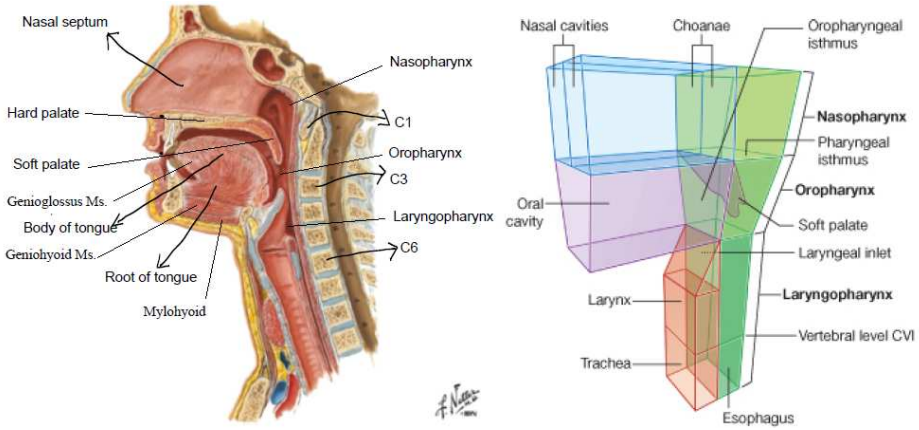
L13 Pharynx

A. Overview on Anatomy of Pharynx

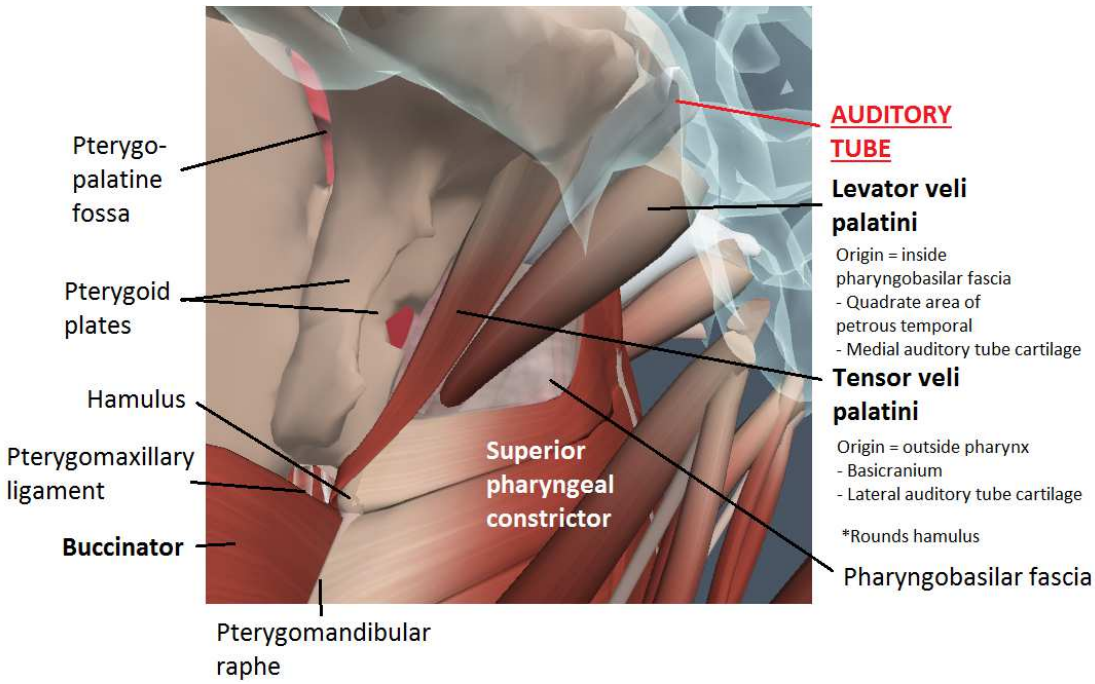


- **Pharynx**: a semicircular tube which lies successively behind nasal cavity, oral cavity and larynx (superior to inferior)
- Separated into **nasopharynx**, **oropharynx** and **laryngopharynx** by:
  - Base of skull
  - Level of **soft palate** (C1)
  - Level of **epiglottis** (C3)
  - Level of **cricoid cartilage** (C6), i.e. level where
    - → **Laryngopharynx** opens into oesophagus
    - → **Larynx** opens into trachea
- Function: a transit for food past the airway
- **Nasopharynx**: functionally only as part of upper respiratory tract
  - Lined by:
    - → **Respiratory epithelium**
    - → Membranous wall without any movements (static)
  - Roof formed by **clivus** (from occipital and sphenoid bones)
  - Essentially a part of nasal cavity lying behind nasal septum
  - No food should enter this region
- **Oro-** and **laryngopharynx**: provide passageway for propelling food across airway during swallowing
  - Speed of movement provided by tongue
    - → need to avoid food passing into larynx
  - Lined by
    - → **Stratified squamous epithelium**
    - → Semicircular (striated) muscles contracting peristaltically during swallowing to push food into oesophagus

