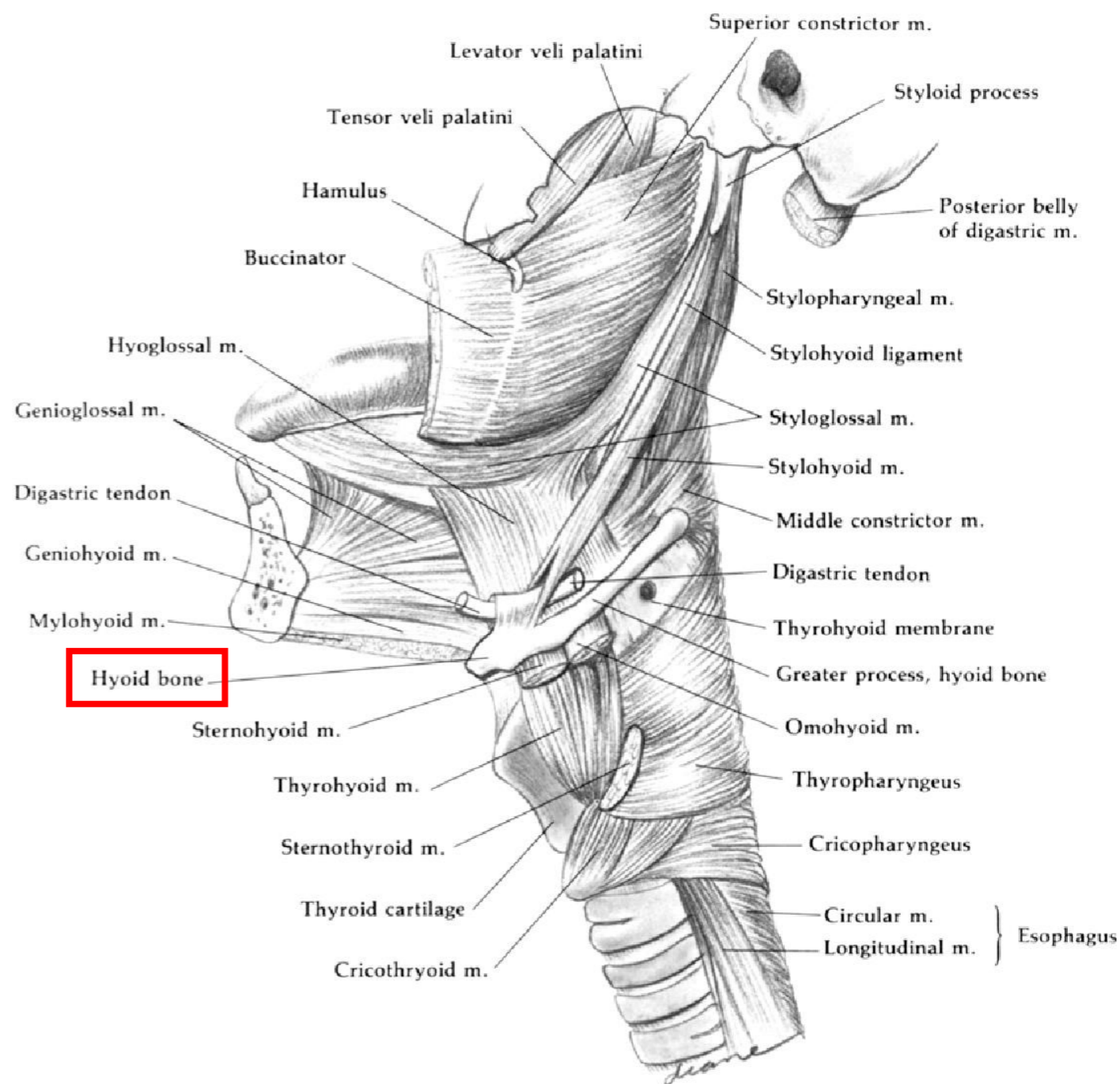
中山醫學大學牙醫學系教授
中山醫學大學附設醫院主治醫師

Four swallowing apparatus



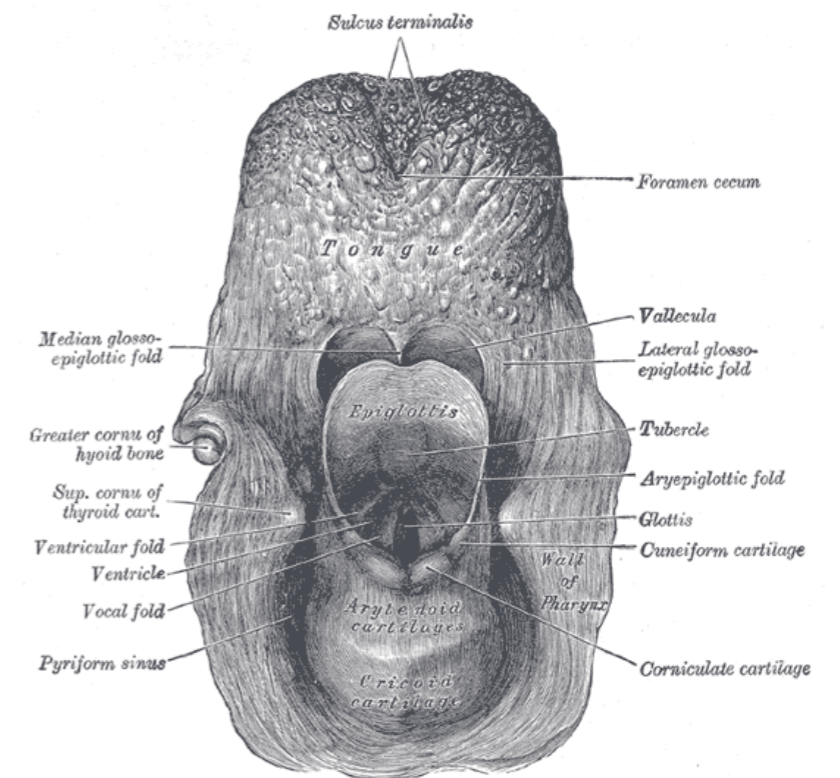
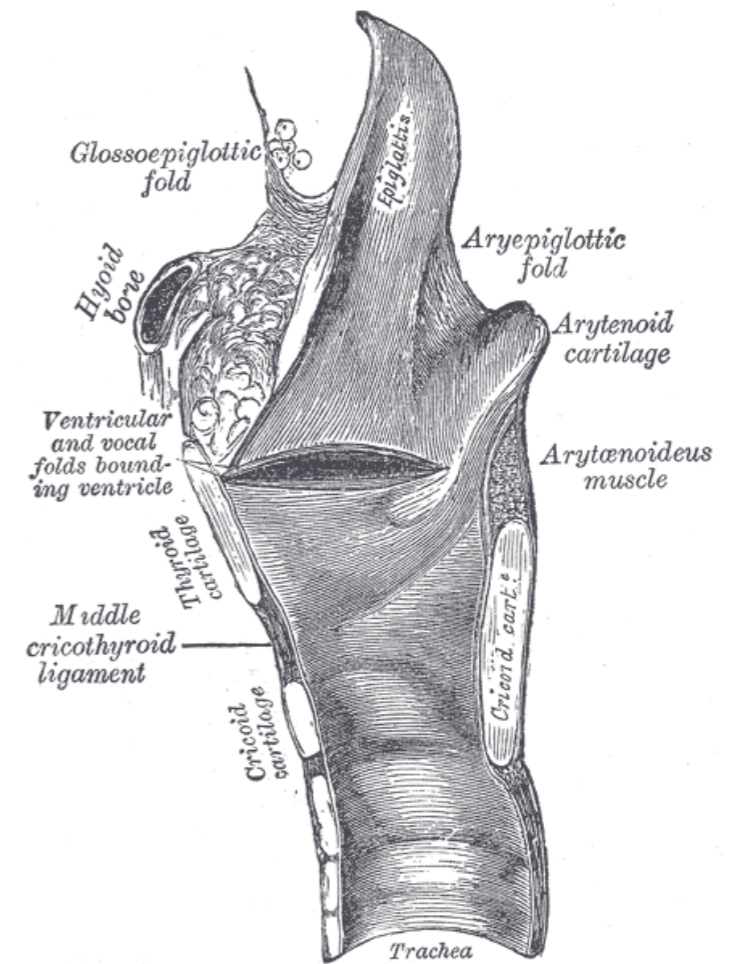
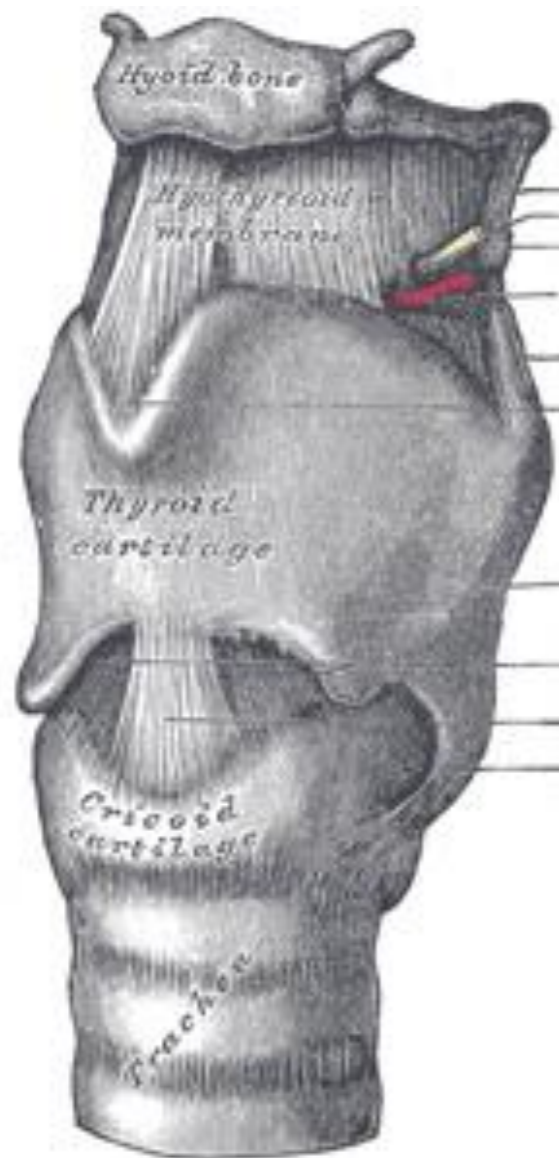
The hyoid bone

- Is suspended by muscles and ligaments between the **oral floor** and the **larynx**
- The **greater horn** and **body** are palpable in the neck
- The physiological movement of the hyoid bone can be palpated during **swallowing**



Cartilages of the larynx and pharynx

Thyroid
Cricoid
Arytenoids
Epiglottis

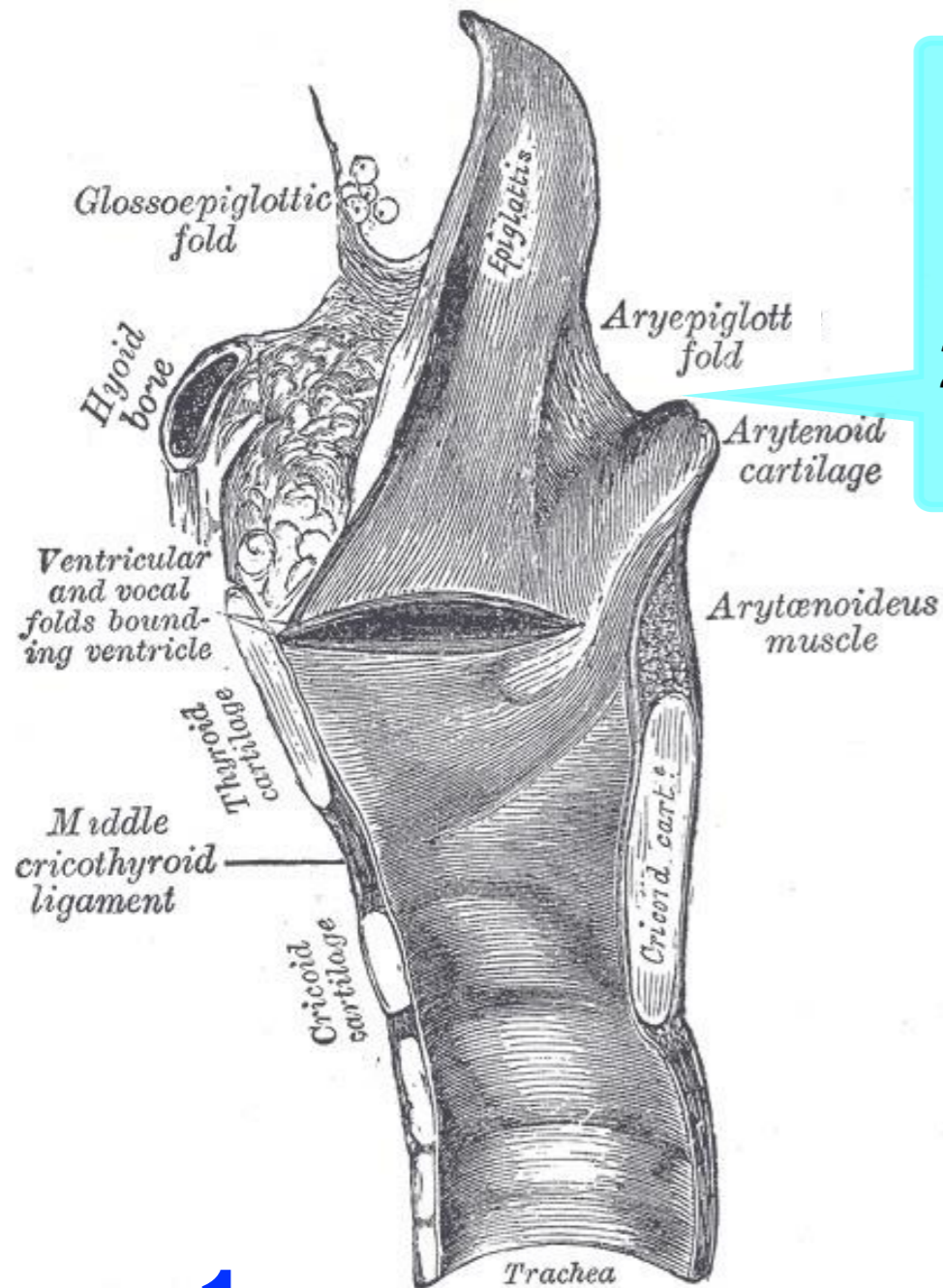


Henry Gray, 1918

The tilting down of the epiglottis - 2 steps

Upright resting to a transverse position:

