Kingdom of Bahrain
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Structure and Nerve Supply of The Larynx

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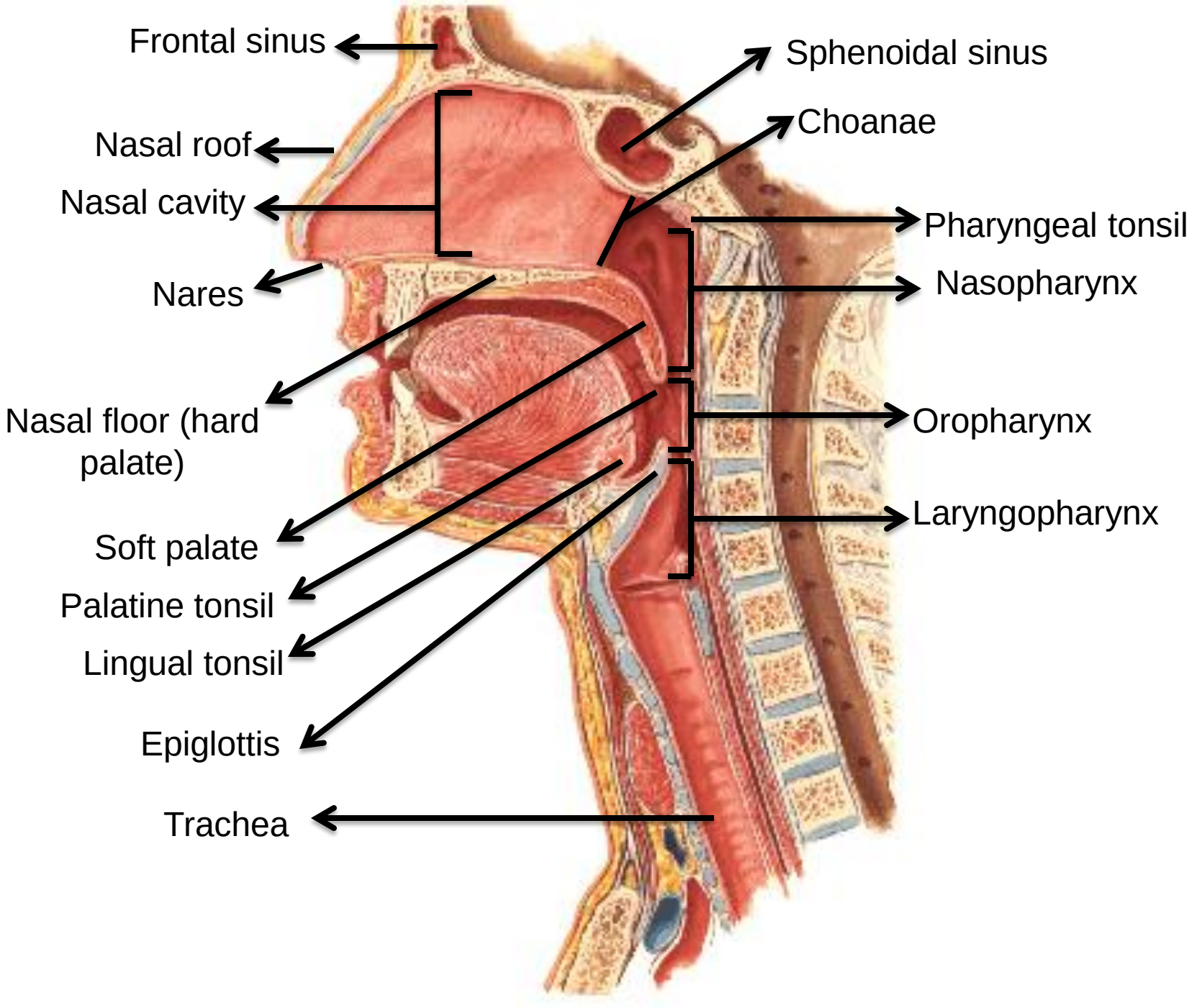
RESPIRATORY TRACT

a. **Upper Respiratory Tract:**
   1. **Nasal Cavities and Paranasal Sinuses**
   2. **Pharynx (البلعوم)**
   3. **Larynx (الحنجرة)**

b. **Lower Respiratory Tract:**
   1. **Trachea**
   2. **Bronchi (Right and left bronchi).**
   3. **Bronchioles (ending with alveoli).**