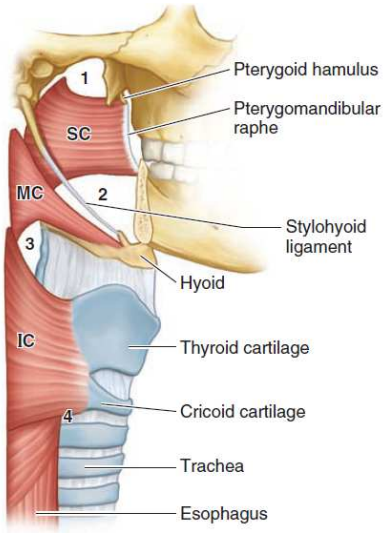
1. Wall of Pharynx

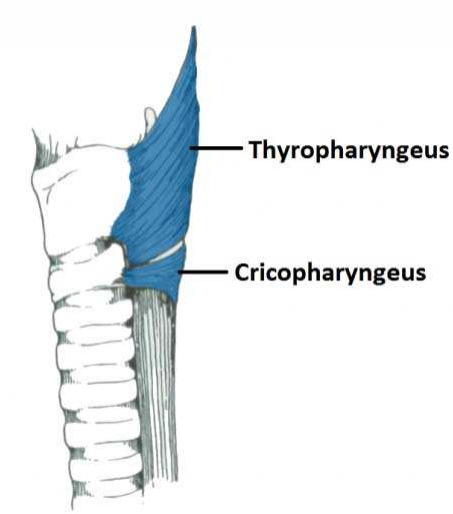
- Formed by <u>two</u> layers of muscles:
  - **Constrictors** (external)
  - **Longitudinal muscles** (internal)
- Muscles lined by **pharyngeal fascia**:
  - **Buccopharyngeal fascia**: outside, thinner layer
  - **Pharyngobasilar fascia**: inner, thicker layer
- Superior to **superior constrictor**, two fasciae blend to form a thin wall and attach to basicranium

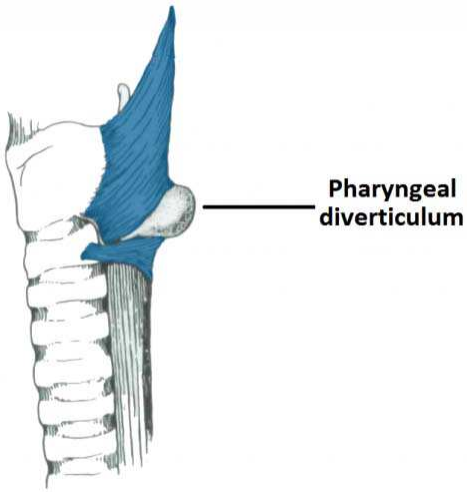
a. Pharyngeal Constrictors



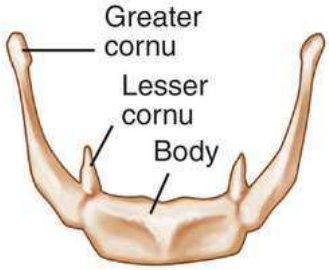
- Mainly formed by three circular muscles: **superior**, **middle** and **inferior constrictors**
  - Arise from the side of head and neck
  - Pass posteriorly to a **posterior midline raphe** just anterior to prevertebral fascia
  - Potential **retropharyngeal space** between prevertebral fascia and the muscles
- **Superior constrictor**:
  - Interdigitates with **buccinator** (an accessory muscle for mastication) at **pterygomandibular raphe** that runs from the hamulus of medial pterygoid plate to the mandible
  - Posteriorly attached to **pharyngeal tubercle** of occipital bone