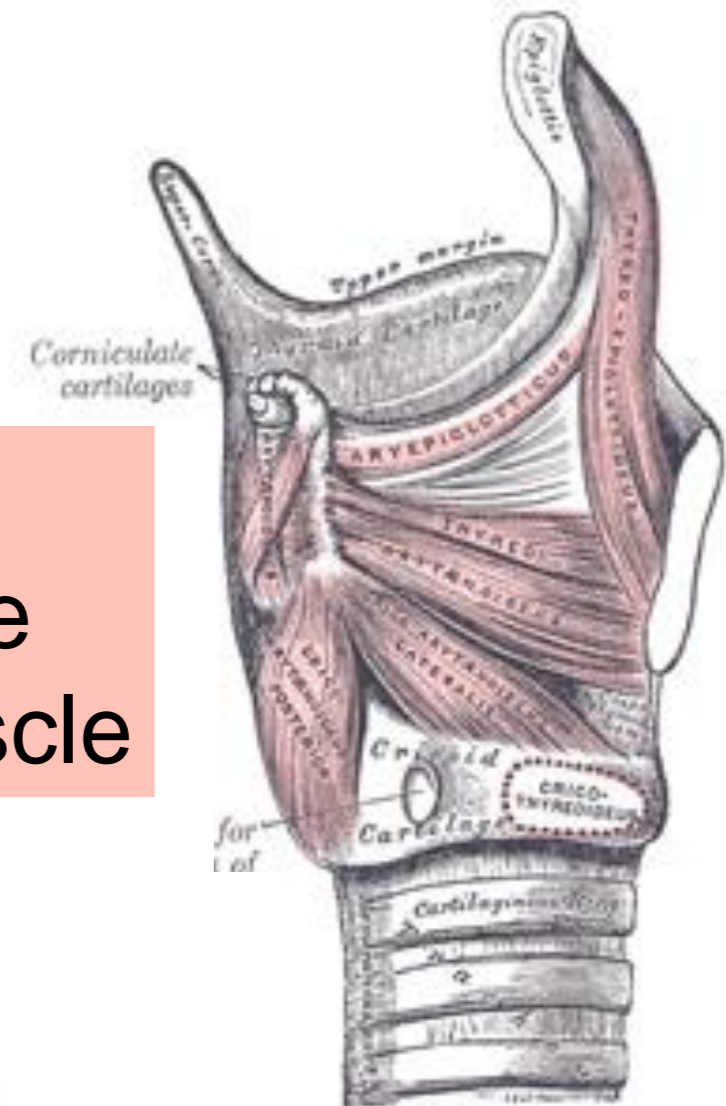
1. elevation of the **hyoid bone**
(stylohyoid, digastric, mylohyoid, geniohyoid muscles)
2. approximates the hyoid bone and the **thyroid cartilage** (thyrohyoid muscle)



Henry Gray, 1918

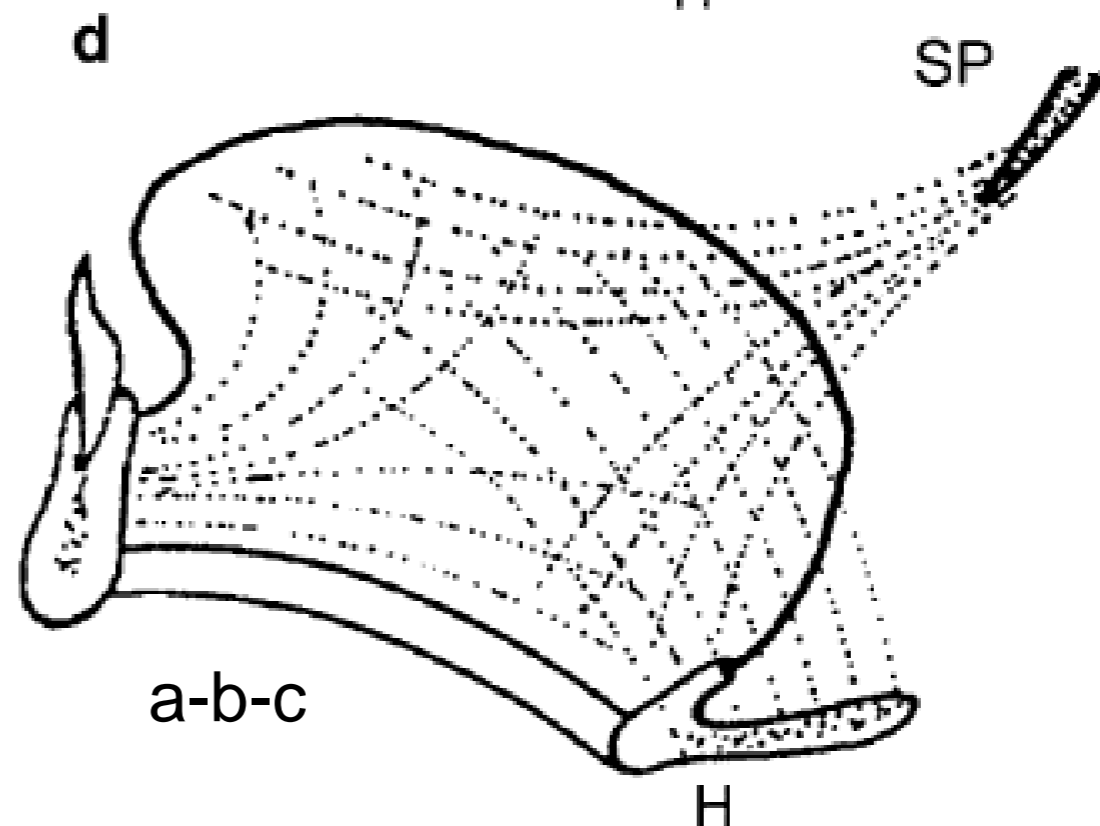
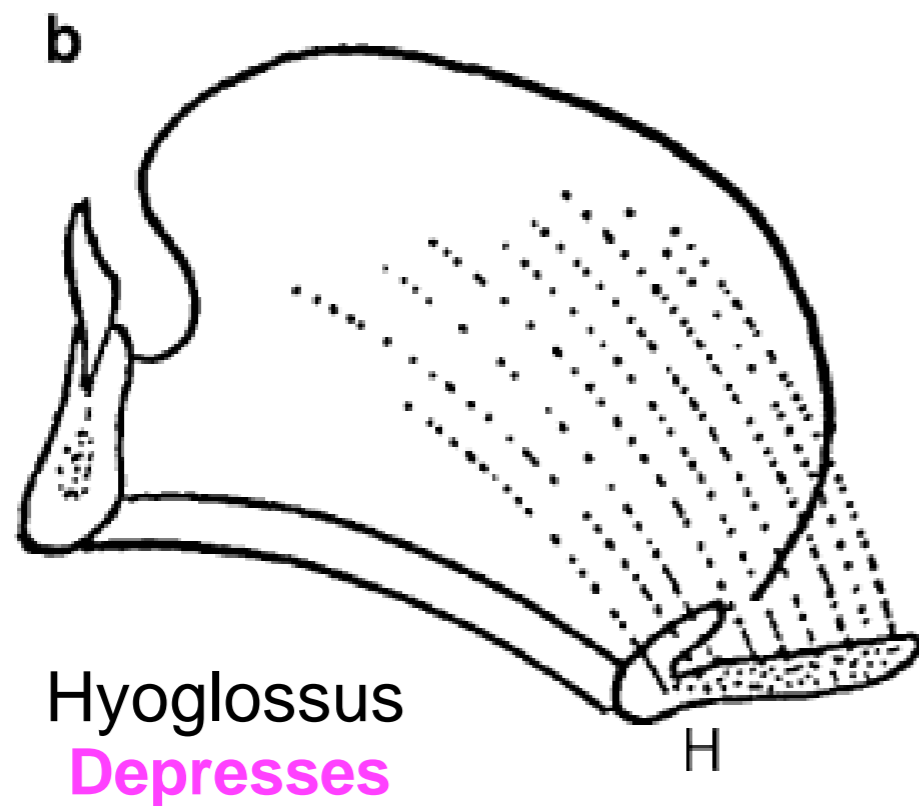
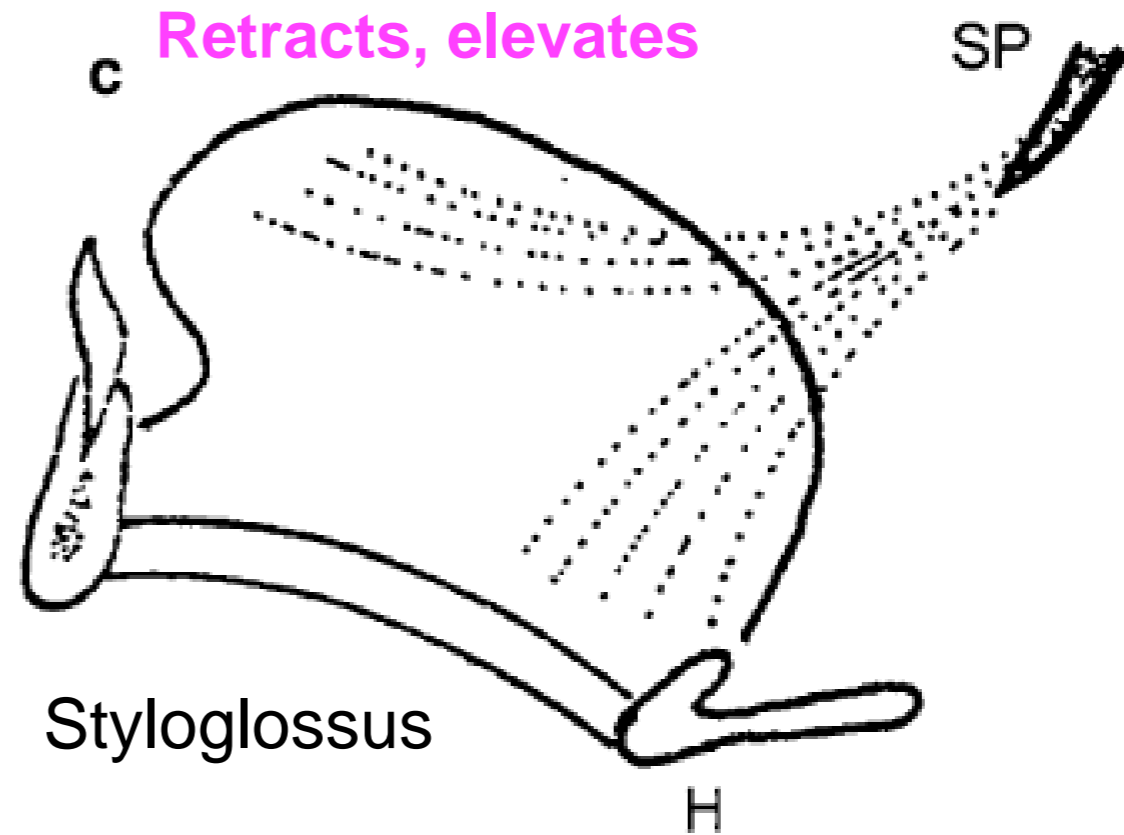
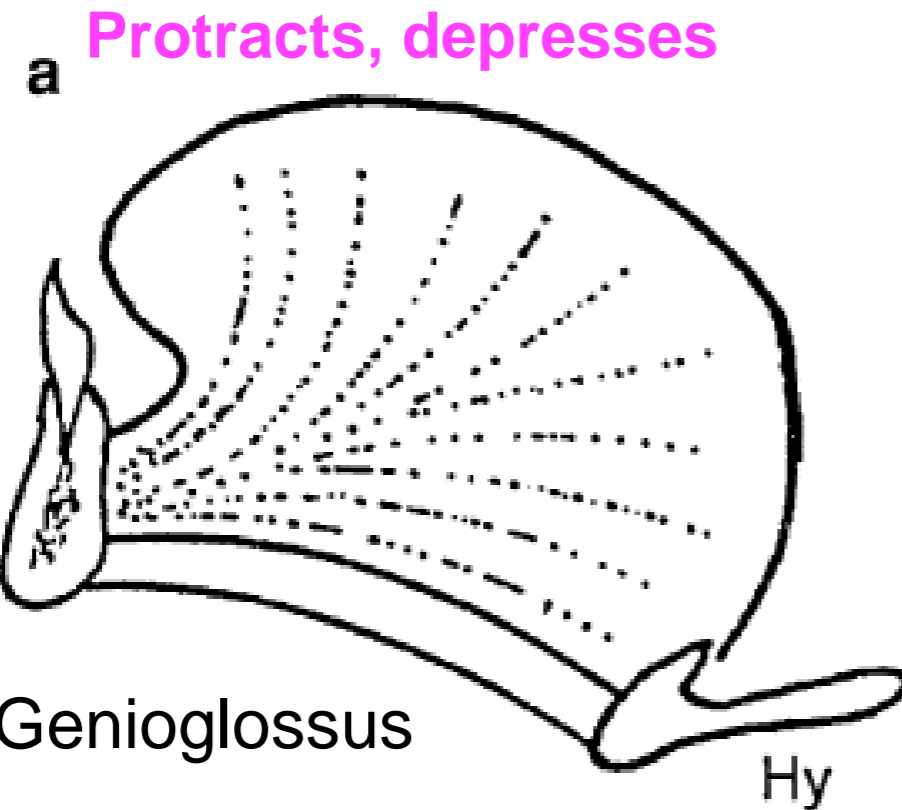
Further down:

1. Aryepiglottis muscle
2. Thyroepiglottic muscle

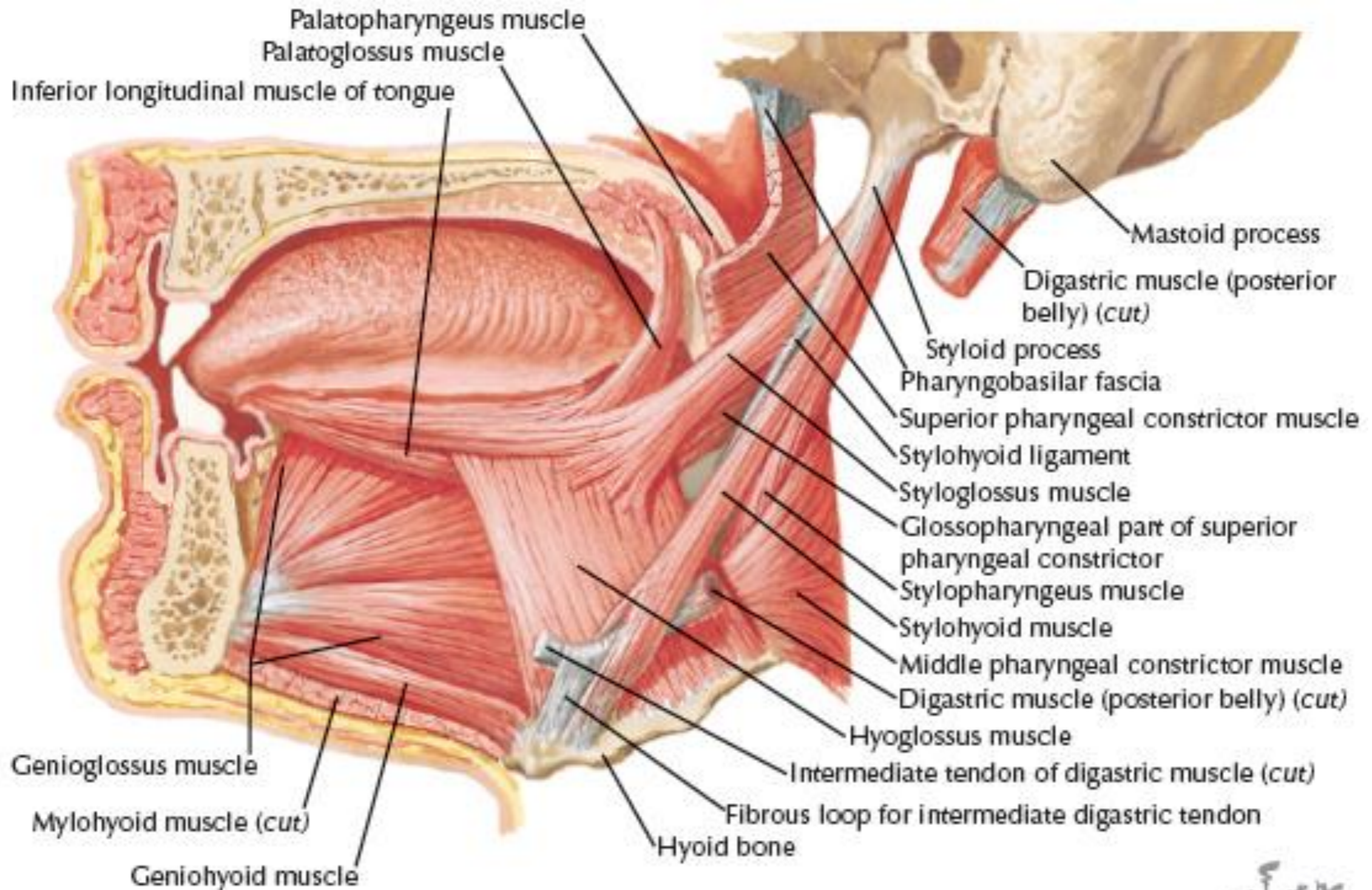


2

Extrinsic muscles of the tongue

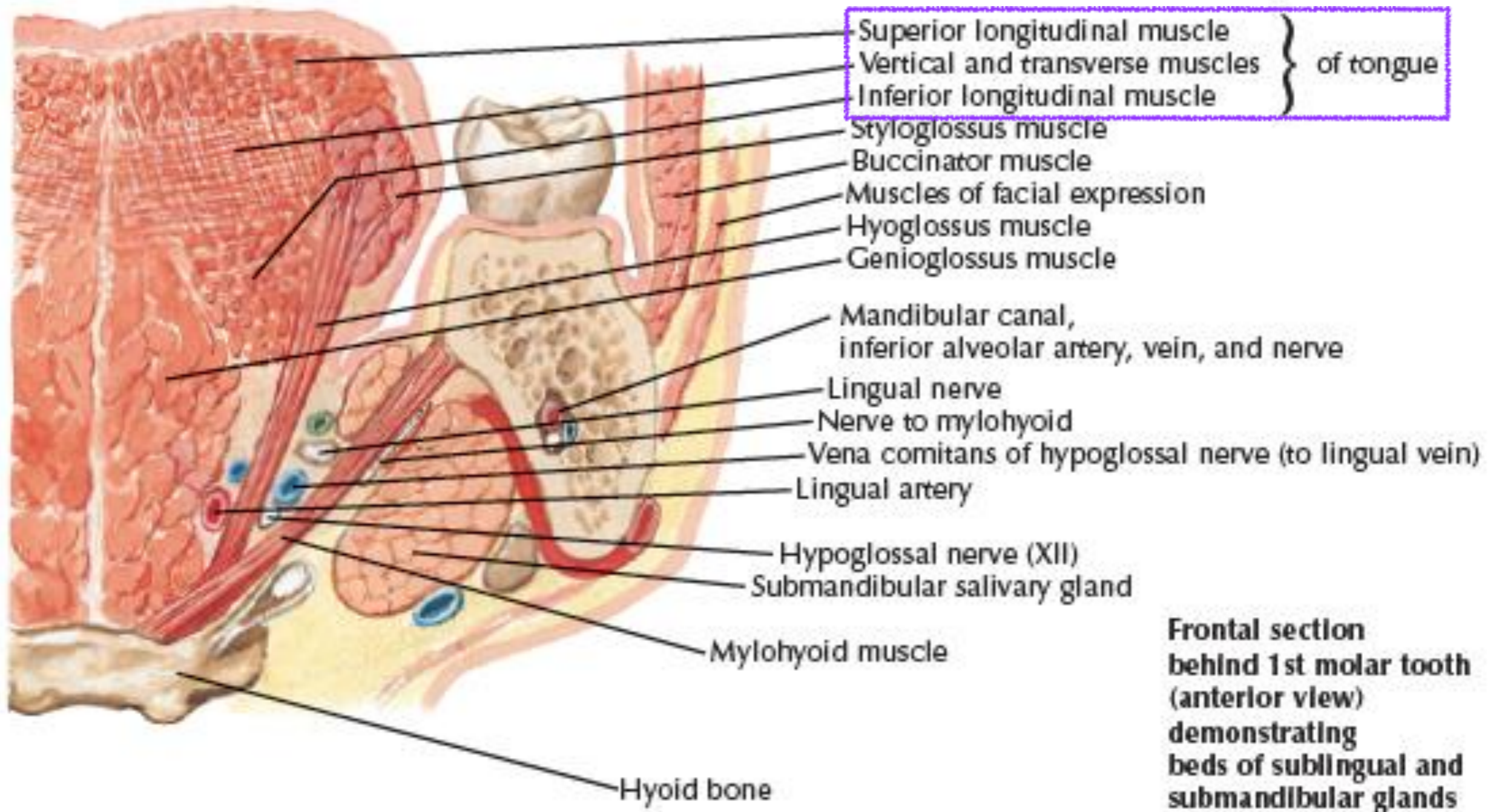


Extrinsic muscles of the tongue



F. Netter
M.D.

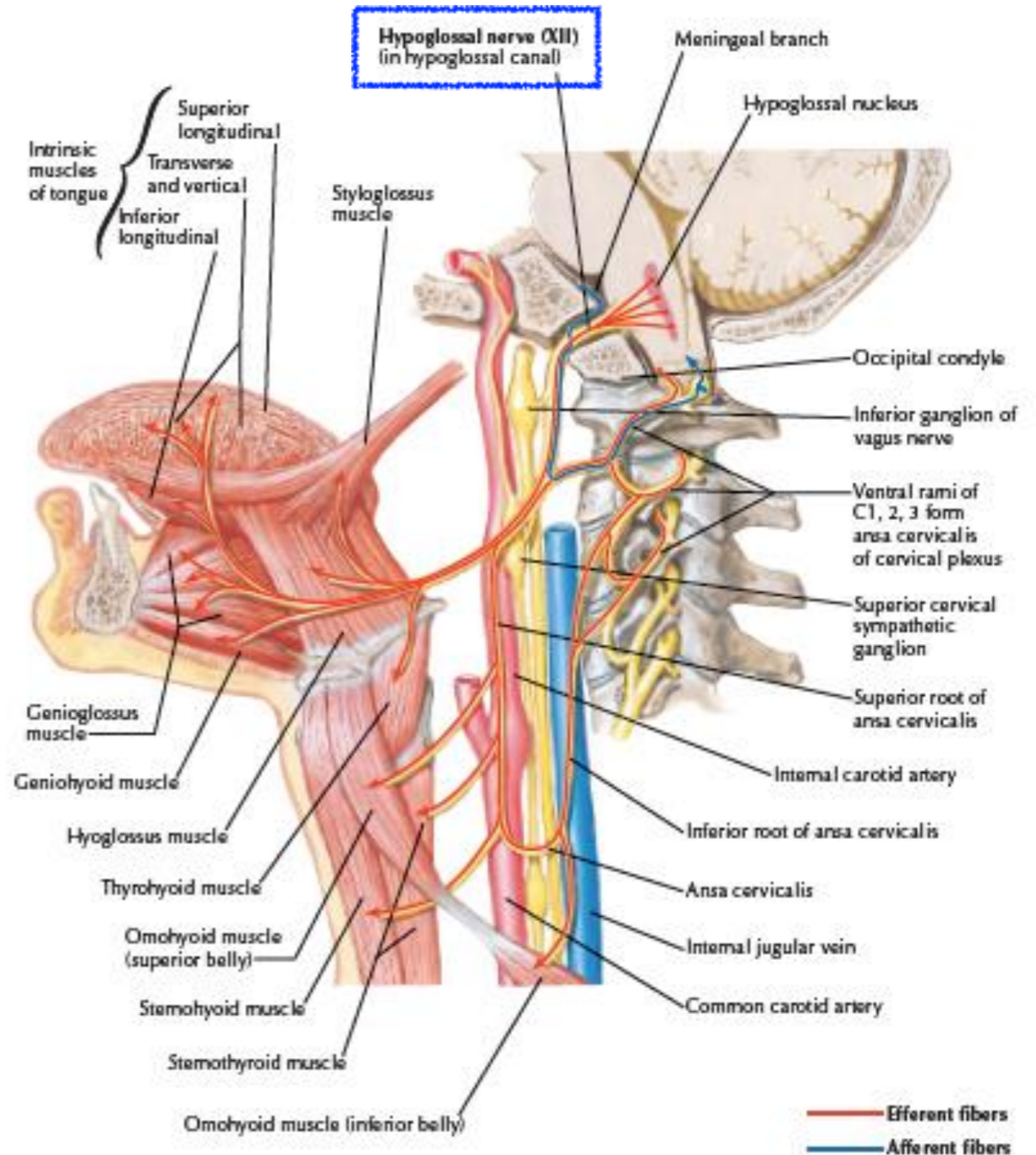
Intrinsic muscles of the tongue



Motor innervation of the tongue

Hypoglossal nerve (**CN XII**)

- Genioglossus
- Hyoglossus
- Styloglossus
- All intrinsic muscles



Sensory innervation of the tongue

Taste

Vagus nerve (CN X, via int. br. of superior laryngeal)

Glossopharyngeal nerve (CN IX)

Facial nerve (CN VII, via chorda tympani)

Taste buds

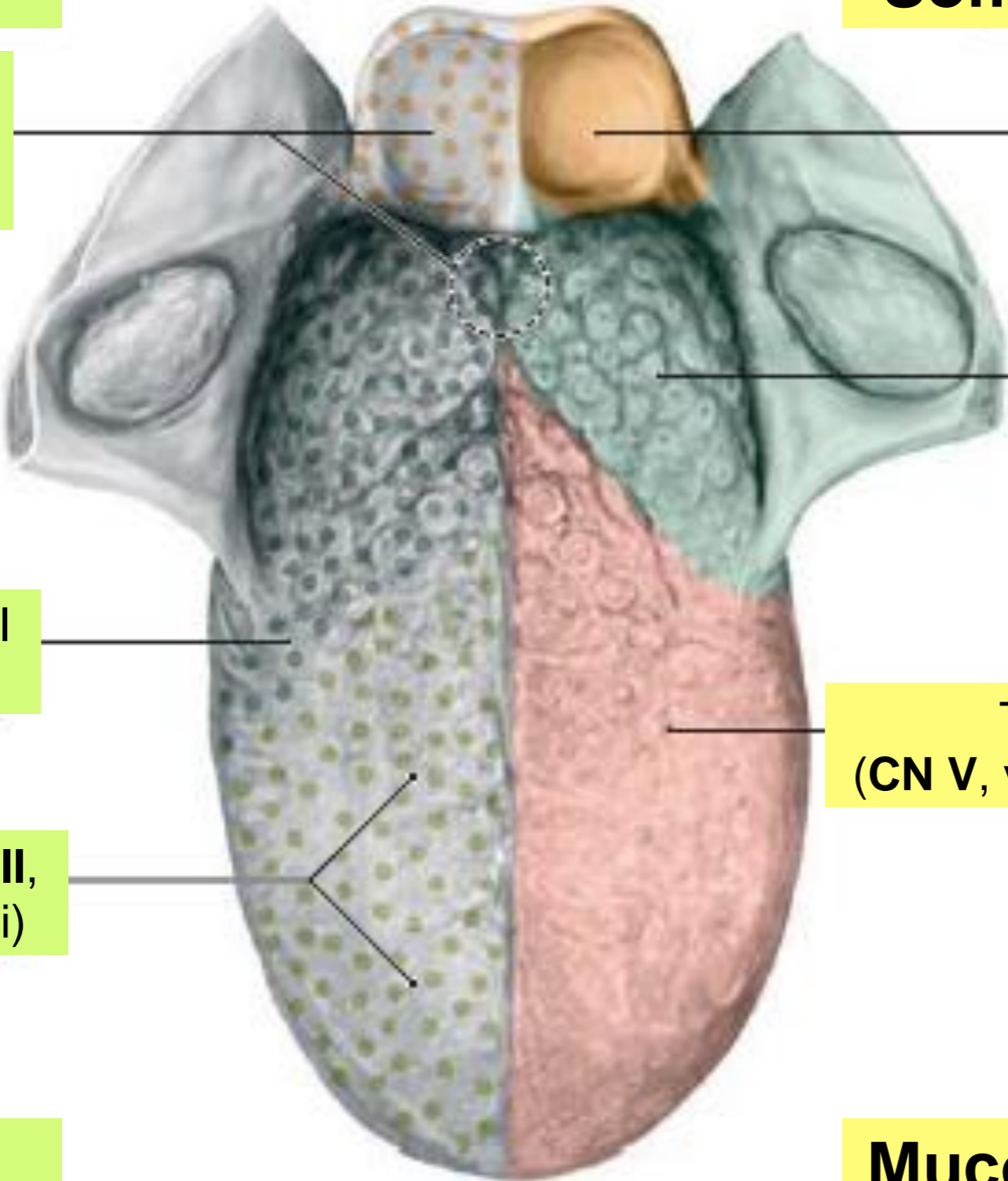
touch, pain, temperature
Somatic sensation

Vagus nerve (CN X, via int. br. of superior laryngeal)

Glossopharyngeal nerve (CN IX)

Trigeminal nerve (CN V, via lingual branch of V₃)