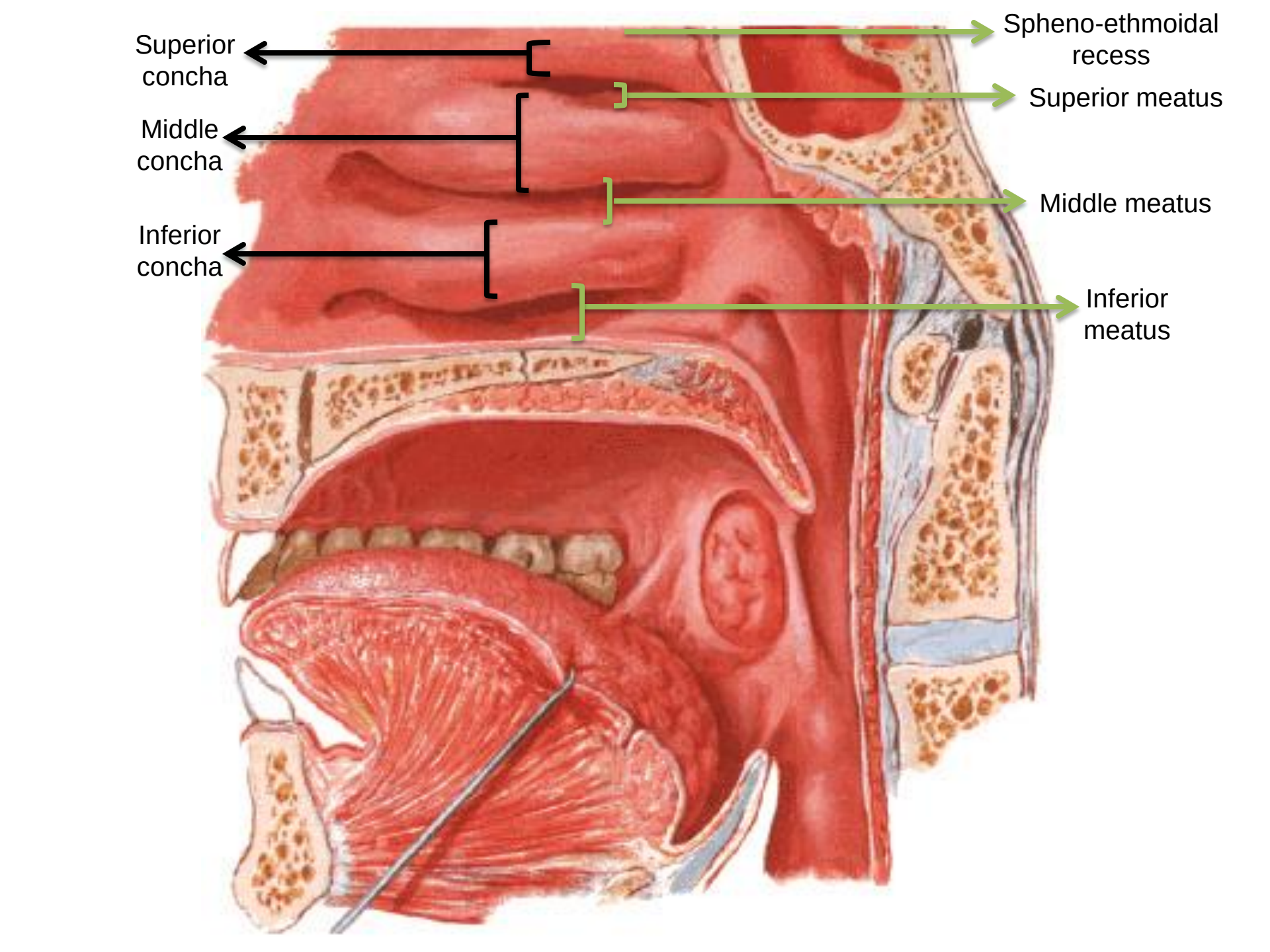
c. **Functional:**
   a. Conducting portion for ***passage of air***
   b. Respiratory portion for ***gaseous exchange (Alveoli)***


Frontal sinus
Sphenoidal sinus
Nasal roof
Choanae
Nasal cavity
Pharyngeal tonsil
Nares
Nasopharynx
Nasal floor (hard palate)
Oropharynx
Laryngopharynx
Soft palate
Palatine tonsil
Lingual tonsil
Epiglottis
Trachea