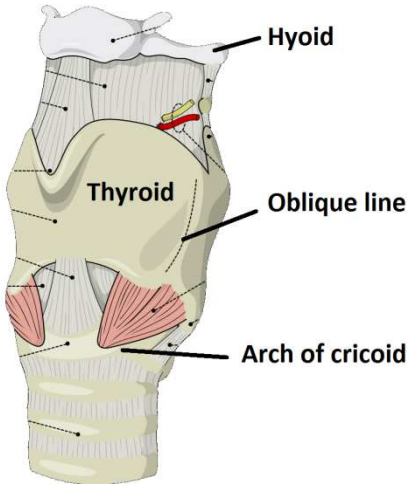


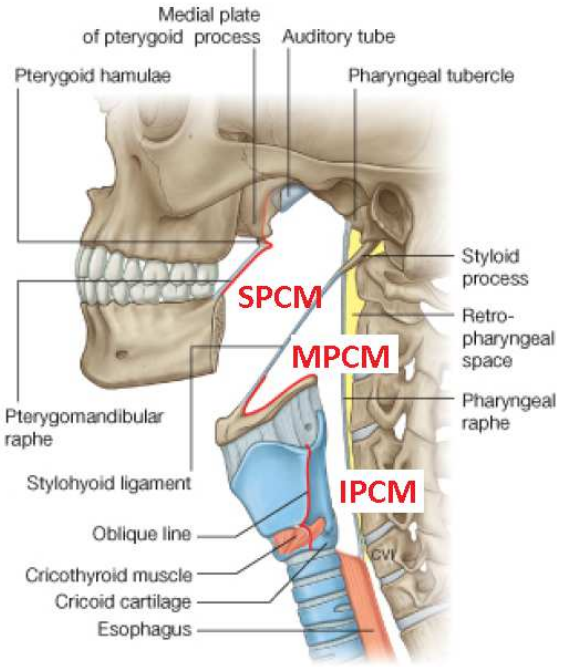




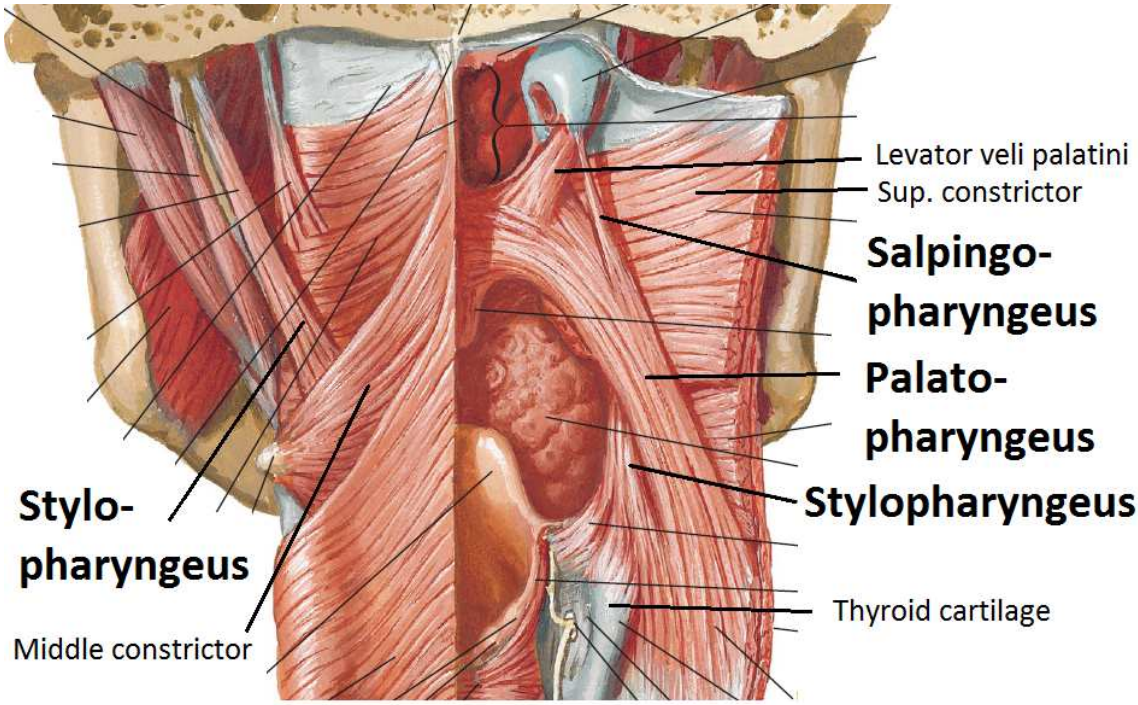
- **Middle constrictor** arises from **hyoid** at the angle between **greater** and **lesser horns (cornu)**
- **Inferior constrictor** consists of:
  - **Thyropharyngeus** from oblique line on thyroid cartilage
  - **Cricopharyngeus** from cricoid arch
- Function: push food into oesophagus
  - Exception: **cricopharyngeus**
    - → Acts as a <u>sphincter</u> for oesophageal entrance
    - → Normally contracted to prevent anything form going down it
    - → Relaxes during swallowing to admit food
- <u>ALL</u> pharyngeal constrictors overlap except for region between **thyropharyngeus** and **cricopharyngeus**
  - → pharyngeal mucosa may herniate here
  - → **pharyngeal diverticulum**



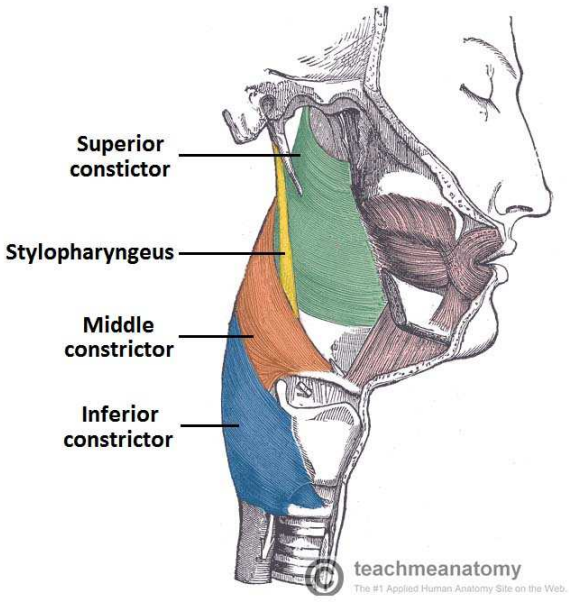




b. Longitudinal Muscles of Pharynx

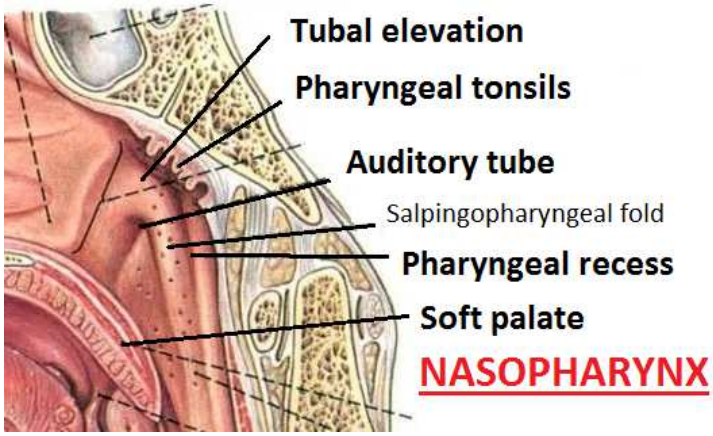


- Three **longitudinal muscles** found on the internal surface of **pharyngeal constrictors**
- Origin:
  - **Salpingopharyngeus** from cartilage of auditory tube
  - **Palatopharyngeus** from soft palate
  - **Stylopharyngeus** from styloid process
    → pass through the gap between superior and middle constrictors from deep side of styloid process
- Insertion: **thyroid cartilage**
- Action: <u>lifts</u> the larynx during <u>swallowing</u>
  - Larynx heavy and held down by trachea