Mucosa, epithelium



Extrinsic muscles of the tongue

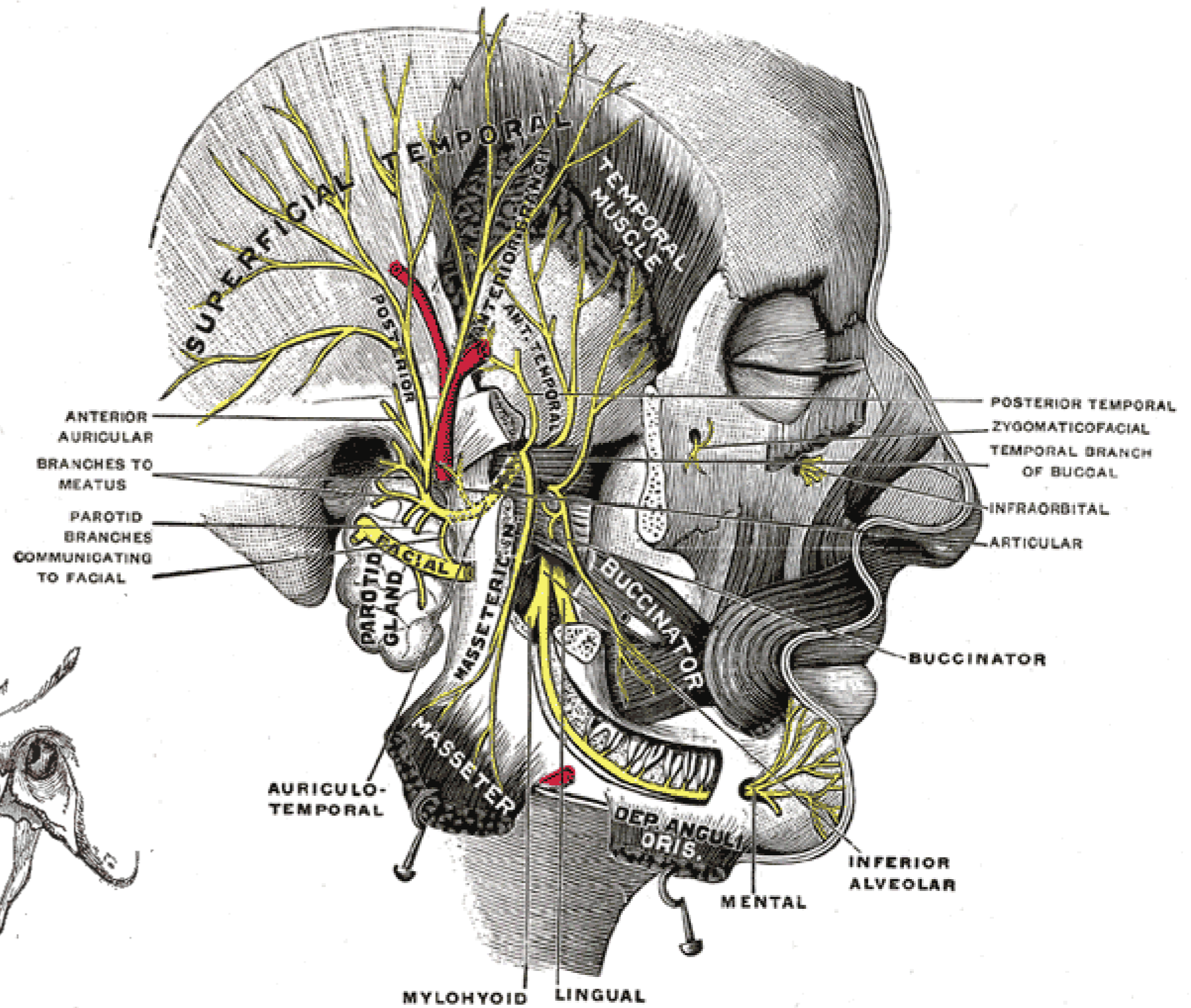
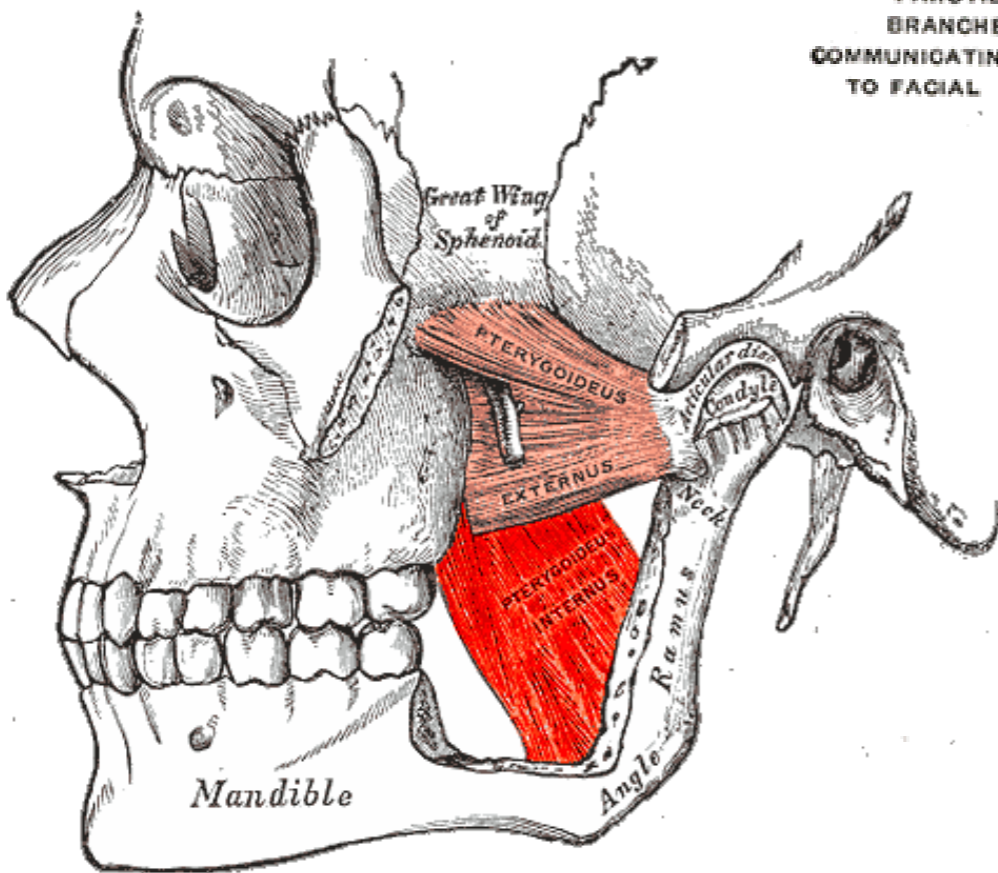
Muscle	Action	Nerve supply
Genioglossus	Protracts Depresses	Hypoglossal nerve (CN XII)
Hyoglossus	Depresses	
Styloglossus	Retracts Elevates	

Intrinsic muscles of the tongue

Superior longitudinal	Shortens Curls the tongue's apex upward	Hypoglossal nerve (CN XII)
Inferior longitudinal	Shortens Curls the tongue's apex downward	
Transverse	Narrows Lengthens	
Vertical	Broadens Flattens	

Muscles of mastication

- Masseter
- Temporalis
- Lateral pterygoid
- Medial pterygoid



Extrinsic muscles of the tongue

Muscle	Action	Nerve supply
Genioglossus 顏舌肌	Protracts (伸舌、下壓舌頭中央) Depresses (下壓舌頭中央)	Hypoglossal nerve (CN XII)
Hyoglossus 舌骨舌肌	Depresses (舌向後拉、兩側下拉)	
Styloglossus 莖舌肌	Retracts (舌向後拉) Elevates (舌兩側拉高)	
Palatoglossus 腭舌肌	Elevates (上提舌頭)	Vagus nerve (CN X)

Intrinsic muscles of the tongue

Superior longitudinal 上縱向肌	Shortens (縮短舌頭) Curls the tongue's apex upward (將舌尖轉向上)	Hypoglossal nerve (CN XII)
Inferior longitudinal 下縱向肌	Shortens (縮短舌頭) Curls the tongue's apex downward (將舌尖拉下)	
Transverse 舌橫向肌	Narrows (將舌變窄並拉長) Lengthens	
Vertical 舌垂直肌	Broadens (將舌頭變平變寬) Flattens	

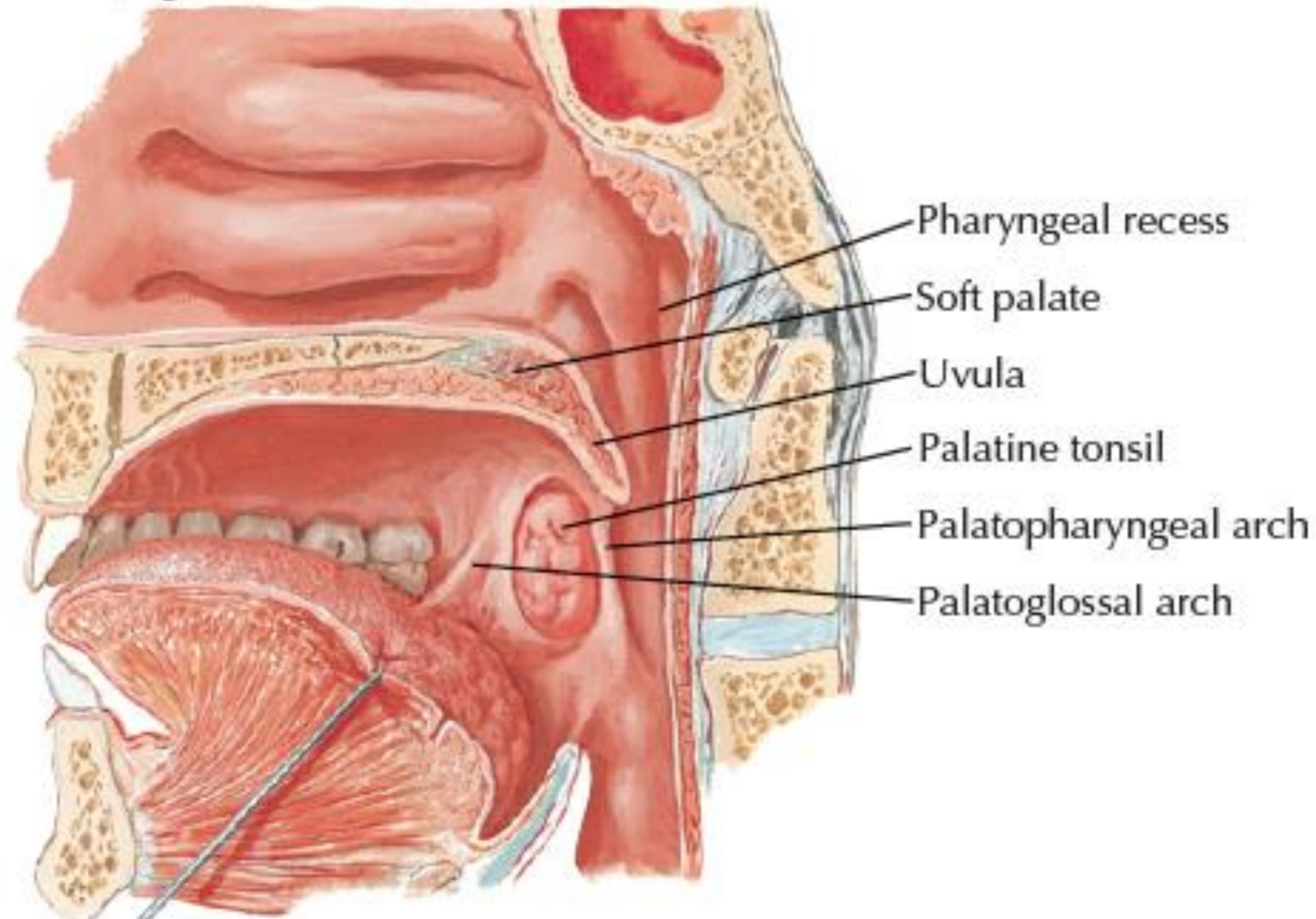
Muscles of the soft palate

3 margins of the soft palate:

- **Anteriorly:** continuous with the hard palate at the vibrating line
- **Posterolaterally:** forms the superior portion of the palatoglossal and palatopharyngeal folds
- **Posteriorly:** the uvula hangs in the center of the posterior free margin

Medial view

Median (sagittal) section



Muscles of the soft palate

5 muscles

- Tensor veli palatini
- Levator veli palatini
- Uvular
- Palatopharyngeus
- palatoglossus

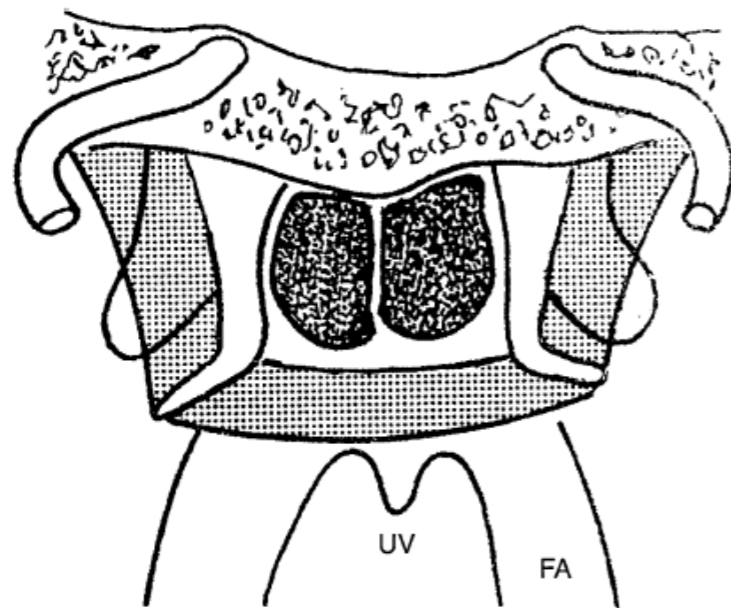


Fig. 14 Tensor veli palatini muscle (*shaded*). The picture shows the skull base with choanae (*dark*) as well as the carotid canal. The pterygoid process (*P*) and the hamulus of the pterygoid process (*H*) are indicated, as are the uvula (*UV*) and the faucial arcs (*FA*)

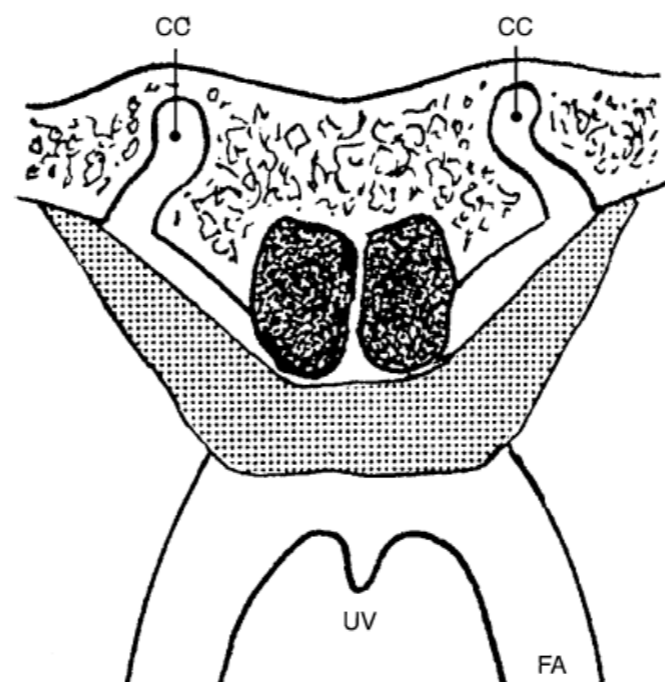
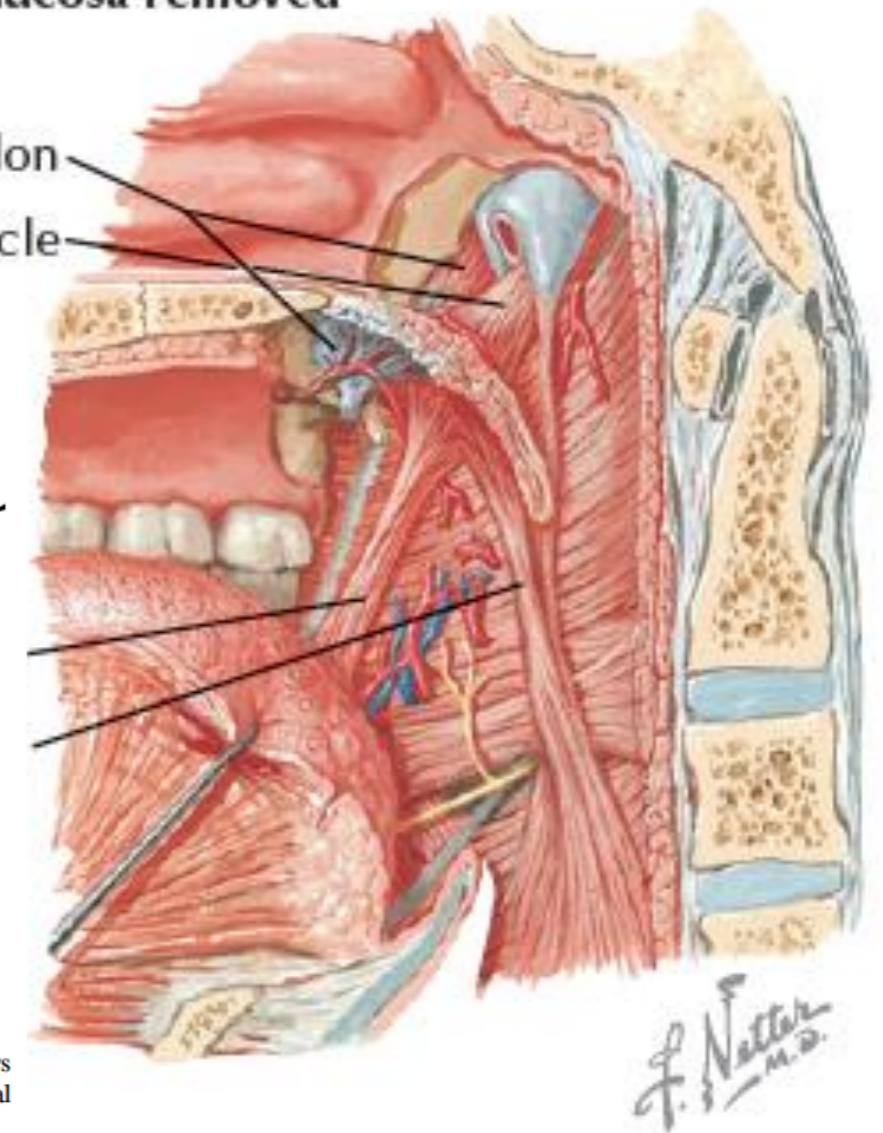