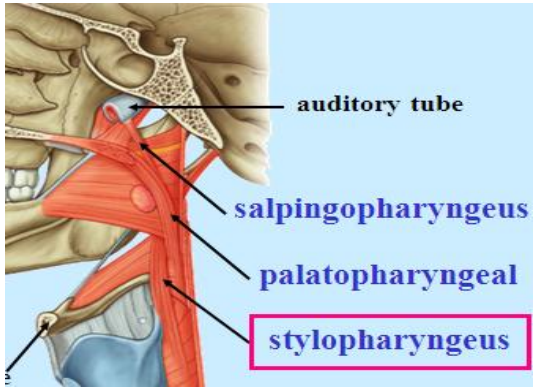
- **Nasal Cavity:**
  - Extends from nostrils (the nares: فتحات الأنف) to nasopharynx. The area between the nasal cavity and the nasopharynx is called: **Choanae.**
  - **Each nasal cavity has a:**
    - Floor: consisting of soft and hard palate
    - Roof: olfactory mucosa (Olfactory receptors مستقبلات الشم are located at the apex of each nasal cavity).
    - Lateral wall: which has 3 projections know as **conchae** (superior, middle and inferior) and underlying **meatuses** (air channels formed by the conchae: Spheno-ethmoidal recess, superior meatus, middle meatus and inferior meatus).
    - Medial wall: that is the **nasal septum** (separating the nasal cavity into two cavities), septal cartilage, perpendicular plate of ethmoid vomer bones.

•Paranasal Sinuses (الجيوب الأنفية):

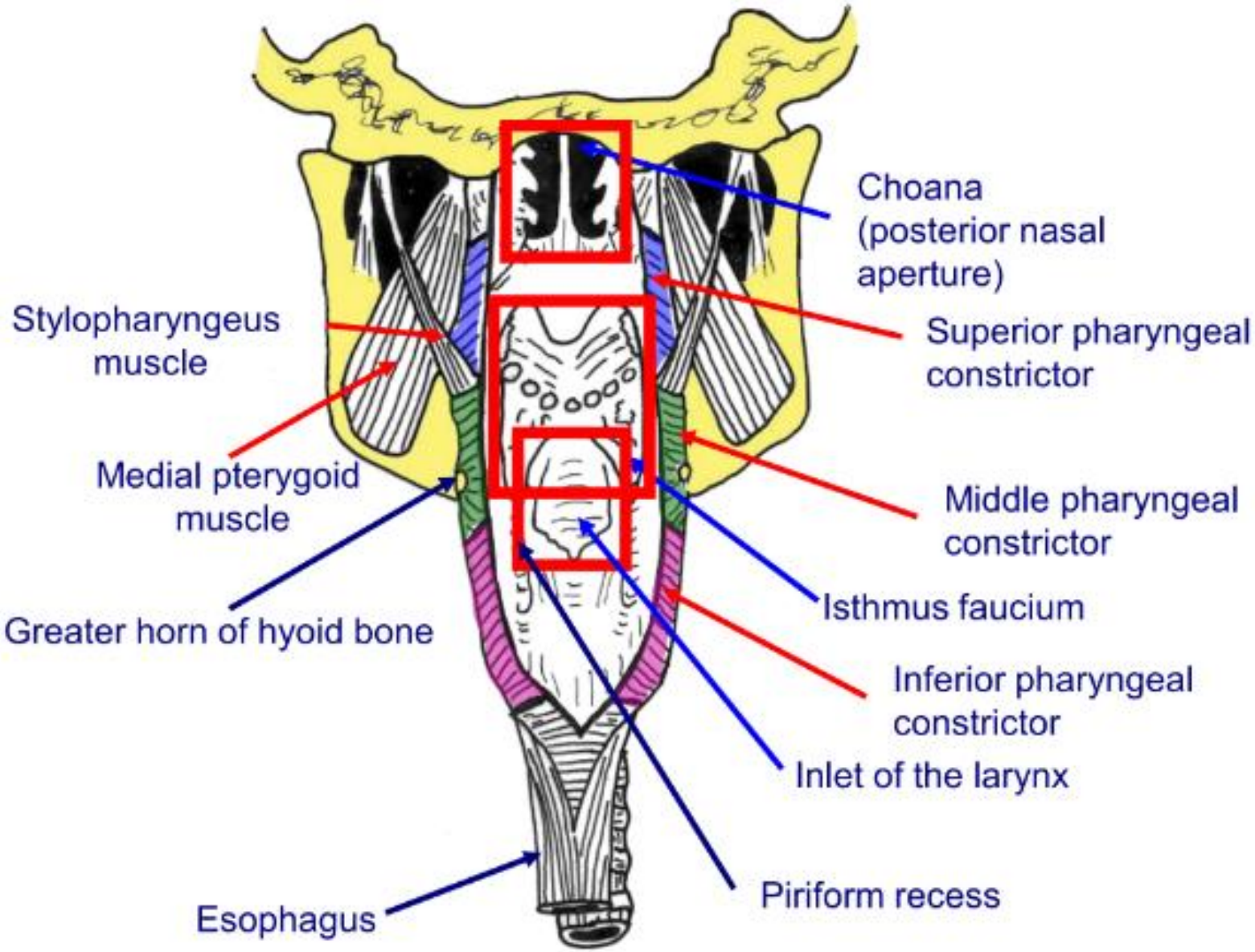
- The Paranasal Sinuses are **air-containing sacs** in the skull bones lined by respiratory mucosa.
- The **Frontal Maxillary** and **Ethmoidal** (A<M) sinuses drains into the **middle meatus.**
- The **Sphenoidal** and **Post-Ethmoidal** sinuses open at the **superior meatus.**
- The **Nasolacrimal duct** and **Eustachian tube (auditory tube)** open into the **inferior meatus.**