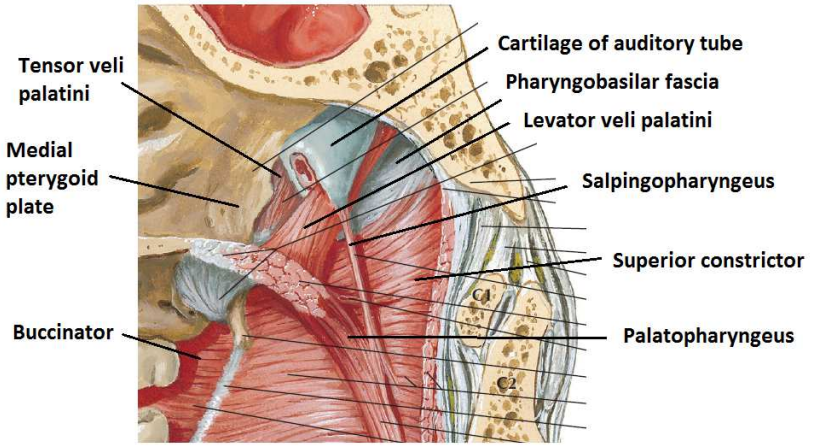


B. Regional Anatomy of Pharynx

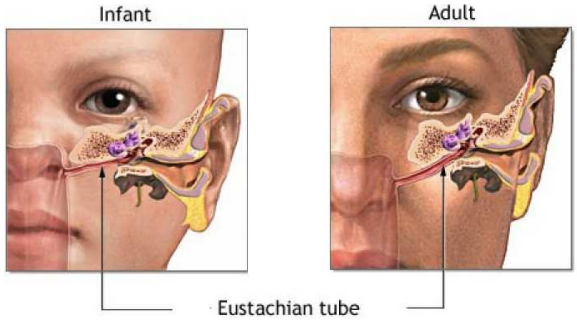
1. Nasopharynx



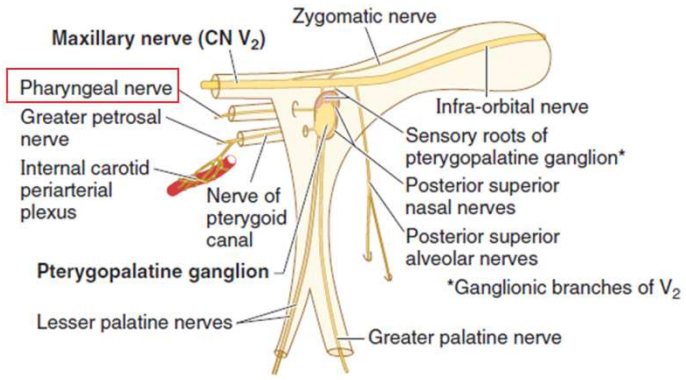
- **Pharyngeal tonsils (adenoid)**: located on the roof
  - Drain to deep cervical nodes
- **Auditory tube**:
  - Emerges near junction of petrous temporal and sphenoid greater wing
  - Opens into <u>lateral</u> wall
  - J-shaped cartilage raises mucosa to form **tubal elevation**
  - **Pharyngeal recess (fossa of Rosenmüller)**:
    - → Located behind tubal elevation
    - → Common site of origin for **nasopharyngeal carcinoma**



- **Auditory tube** as common route of infection spread into middle ear
  - Results in **otitis media**
  - Young children have <u>shorter</u>, more <u>horizontal</u> and wider auditory tubes
    - → more prone to otitis media
  - Results in immediate (temporary) hearing loss
  - Can further spread to mastoid antrum unless checked with antibiotics
  - Common in ≤10y/o



- Innervation: by **pharyngeal br.** of **maxillary nerve (CN V_2)**
  - Passes <u>posteriorly</u> from **pterygopalatine ganglion** via **pharyngeal canal** in pterygoid process