Fig. 13 Levator veli palatini muscle (*shaded*). The picture shows the skull base with choanae (*dark*) as well as the carotid canal (*CC*). The uvula (*UV*) and the faucial arcs (*FA*) are indicated

Pharyngeal mucosa removed

Tensor veli palatini muscle and tendon

Levator veli palatini muscle



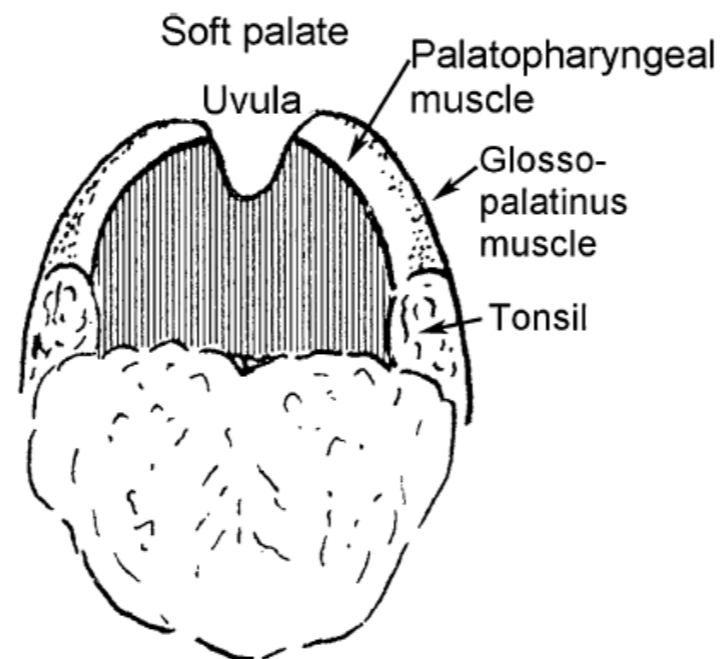
Ekberg O. *Dysphagia: diagnosis and treatment*, 2012

Norton NS. *Netter's Head and Neck Anatomy for Dentistry*, 2012

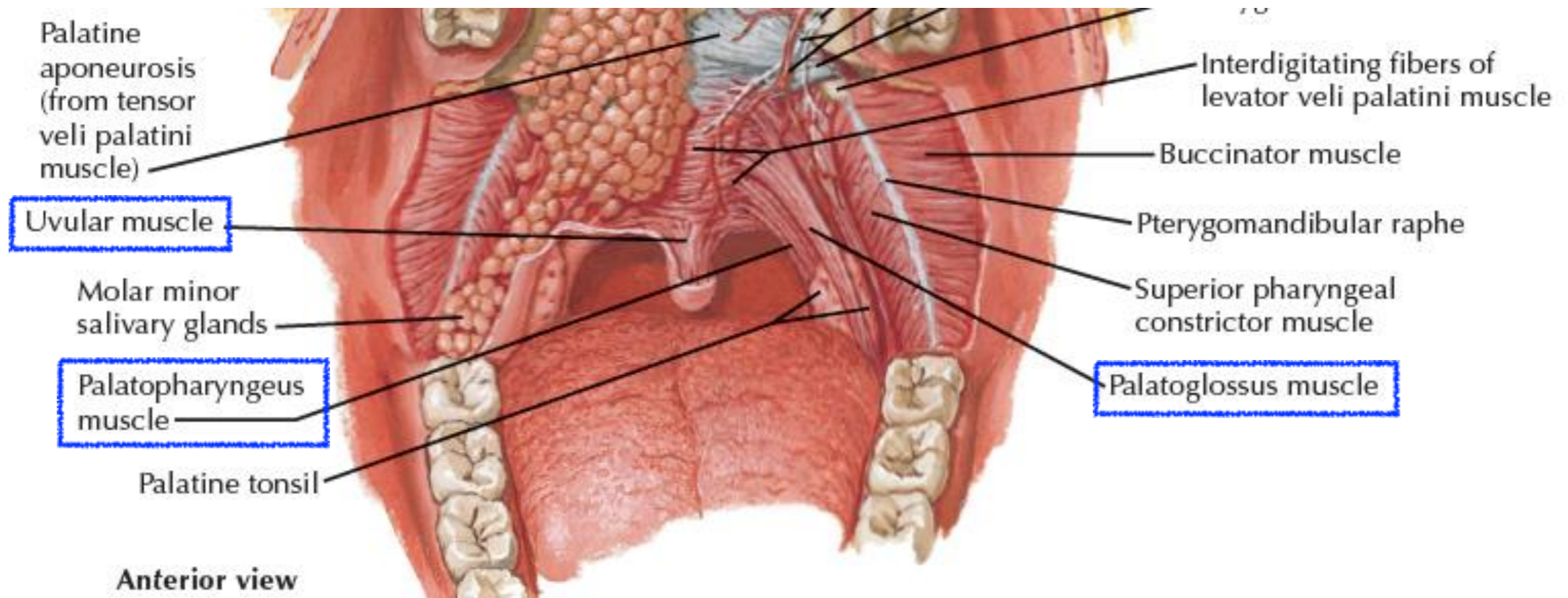
Muscles of the soft palate

5 muscles

- Tensor veli palatini
- Levator veli palatini
- Uvular
- Palatopharyngeus
- palatoglossus



Soft palate:
Helps close off the **nasopharynx** during swallowing



Muscles of the soft palate

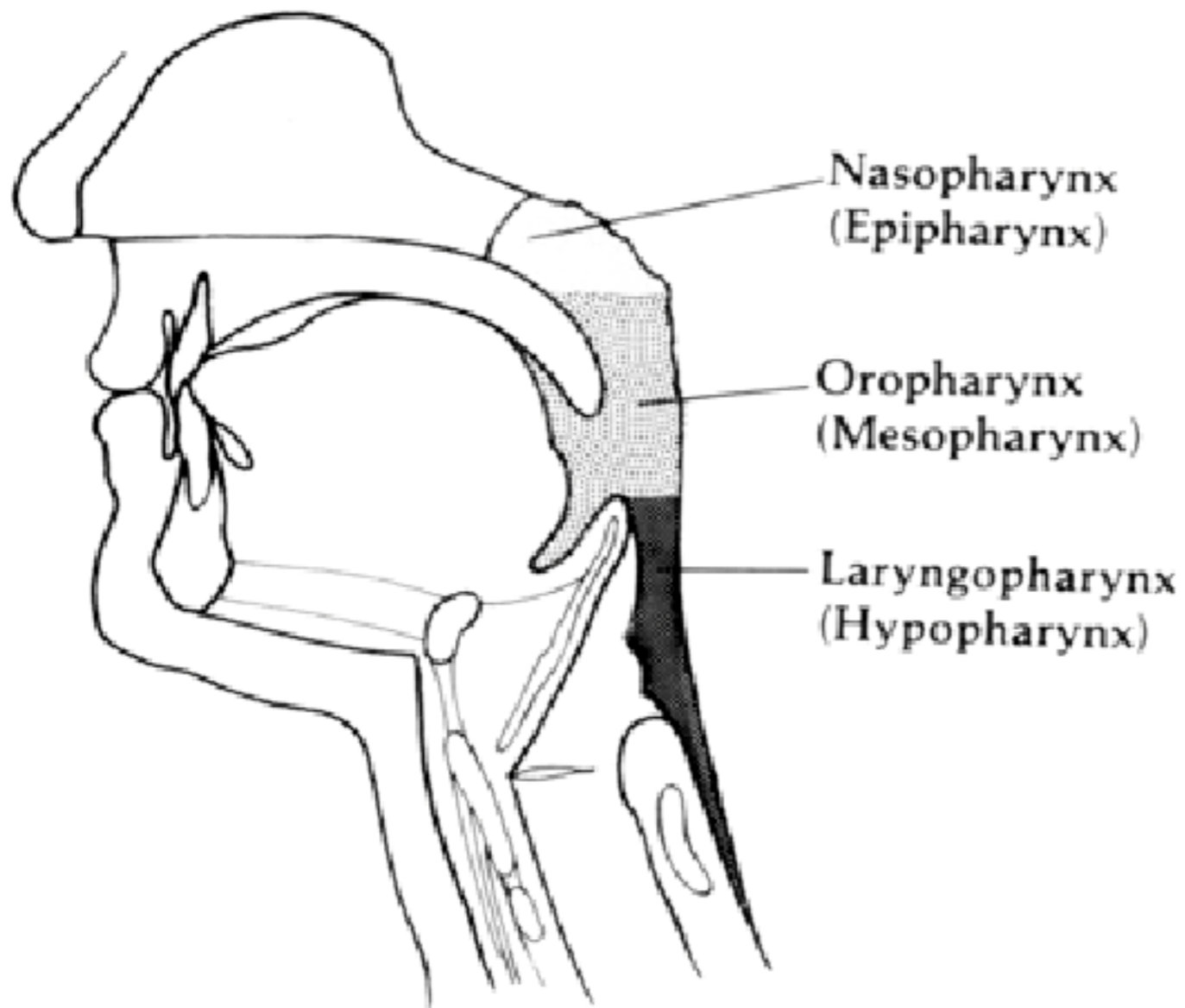
Muscle	Action	Nerve supply
Tensor veli palatini	Pulls the soft palate laterally, which broadens it	Trigeminal nerve (CN V₃)
Levator veli palatini	Elevates soft palate Pulls soft palate posteriorly Acts to help close the nasopharynx	Pharyngeal plexus (motor portion from the vagus nerve and cranial part of the accessory nerve) (CN X, XI)
Uvular	Elevates uvula Pulls uvula laterally	
Palatopharyngeus	Elevates the pharynx and larynx Acts to help close the nasopharynx	
Palatoglossus	Elevates the tongue Narrows the oropharyngeal isthmus for swallowing	

Muscles of the soft palate

Muscle	Action	Nerve supply
Tensor veli palatini 腭帆張肌	Pulls the soft palate laterally, which broadens it	Trigeminal nerve (CN V₃)
Levator veli palatini 腭帆提肌	Elevates soft palate Pulls soft palate posteriorly Acts to help close the nasopharynx	Pharyngeal plexus (motor portion from the vagus nerve and cranial part of the accessory nerve) (CN X, XI) 借道迷走神經咽支的脊副神經和咽神經叢
Uvular 懸壅垂肌	Elevates uvula Pulls uvula laterally	
Palatopharyngeus 腭咽肌，形成腭咽弓	Elevates the pharynx and larynx Acts to help close the nasopharynx	
Palatoglossus 腭舌肌，形成腭舌弓	Elevates the tongue Narrows the oropharyngeal isthmus for swallowing	

Muscles of the pharynx

- 5-inch muscular tube
- from the base of the skull to the lower border of the cricoid cartilage (C6)
- 3 parts: nasopharynx, oropharynx, laryngopharynx