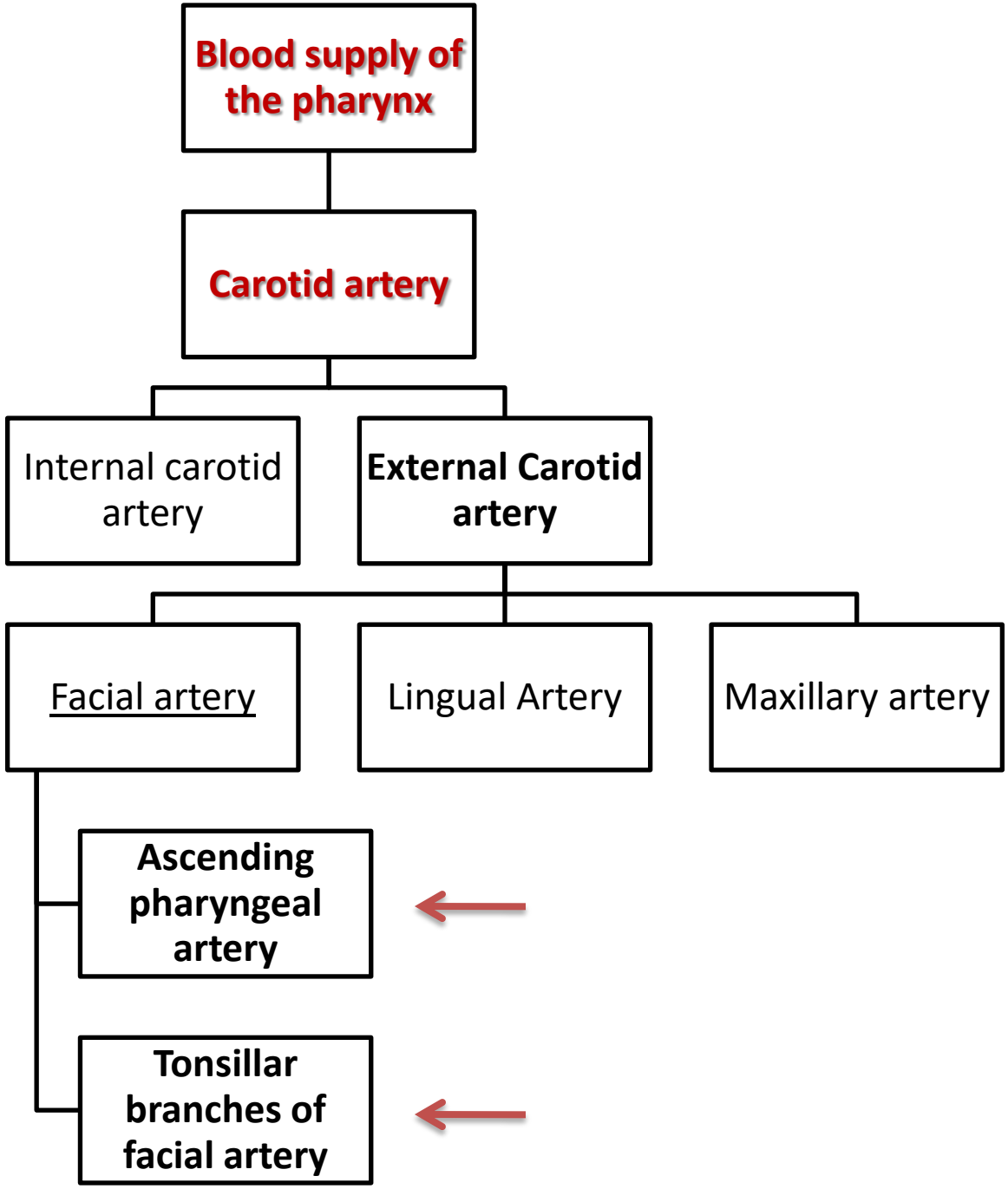

Superior concha
Middle concha
Inferior concha
Spheno-ethmoidal recess
Superior meatus
Middle meatus
Inferior meatus

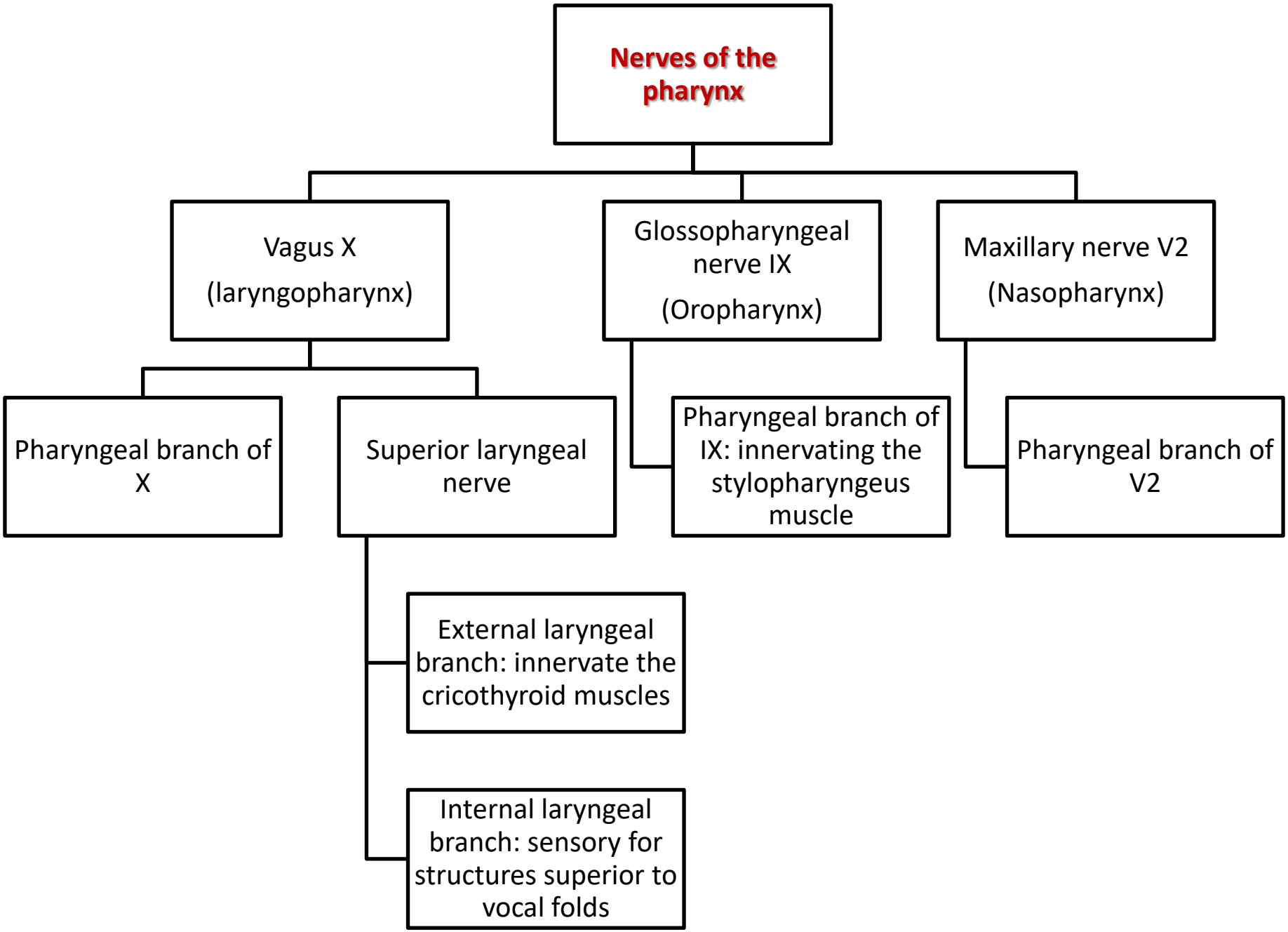
- **The Pharynx:**
  - It is a musculofacial tube: **3 constrictor muscles** lined by mucosa (**superior**, **middle** and **inferior** constrictors).
  - Constrictor muscles have fibers contained in a **circular** direction relative to the pharyngeal wall. All of them are innervated by the **vagus nerve X** and when they contract sequentially from top to bottom, as in swallowing, they **move a bolus of food** through the pharynx and into the esophagus.
  - Constrictor muscles **overlap each other** and they all come together posteriorely in the **pharyngeal raphe.**
  - **The pharynx is divided into three parts:**
    - **Nasopharynx** (Adenoids; Eustachian)
    - **Oropharynx** (Palatine tonsils)
    - **Laryngopharynx** (Epiglottis; laryngeal inlet)