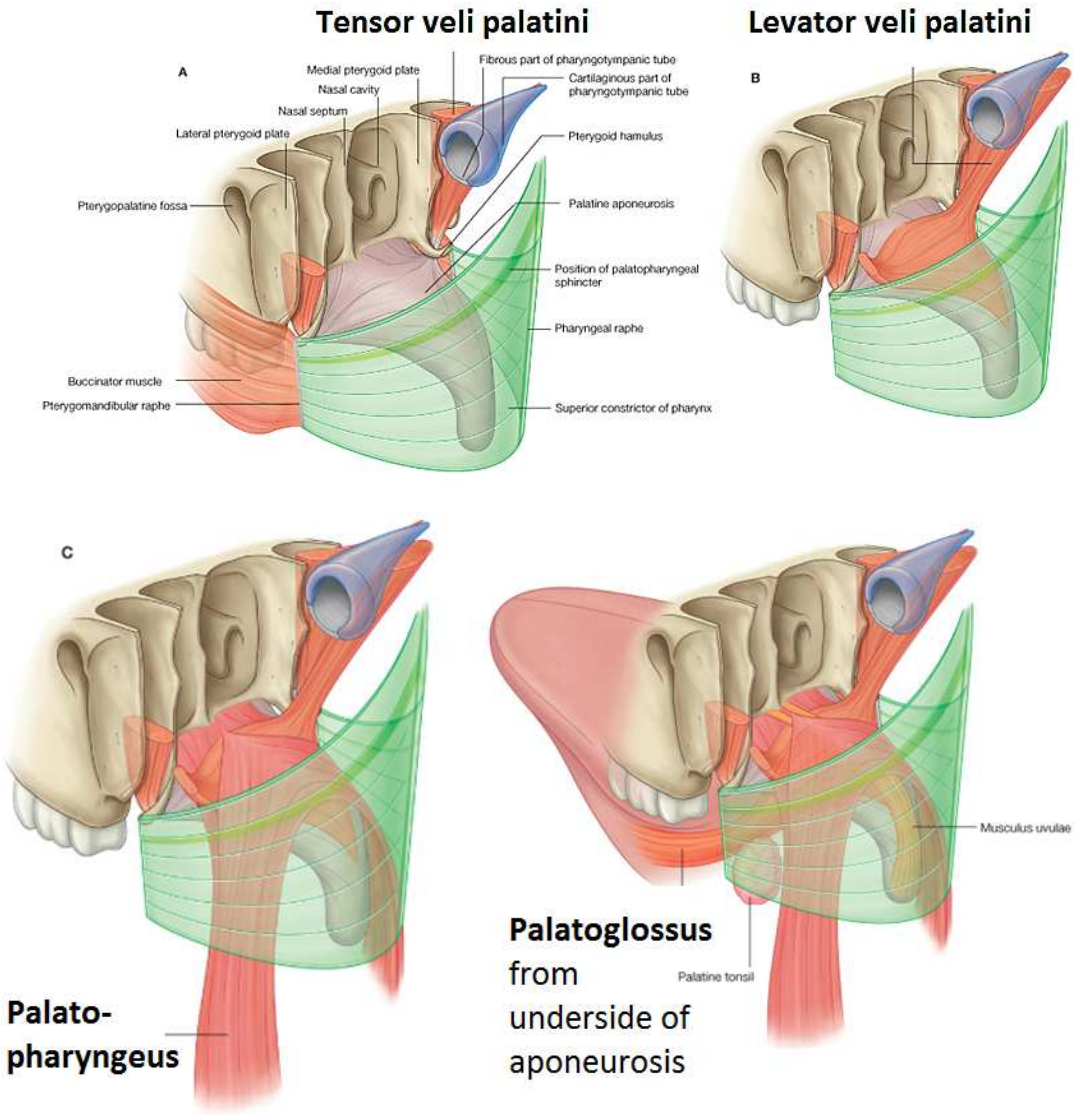


Consequence of NPC at **Fossa of Rosenmueller:*

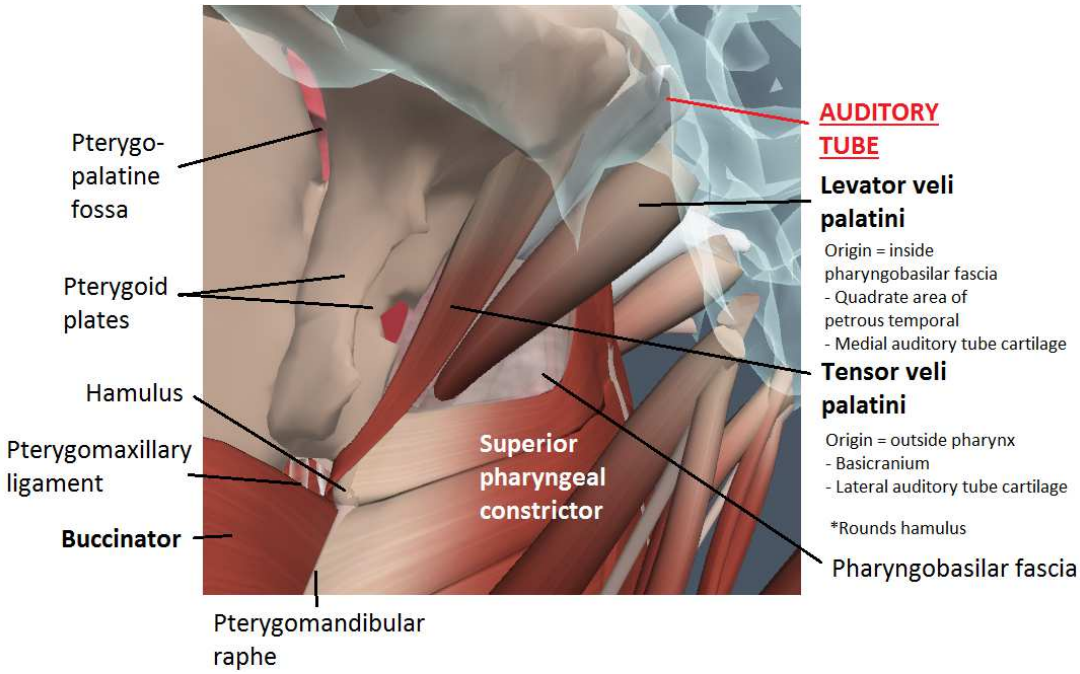
(1) invades the opening of auditory tube → vacuum in middle ear may suck out fluid from blood vessels of the mucosa, resulting in middle ear effusion and thus conductive deafness.

*(2) Affects the functioning of **levator** and **tensor veli palatini**.*

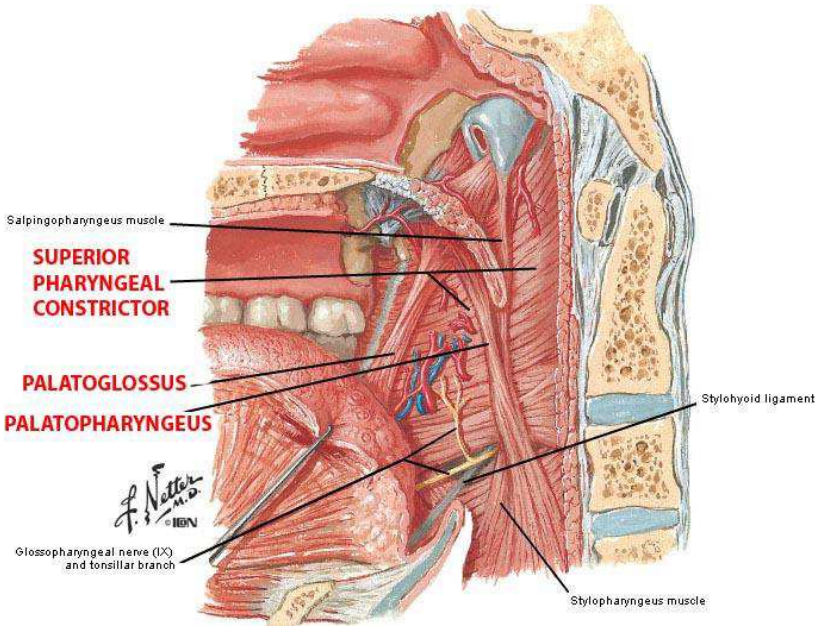
2. Soft Palate



- **Soft palate**: a mobile fold attached to <u>posterior</u> part of hard palate
- **Uvula**: conical projection in the midline of soft palate
- Muscles of soft palate:
  - **Tensor veli palatini**: tenses soft palate
  - **Levator veli palatini**: raises soft palate
  - **Palatoglossus**: raises <u>tongue</u>
  - **Palatopharyngeus**: elevates wall of pharynx
  - **Musculus uvulae**: elevates uvula