Nasopharynx

Respiratory function

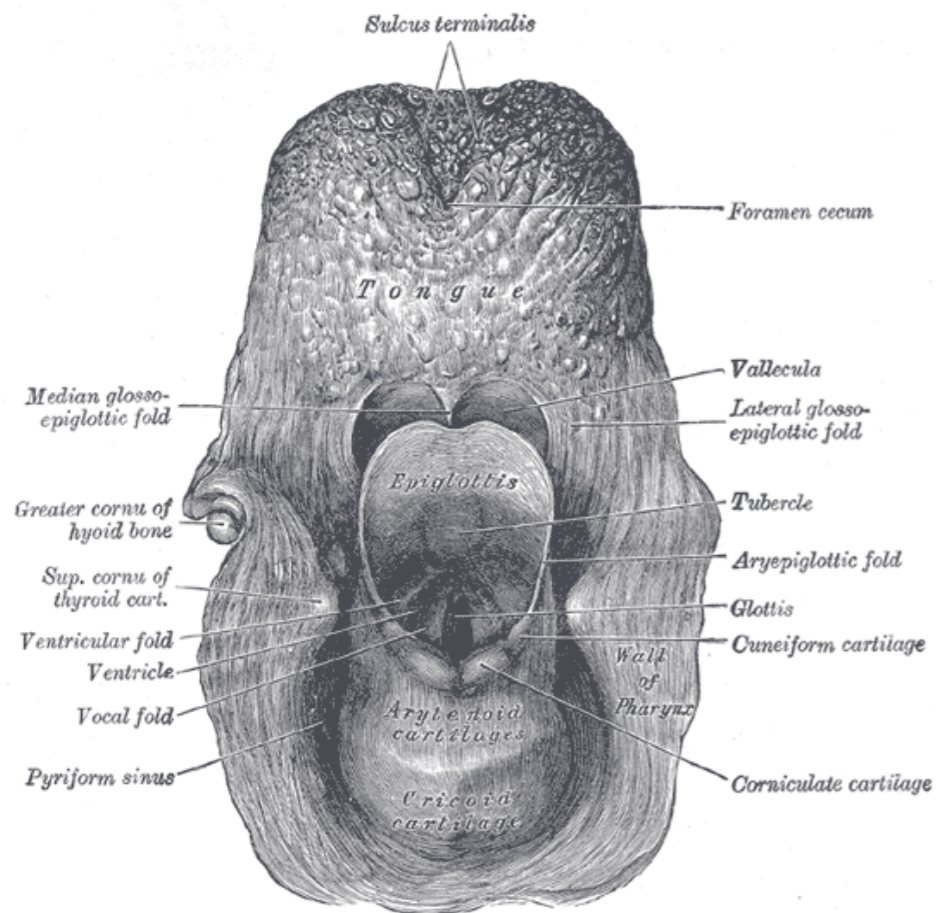
Oropharynx

Respiratory and digestive function

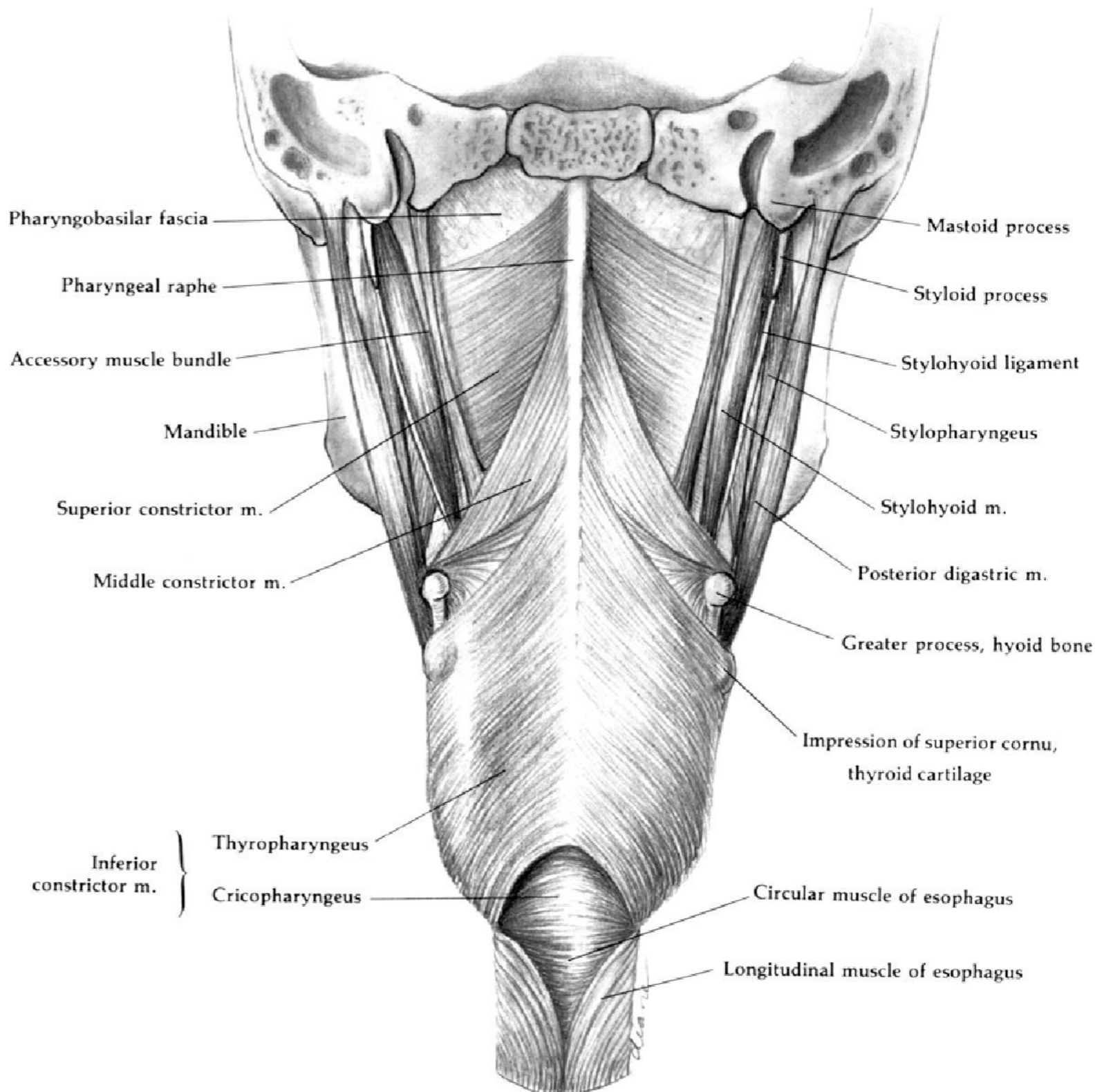
Laryngopharynx

Communicates with the larynx

Muscles of the pharynx



Henry Gray, 1918

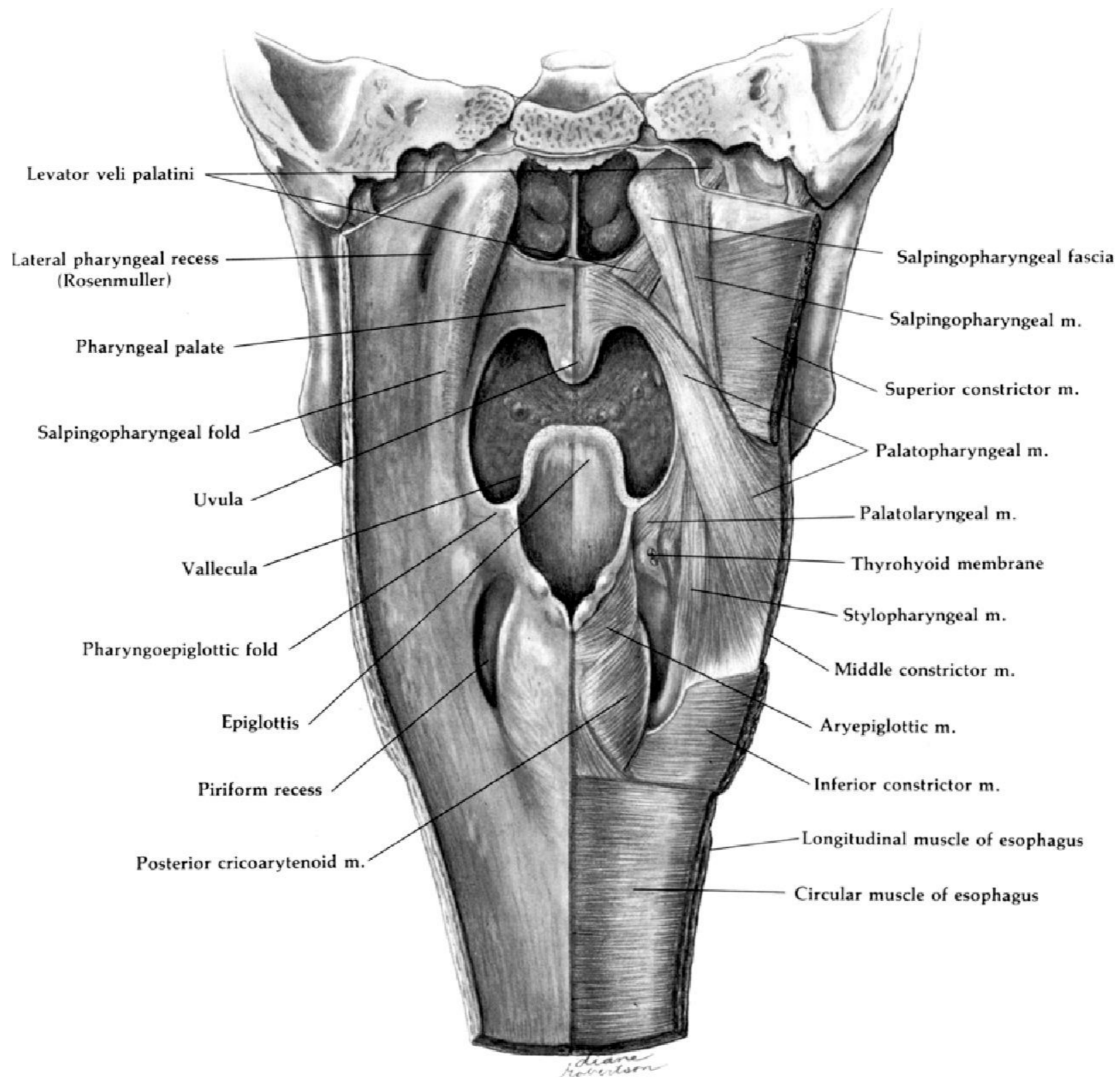


Bosma JF, et al. *Dysphagia*, 1986

Muscles of the pharynx

Muscle	Action	Nerve supply
Superior constrictor	Constricts the upper portion of the pharynx	Pharyngeal plexus (motor portion: vagus nerve CN X and spinal accessory nerve CN XI)
Middle constrictor	Constricts the middle portion of the pharynx	
Inferior constrictor	Constricts the lower portion of the pharynx	Pharyngeal plexus (CN X) External laryngeal nerve (CN X) Recurrent laryngeal nerve (CN X)

Muscles of the pharynx

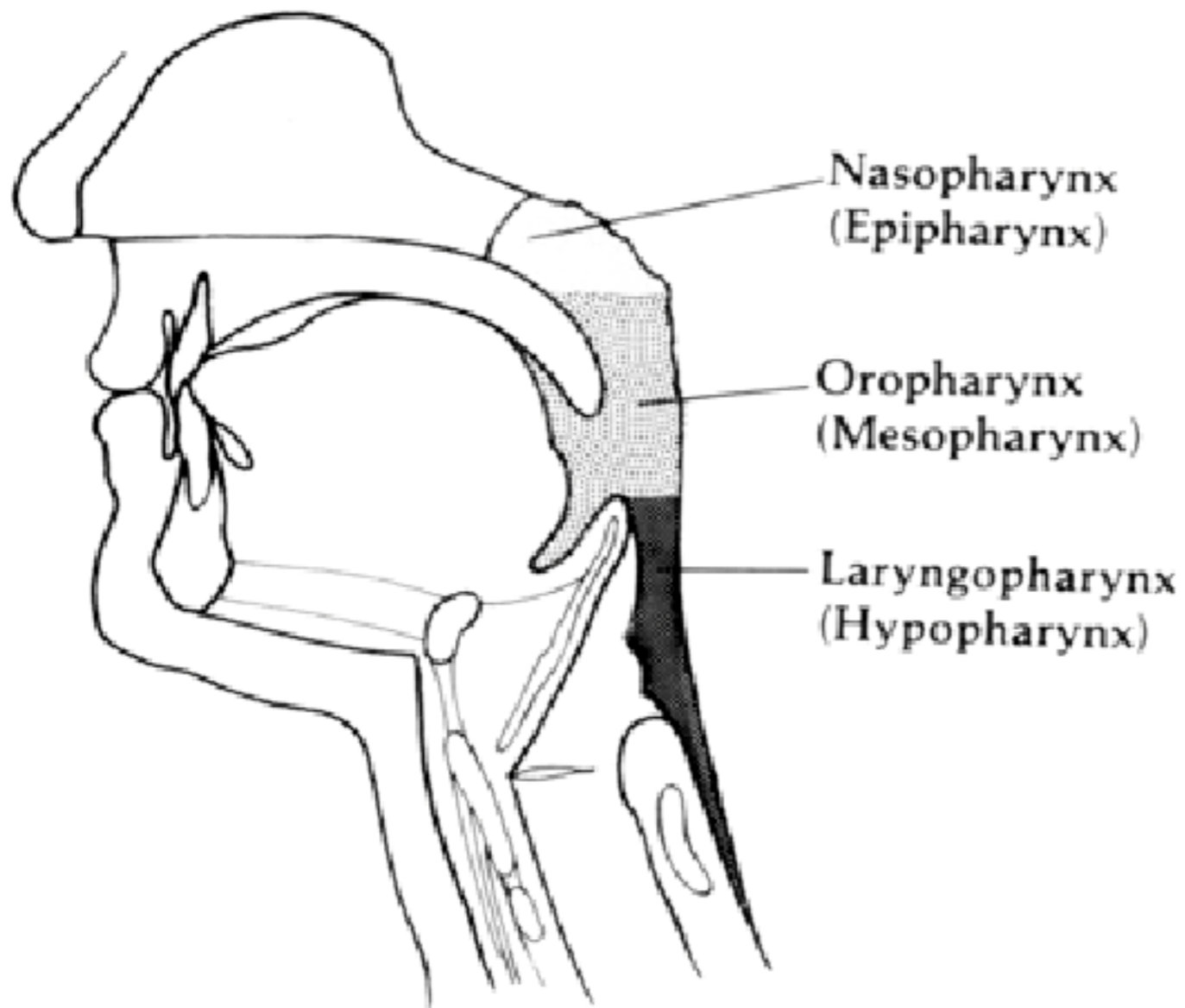


Muscles of the pharynx

Muscle	Action	Nerve supply
Palatopharyngeus	Elevates pharynx Helps close the nasopharynx	Pharyngeal plexus (motor portion: vagus nerve CN X and spinal accessory nerve)
Salpingopharyngeus	Elevates the upper and lateral portions of the pharynx	
Stylopharyngeus	Elevates pharynx Expands the sides of the pharynx	Glossopharyngeal nerve (CN XII)

Muscles of the pharynx

- 5-inch muscular tube
- from the base of the skull to the lower border of the cricoid cartilage (C6)
- 3 parts: nasopharynx, oropharynx, laryngopharynx



Nasopharynx

Respiratory function

Oropharynx

Respiratory and digestive function

Laryngopharynx

Communicates with the larynx

Muscles of the hyoid bone

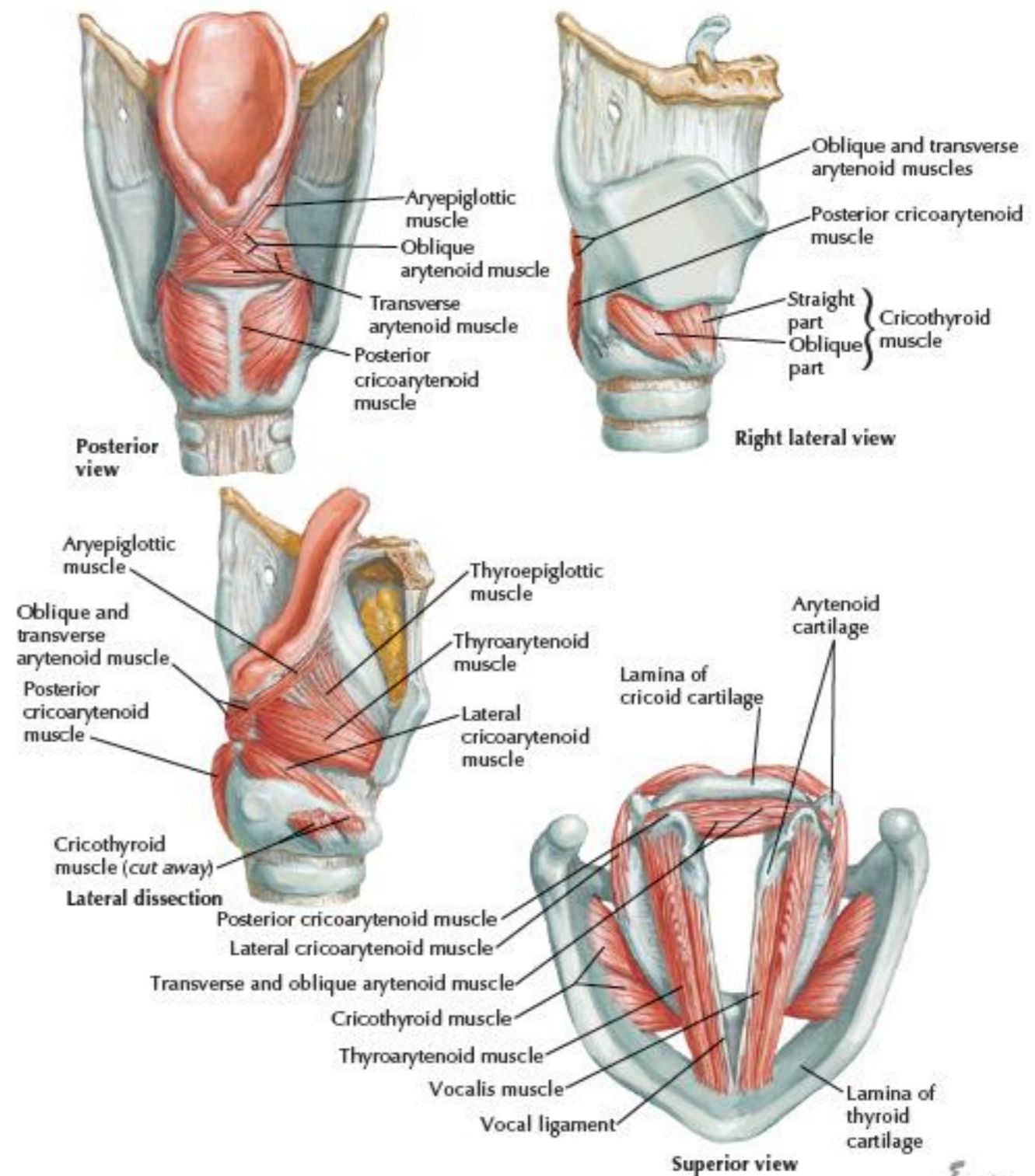
Suprahyoid muscles		
Muscle	Action	Nerve supply
Geniohyoid	Draws hyoid bone forward (during swallowing): assists in opening mandible	Ventral ramus of C1 via CN XII
Mylohyoid	Tightens and elevates oral floor; draws hyoid bone forward (during swallowing); assists in opening mandible and moving it side to side (mastication)	Mylohyoid nerve (from CN V₃)
Digastric, anterior belly	Elevates hyoid bone (during swallowing); assists in depressing mandible	
Digastric, posterior belly		Facial nerve (CN VII)
Stylohyoid		