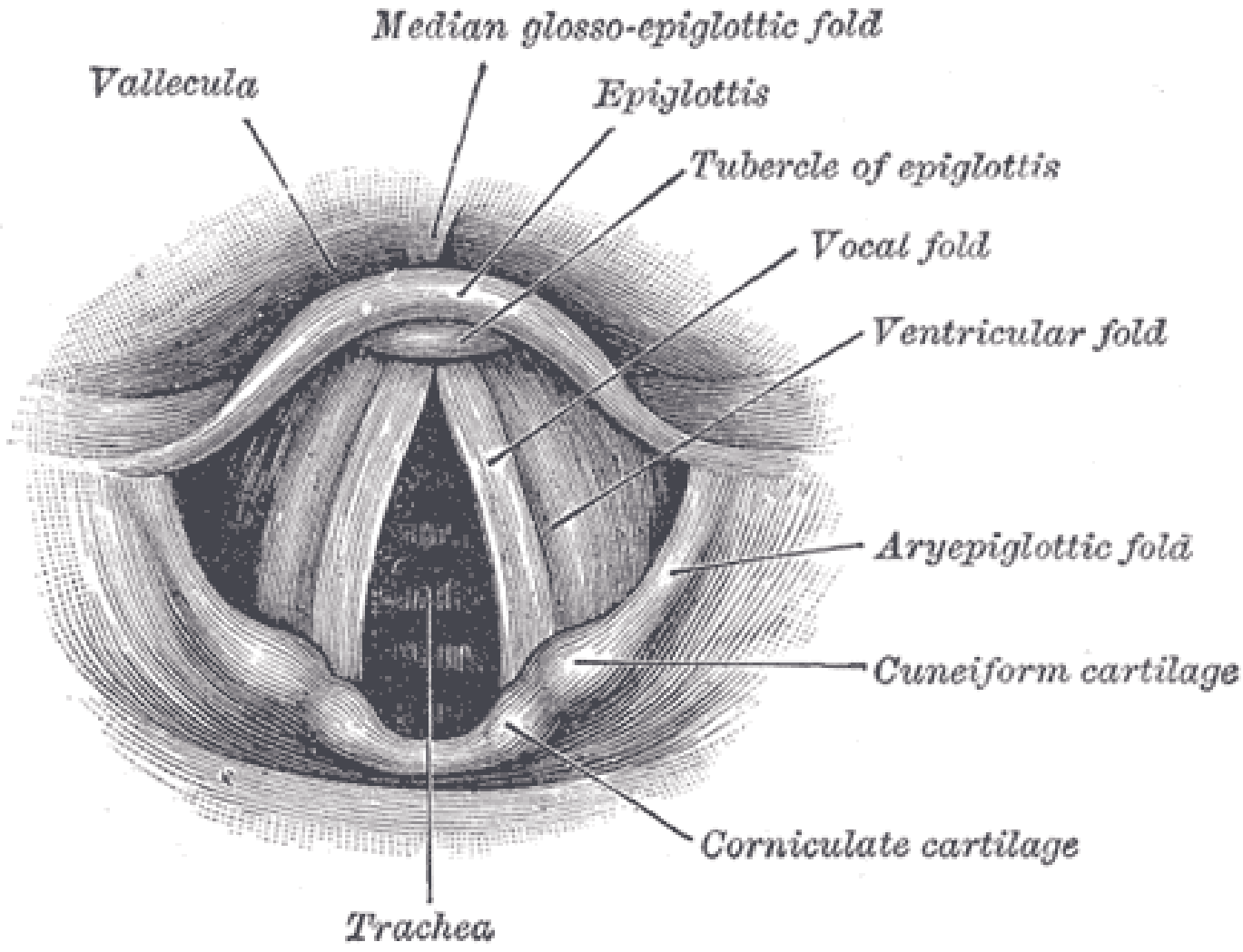
  - There are also **3 longitudinal muscles**: **stylopharyngeus**, **salpingopharyndeus**, and **palatopharyngeus**. All of them are innervated by the vagus nerve except the stylopharyngeus muscle which is innervated by the glossopharyngeal nerve (IX).