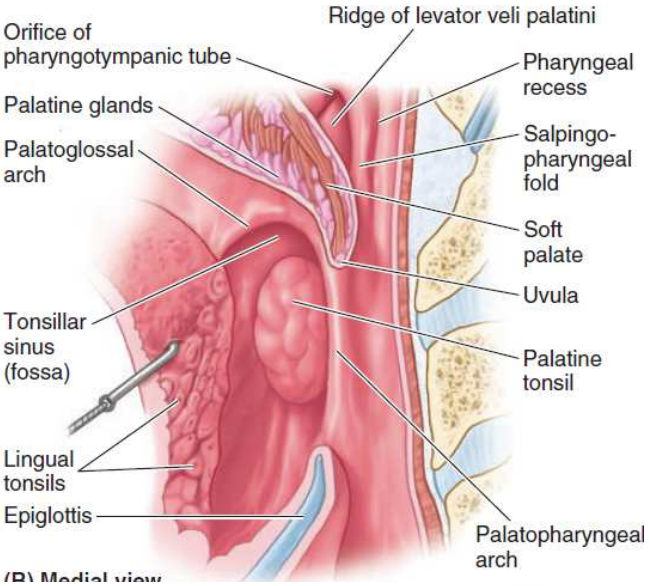


- Motor supply:
  - **Tensor veli palatini**: CN V_3 via **n. to medial pterygoid**
  - Others: CN X via **pharyngeal plexus**
- Auditory tube cartilage as attachment to several muscles:
  - **Tensor veli palatini** from lateral auditory tube cartilage outside the pharynx
  - **Levator veli palatini** from medial auditory tube cartilage inside the pharyngobasilar fascia
  - Note how **tensor veli palatini** hooks the hamulus to go through a gap above the **pterygomaxillary ligament** (and **buccinator**) to enter the pharynx
- **Palatopharyngeus** and **palatoglossus** found inside pharynx:
  - Seen as two **arches** from the internal surface of oropharyngeal mucosa
    - → **Palatoglossal arch (anterior pillar of fauces)**
    - → **Palatopharyngeal arch (posterior pillar of fauces)**
  - Encloses the **palatine tonsils**

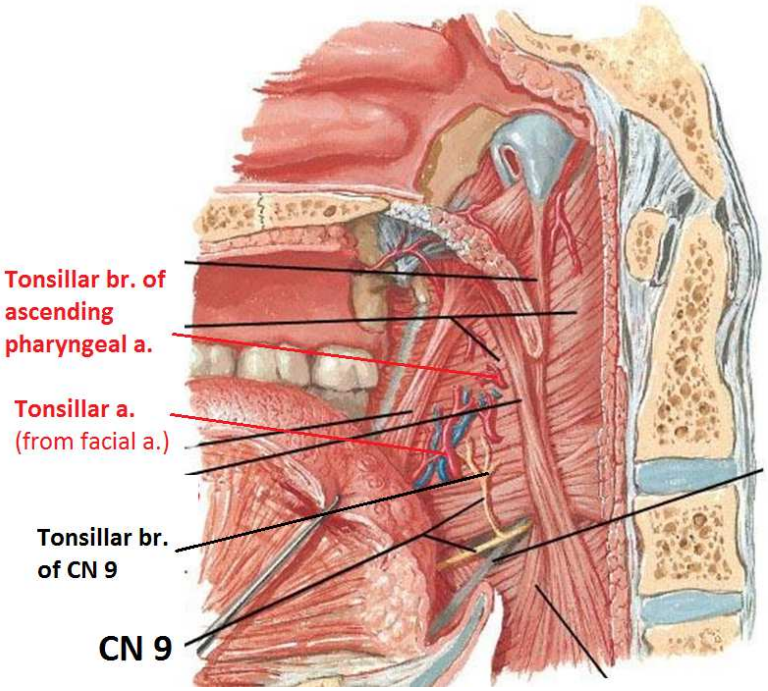


Note that the action of elevating the soft palate by **levator veli palatini must be in concert with **tensor veli palatini**, or else the palatine aponeurosis will be flaccid.*