Muscles of the hyoid bone

Infrahyoid muscles		
Muscle	Action	Nerve supply
Thyrohyoid	Depresses and fixes hyoid; raises the larynx during swallowing	Ventral ramus of C1 via CN XII
Sternothyroid	Depresses (fixes) hyoid; draws larynx and hyoid down for phonation and terminal phases of swallowing	Ansa cervicalis of cervical plexus (C1-C3)
Sternohyoid		
Omohyoid, inferior belly		

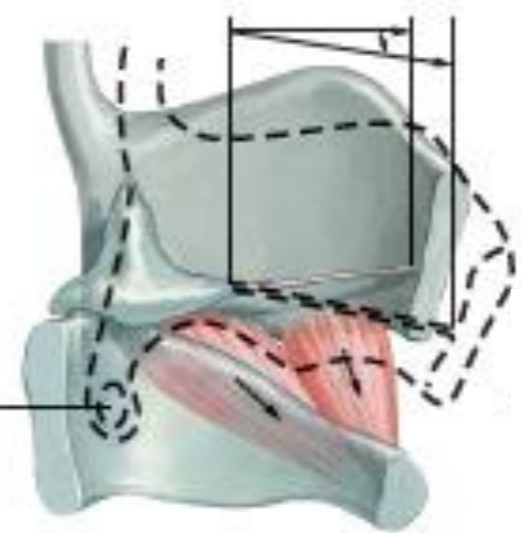
Muscles of the larynx

Muscle
Cricothyroid
Thyroarytenoid
Posterior cricoarytenoid
Lateral cricoarytenoid
Transverse arytenoid
Oblique arytenoid
Aryepiglotticus
Thyroepiglotticus



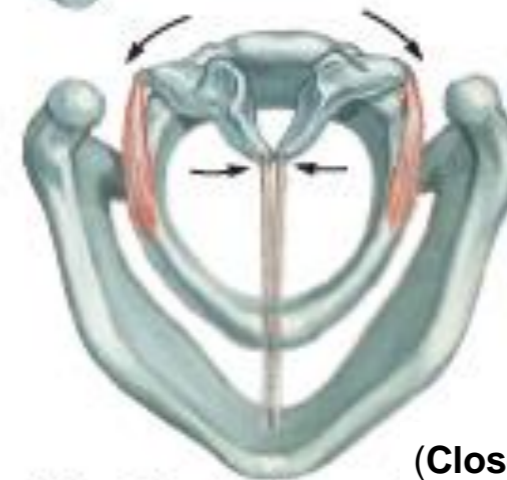
F. Netter M.D.

Muscles of the larynx



Action of cricothyroid muscles
Lengthening (**increasing** tension of vocal ligaments)

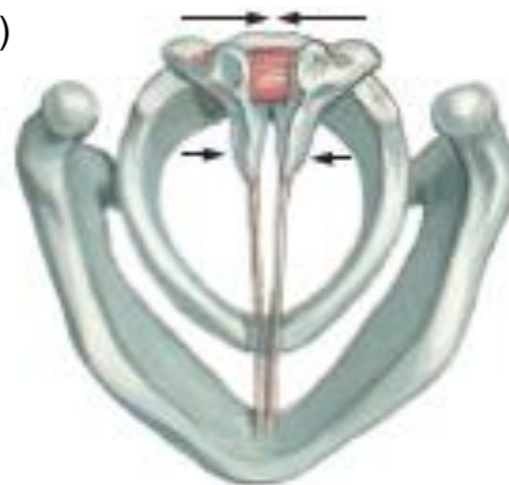
Action of posterior cricoarytenoid muscles
Abduction of vocal ligaments
(**opens** the rima glottidis)



(**Closes** rima glottidis)

Action of transverse arytenoid muscles
Adduction of vocal ligaments
(Arytenoids **closes** the rima glottidis)

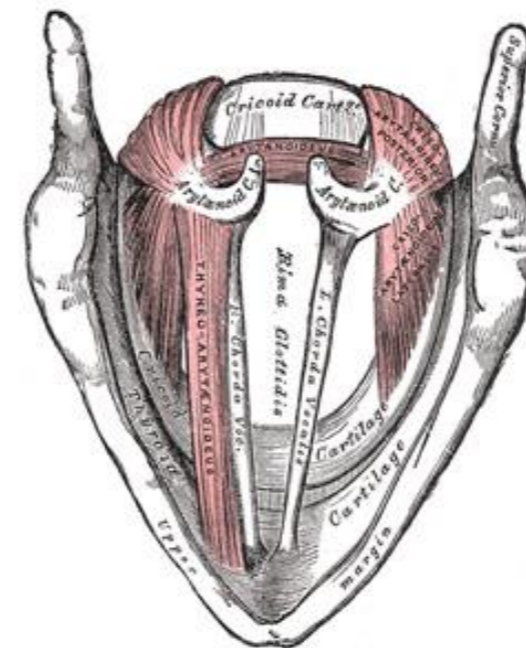
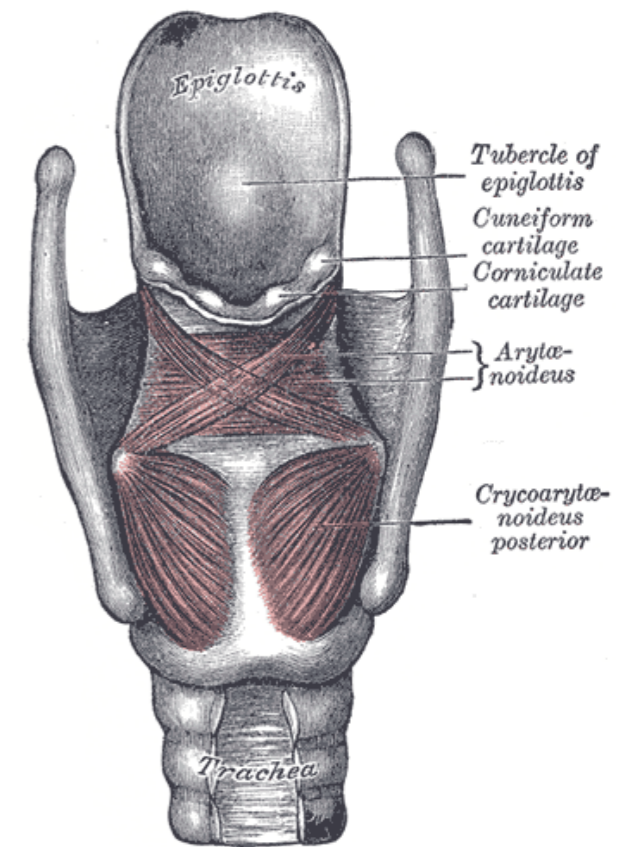
Action of lateral cricoarytenoid muscles
Adduction of vocal ligaments



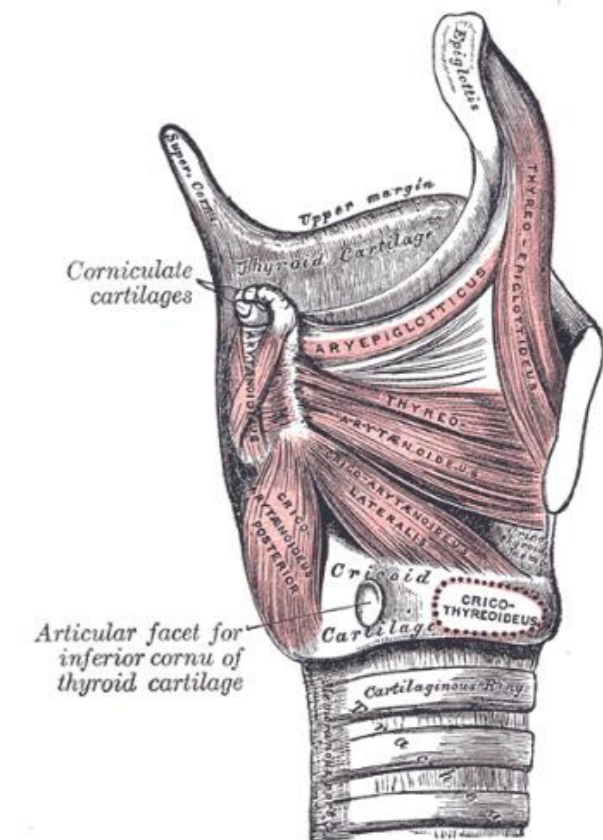
Action of vocals and thyroarytenoid muscles
Shortening (**relaxation**) of vocal ligaments

Muscles of the larynx

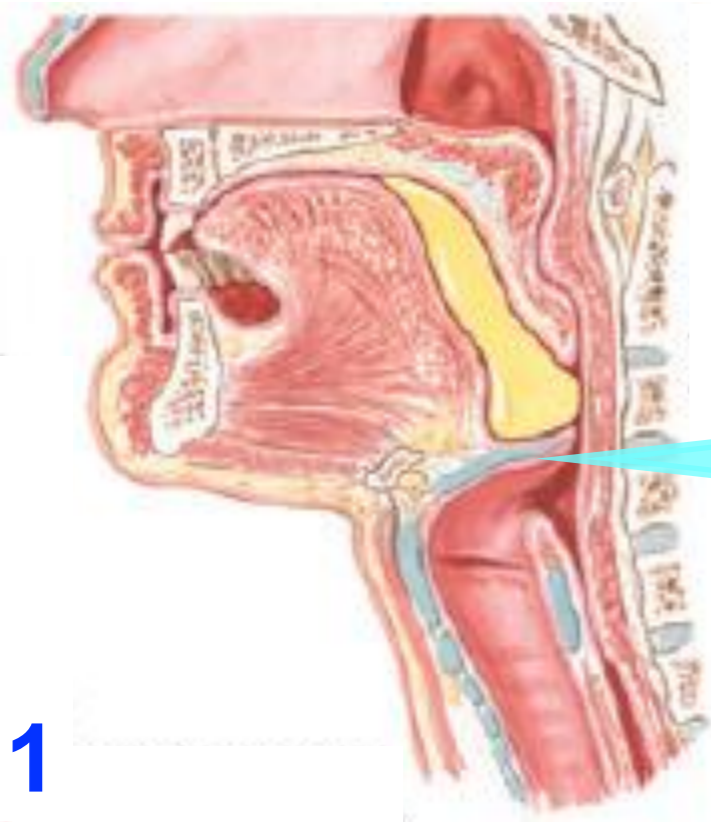
Muscle	Action	Nerve supply
Cricothyroid	Increases tension on vocal ligaments	External laryngeal nerve
Thyroarytenoid	Decreases tension on vocal ligaments	Recurrent laryngeal nerve
Posterior cricoarytenoid	Opens rima glottidis	
Lateral cricoarytenoid	Closes rima glottidis	
Transverse arytenoid		
Oblique arytenoid		
Aryepiglotticus	Helps close laryngopharyngeal opening	
Thyroepiglotticus		



Henry Gray, 1918



The tilting down of the epiglottis - 2 steps



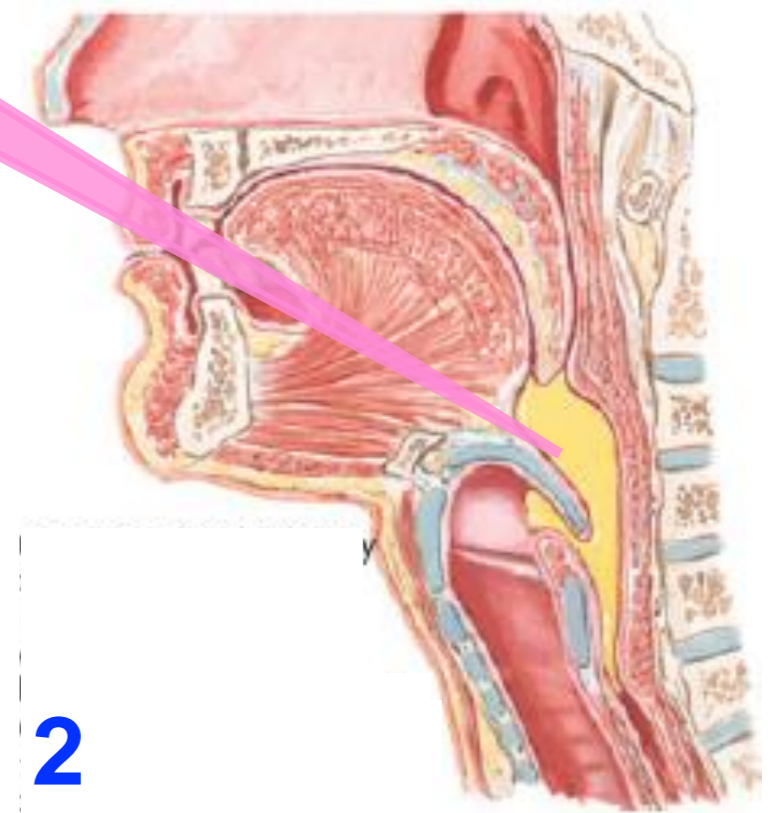
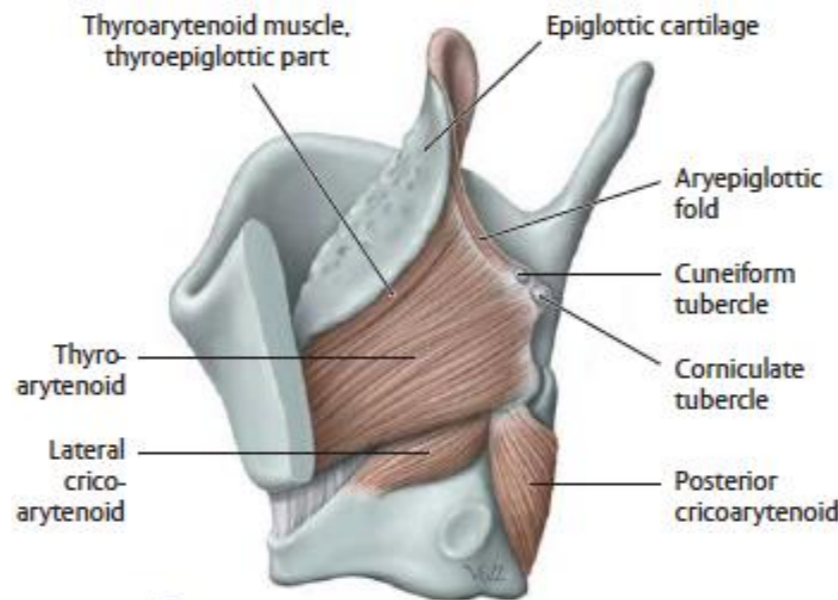
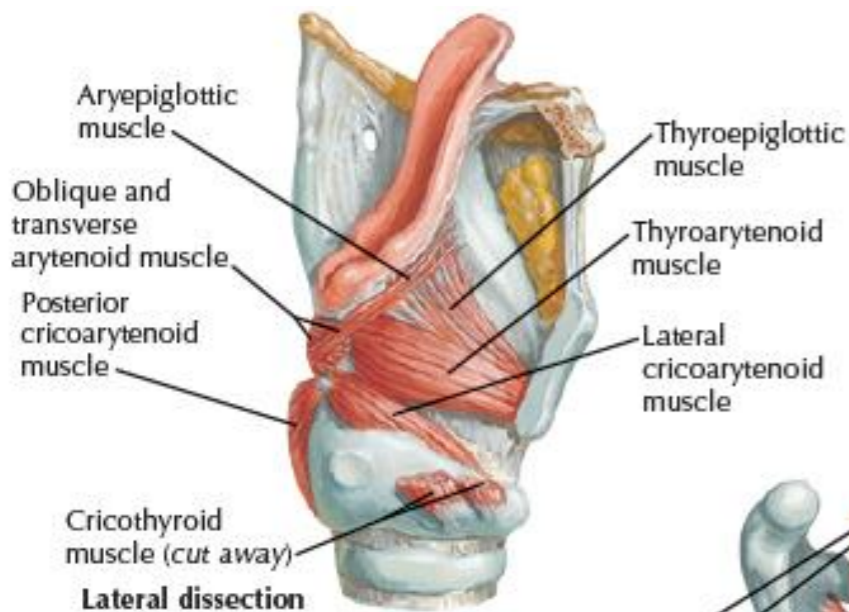
Upright resting to a transverse position:

1. elevation of the **hyoid bone**
(stylohyoid, digastric, mylohyoid, geniohyoid muscles)
2. approximates the hyoid bone and the **thyroid cartilage** (thyrohyoid muscle)

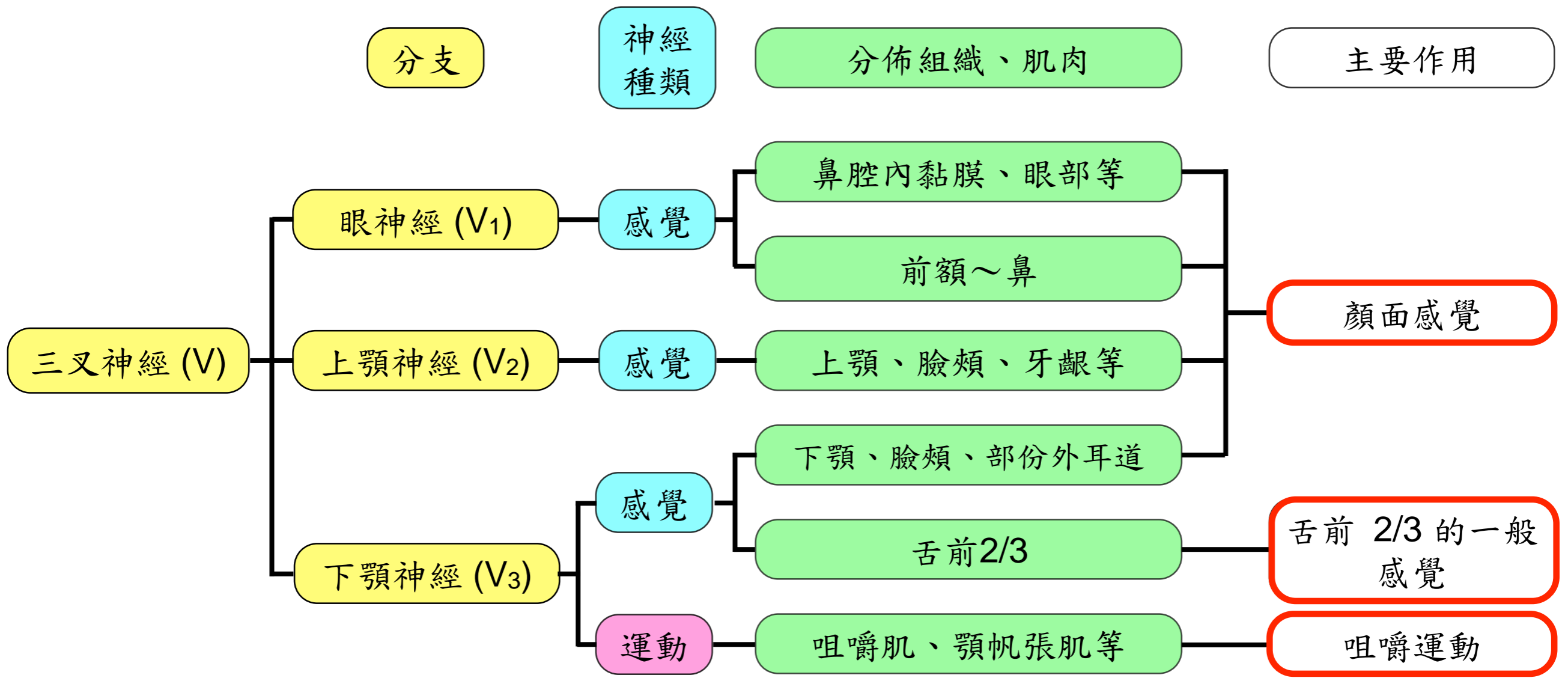
1

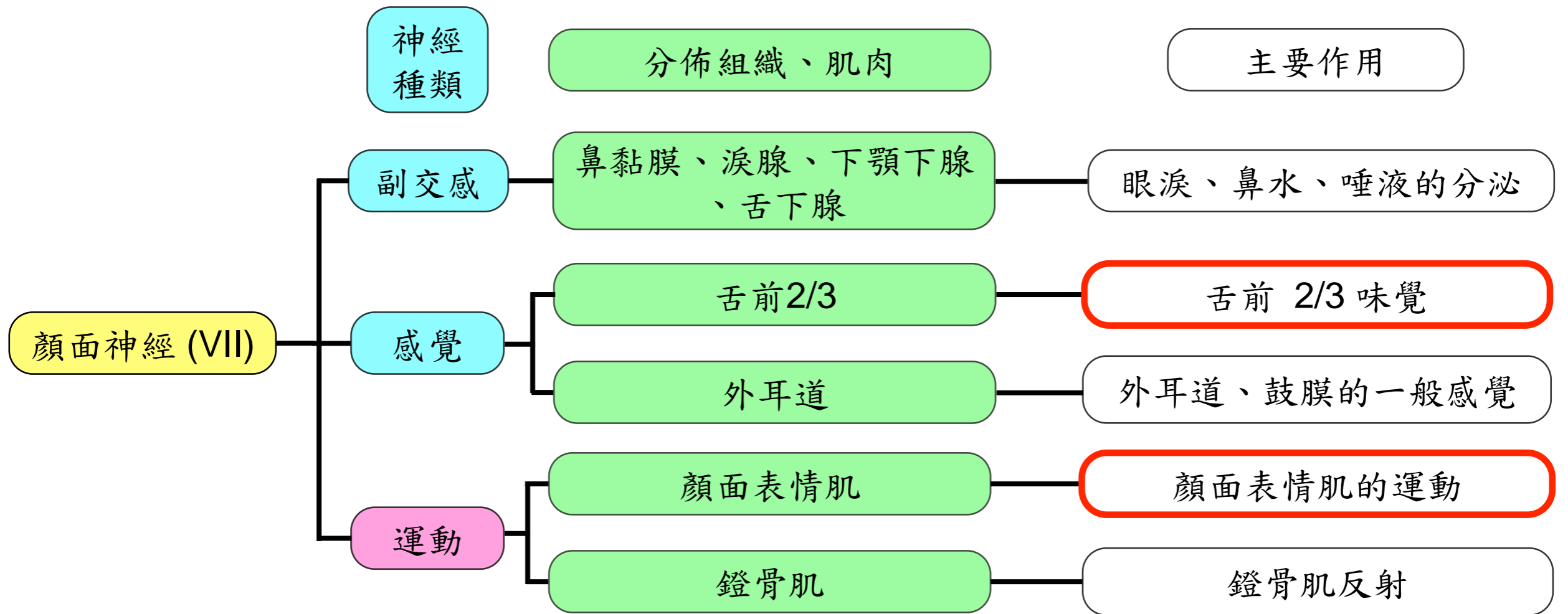
Further down:

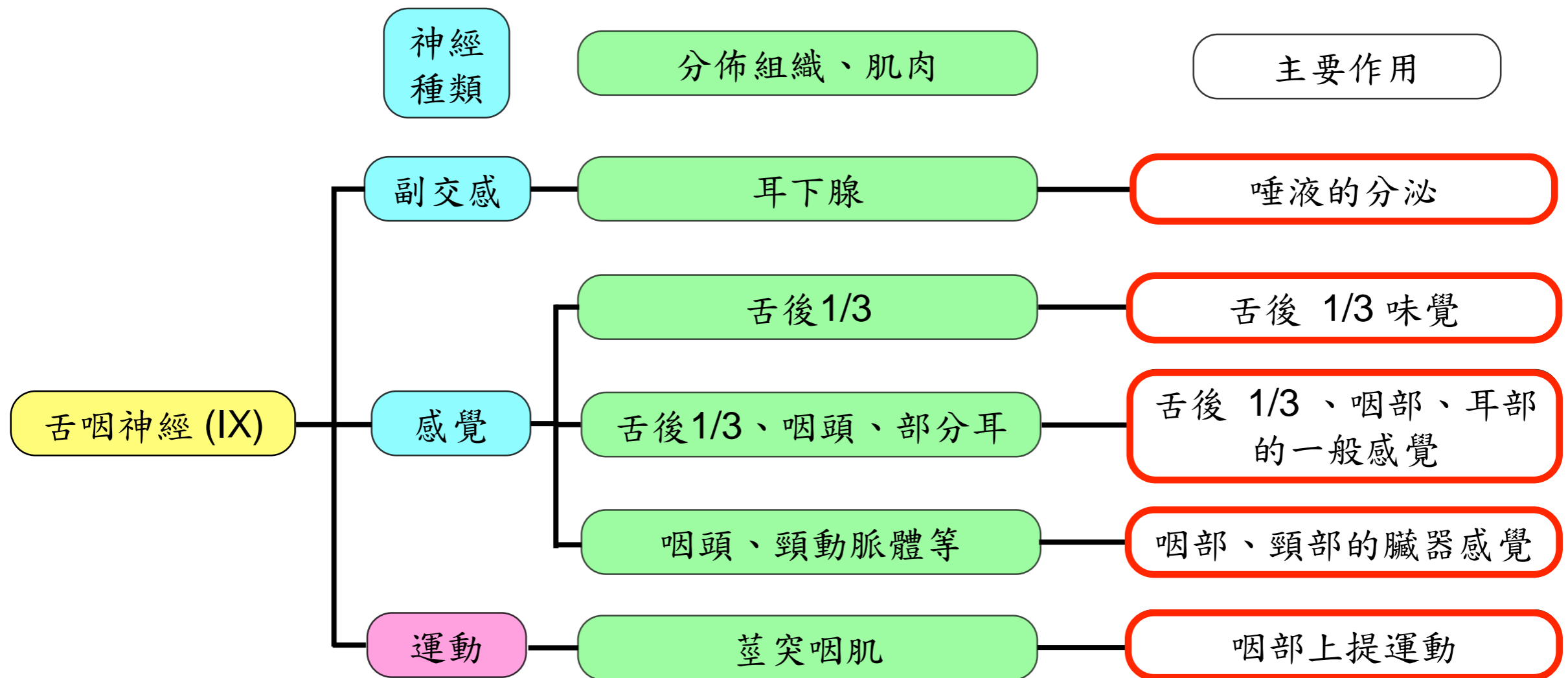
1. aryepiglottic muscle
2. thyroepiglottic muscle

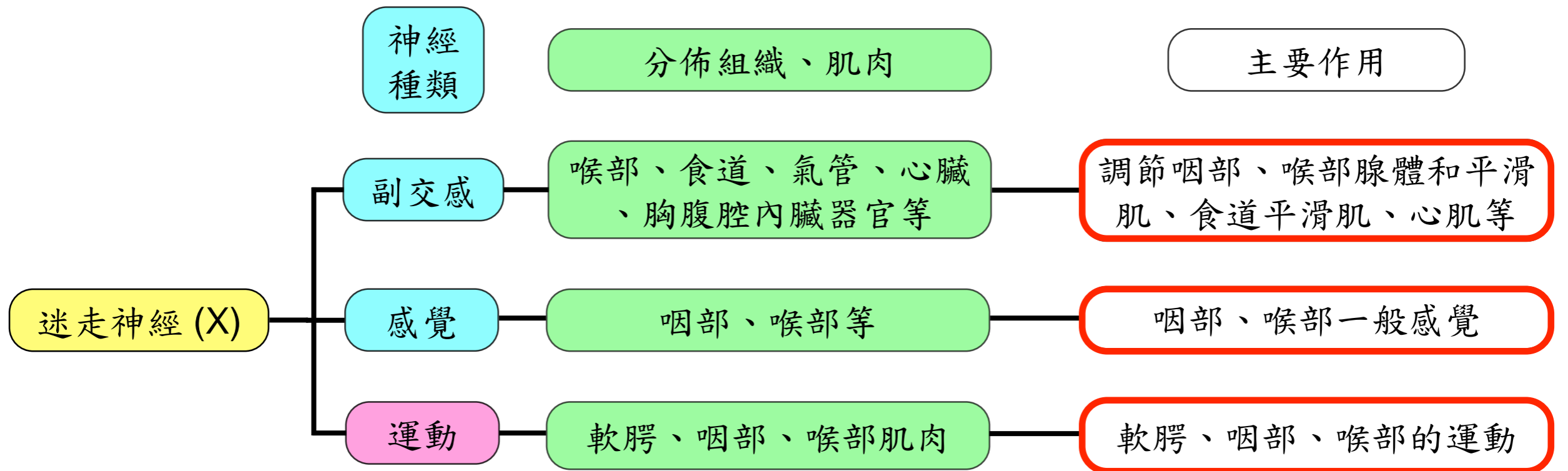


2









Afferent controls involved in swallowing

Sensory function	Innervation (Cranial nerve)
General sensation, anterior 2/3 of the tongue	Lingual nerve, trigeminal (V)
Taste, anterior 2/3 of the tongue	Chorda tympani, facial (VII)
Taste and general sensation, posterior 1/3 of the tongue	Glossopharyngeal (IX)
Mucosa of valleculae	Internal branch of superior laryngeal nerve (vagus; X)
Tonsils, pharynx, soft palate	Pharyngeal branch of vagus (X)
Pharynx, larynx, viscera	Glossopharyngeal (IX) Vagus (X)

Efferent controls involved in swallowing

Efferent/Stage	Innervation (Cranial Nerve)
Oral	
Masticatory, buccinators, floor of mouth	Trigeminal (V)
Lip sphincter	Facial (VII)
Tongue	Hypoglossal (XII)
Pharyngeal	
Constrictors and stylopharyngeus	Glossopharyngeal (IX)
Palate, pharynx, larynx	Vagus (X)
Tongue	Hypoglossal (XII)
Esophageal	
Esophagus	Vagus (X)