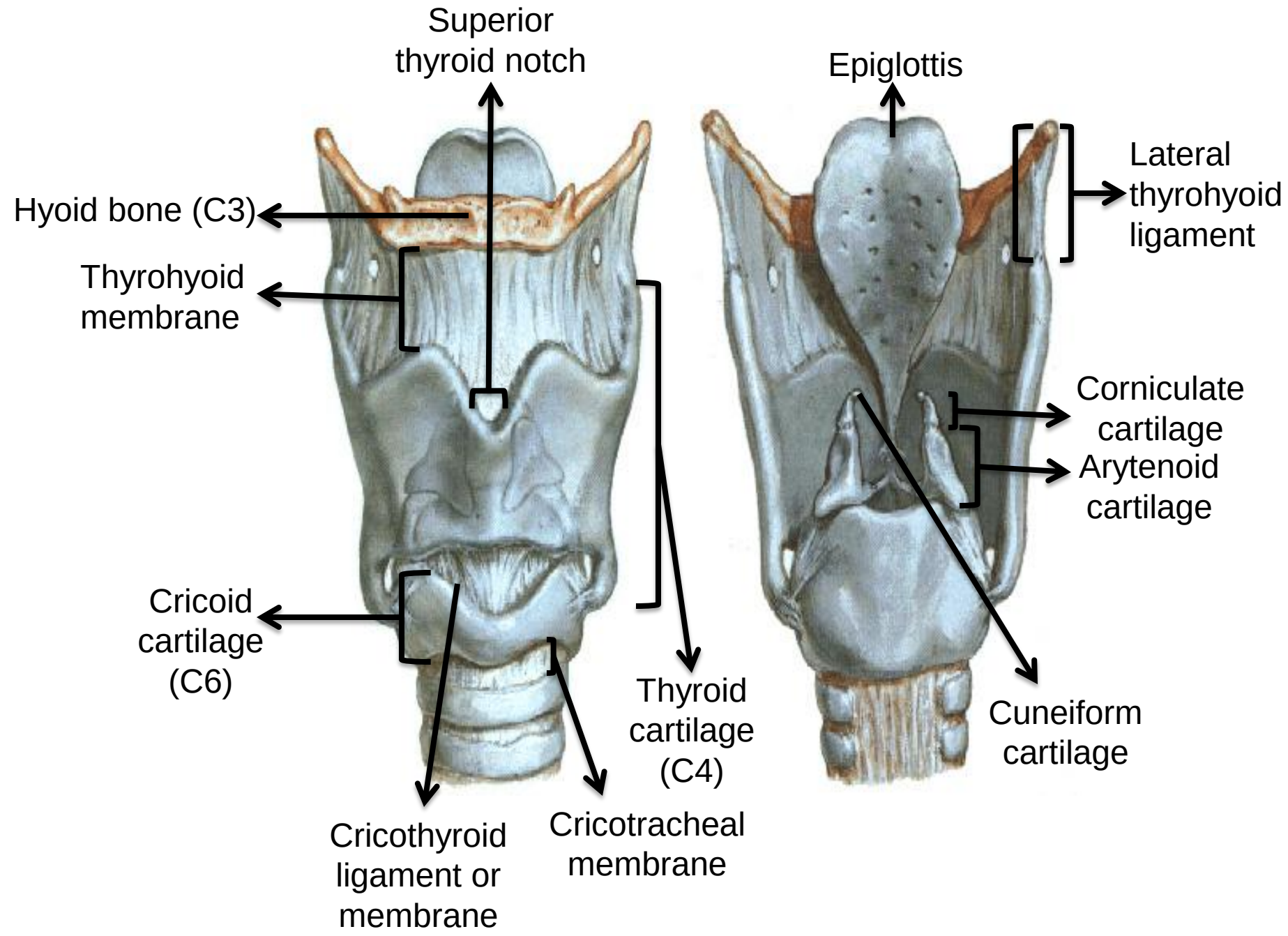

Choana
(posterior nasal
aperture)
Stylopharyngeus
muscle
Superior pharyngeal
constrictor
Medial pterygoid
muscle
Middle pharyngeal
constrictor
Isthmus faucium
Greater horn of hyoid bone
Inferior pharyngeal
constrictor
Inlet of the larynx
Piriform recess
Esophagus