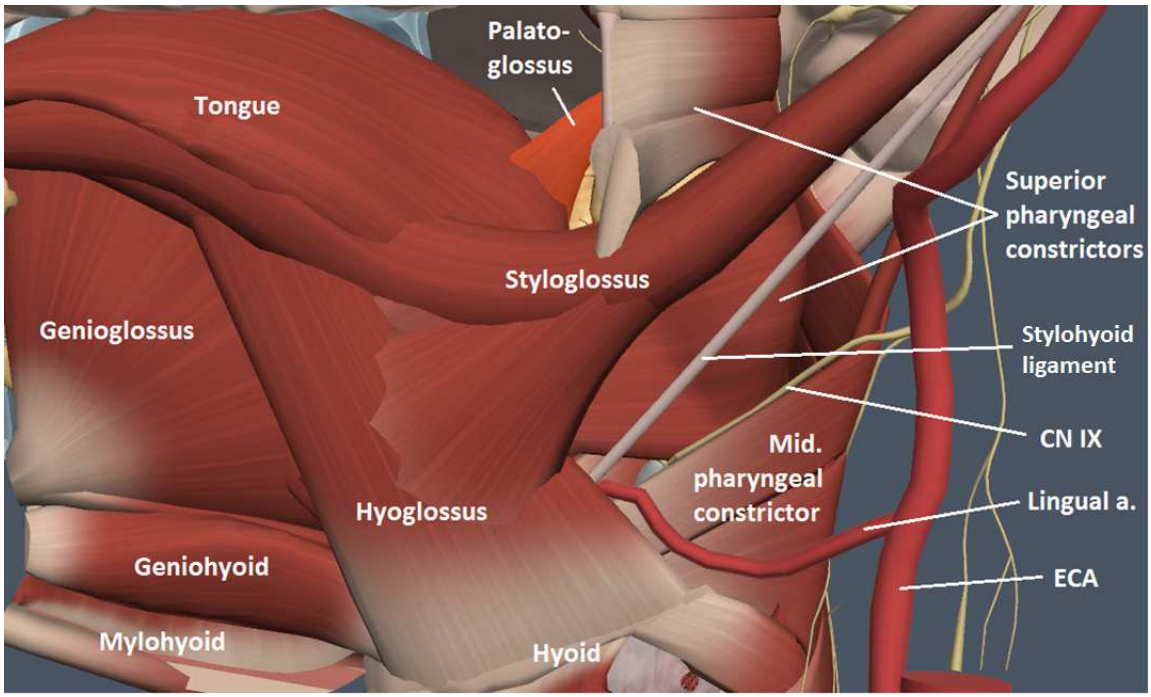
3. Oropharynx



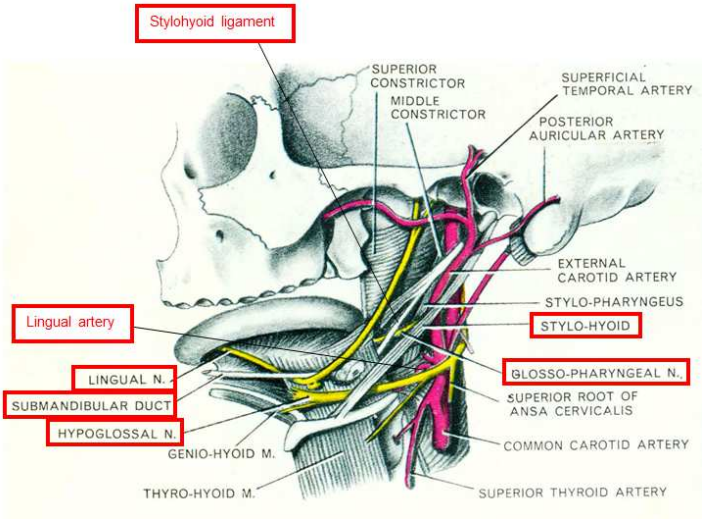
- **Palatine tonsils**: lumps of lymphoid tissues lying on lateral wall of oropharynx
  - Most important feature of oropharynx
  - Lies between **palatoglossal** and **palatopharyngeal arches**
  - Covering:
    - → Internal: mucosa
    - → Lateral: fibrous capsule (from carotid sheath)
- Neurovascular supply of **palatine tonsils**:
  - Vascular supply:
    - → **Tonsillar a.** from facial a.
    - → **Tonsillar br. of ascending pharyngeal a.**
  - Innervation: **tonsillar br. of CN 9**
  - Lymphatic drainage: **jugulodigastric lymph node** (an upper deep cervical LN)
- Young children tend to get repeated infections of palatine tonsils
  - Results in enlargement of jugulodigastric LNs
  - If infection becomes chronic
    - → **tonsillectomy**
  - Perfectly safe provided that the fibrous capsule is respected
  - Rather large vein running between tonsil and soft palate appears to cause much of the bleeding in this operation
  - Note proximity to:
    - → CN 9 accompanying tonsillar a. on lateral wall
    - → ICA just lateral to tonsils
  - ICA and CN 9 vulnerable to injury during tonsillectomy
- **Lingual tonsils** located behind **sulcus terminalis** and **palatoglossal arch** at the pharyngeal part of the tongue
  - Also drain to deep cervical nodes



a. Anterior Relations of Oropharyngeal Muscles with Floor of Oral Cavity



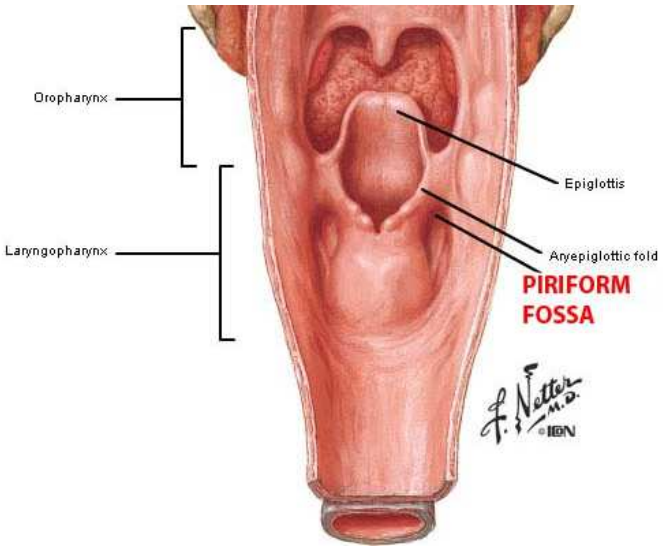
- Note a gap between **superior** and **middle pharyngeal constrictors**
- **Styloglossus** and **hyoglossus** 'cover' the anterior part of this opening
  → can be seen as an 'extension' of the pharyngeal wall anteriorly
- Structures passing <u>medial</u> to these two muscles:
  - **Lingual artery** from ECA
  - **Stylohyoid ligament**
  - **Glossopharyngeal n. (CN IX)**
- This explains the distribution of structures superficial and deep to the **hyoglossus** muscle in the floor of oral cavity:
  - Superficial:
    → **Submandibular duct**
    → **Lingual n.** from V_3
    → **Hypoglossal n. (CN XII)**
    → **Stylohyoid muscle**
  - Deep:
    → **Lingual artery**
    → **Stylohyoid ligament**
    → **Glossophaygeal n. (CN IX)**

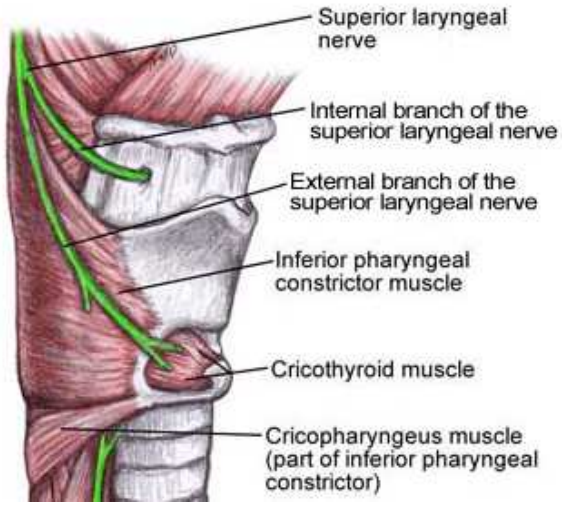


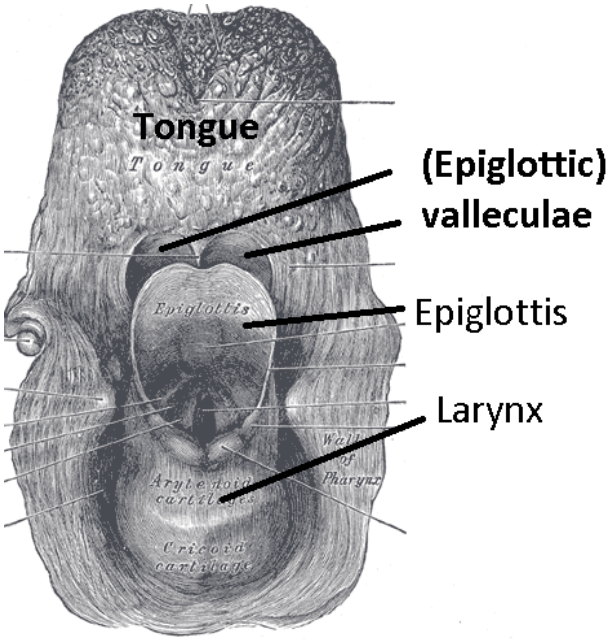
Strictly speaking, the main branch of **lingual a. only runs deep to the hyoglossus and does not enter the pharynx. It does, however, send branches entering deeper parts of the oropharynx (eg. **dorsal lingual a., tonsillar br.**)*

4. Laryngopharynx

- **Piriform fossa (recess)**: most important feature of laryngopharynx
  - Lies <u>anteriorly</u> on either side of larynx
  - Located <u>medial</u> to thyroid cartilage
  - Deep to mucosa: **internal laryngeal n.** from **superior laryngeal n.** (X)
    - → Just pierced thyrohyoid membrane
    - → Can be irritated by food stuck in piriform fossa
- Most important lateral relation of **oropharynx** and **laryngopharynx** is the **carotid sheath**
- **Epiglottic valleculae**: two depressions situated between the root of tongue and epiglottis
  - Function: holds saliva temporarily to prevent initiation of swallowing reflex
  - Food can easily get lodged there
    - → irritation

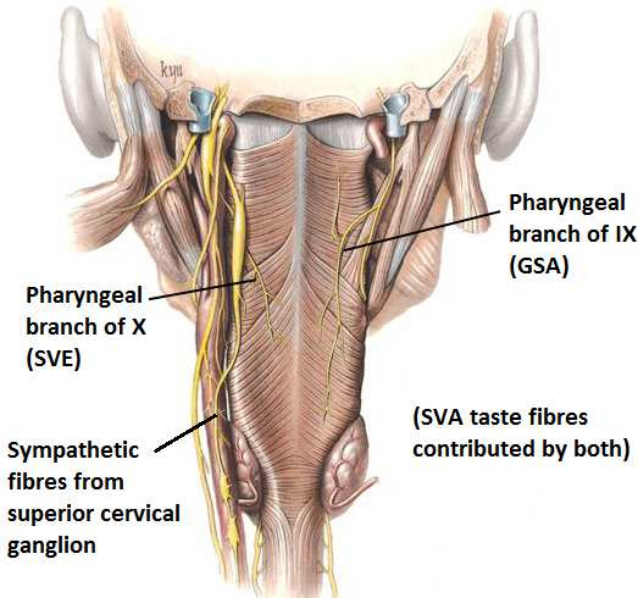






C. Neurovascular Supply and Functions of Pharynx

1. Innervation of Pharynx



- **Pharyngeal plexus**: a network of nerves providing supply to the pharynx
- Supplied by:
  - **Pharyngeal branch of IX**
    → sensory innervation
  - **Pharyngeal branch of X**
    → motor innervation
  - **Superior cervical ganglion** (T1)
    → sympathetic motor innervation
- Forms the pharyngeal plexus on the lateral side of middle pharyngeal constrictor
- Sensory supply of pharynx:
  - **Nasopharynx**: pharyngeal br. of V_2
  - **Oropharynx** and **laryngopharynx**:
    → Sensory fibres from **glossopharyngeal n. (IX)**
    → **Internal laryngeal n.** from **vagus n. (X)**
  - Clinical relevance: use of **gag reflex** (by touching oropharyngeal mucosa) to test the function of **CN IX**
- Motor supply of pharynx: **pharyngeal plexus** (X) except
  - **Tensor veli palatini** by n. to medial pterygoid (V_3)
  - **Stylopharyngeus** by muscular br. of CN IX
  - **Cricopharyngeus** by recurrent laryngeal n. (X)

2. Vascular Supply to Pharynx

- Arterial supply: branches of **external carotid artery**
  - **Ascending pharyngeal aa.** from ECA
  - Assisted by:
    → Branches of **facial a.**
    → Branches of **maxillary a.**
- Venous drainage: **pharyngeal venous plexus** around the pharynx
  - Drains into **internal jugular vein**
  - Communicates with **pterygoid venous plexus**
- Lymphatic drainage:
  - Majority: **upper deep cervical nodes**
  - Also to **retropharyngeal lymph nodes**

Note that **cranial root of CN XI provides the motor fibres to the pharyngeal plexus. However, this is grouped by Moore as a part of **CN X** and thus is not mentioned here.*

3. Act of Swallowing

- **Act of swallowing**: well-coordinated function of tongue, soft palate and pharynx
- **Stage I**: voluntary
  - Once food ready to be swallowed, pushed upward and backward by tongue through action of **styloglossus** muscle
- **Stage II**: involuntary
  - **Palatoglossus** constricts opening of oropharynx
    → pushes food further backwards
  - Action becomes involuntary once entered pharynx
  - Food prevented to enter nasopharynx and nasal cavities by:
    → Elevating soft palate
    → Forward movement of pharynx
    → Constriction of **palatopharygeal folds**
  - Epiglottis closed by elevation of pharynx via action of:
    → Three longitudinal muscles: **stylopharyngeus**, **salpingopharyngeus**, and **palatopharygeus**
    → **Thyrohyoid**
  - Results:
    → Diversion of food towards oesophagus
    → Prevention of food from entering trachea
- **Stage III**: involuntary
  - Movement aided by **pharyngeal constrictors**
  - **Cricopharyngeus** muscle relaxes to allow food to enter the oesophagus