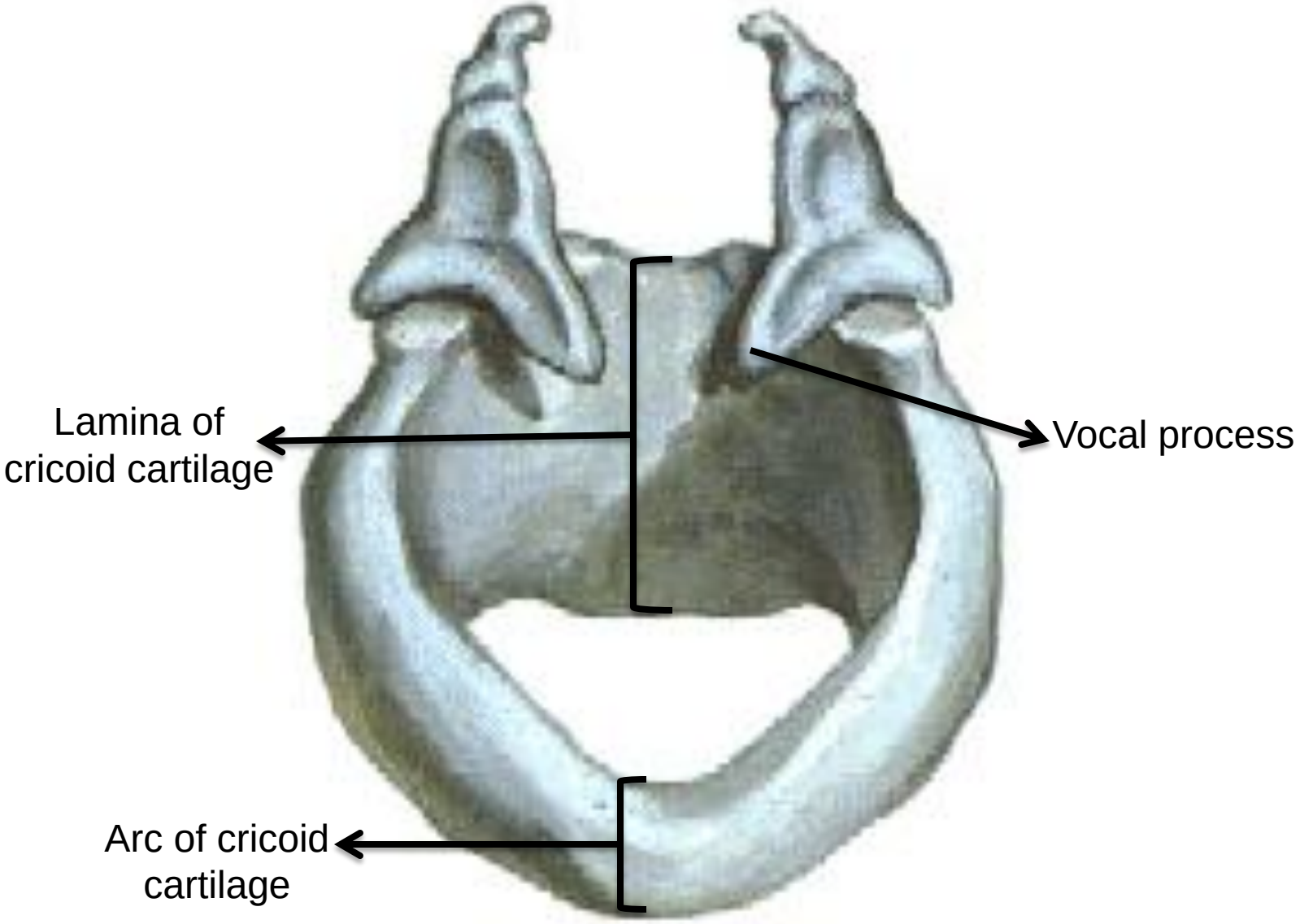

Blood supply of the pharynx
Carotid artery
Internal carotid artery
External Carotid artery
Facial artery
Lingual Artery
Maxillary artery
Ascending pharyngeal artery
Tonsillar branches of facial artery

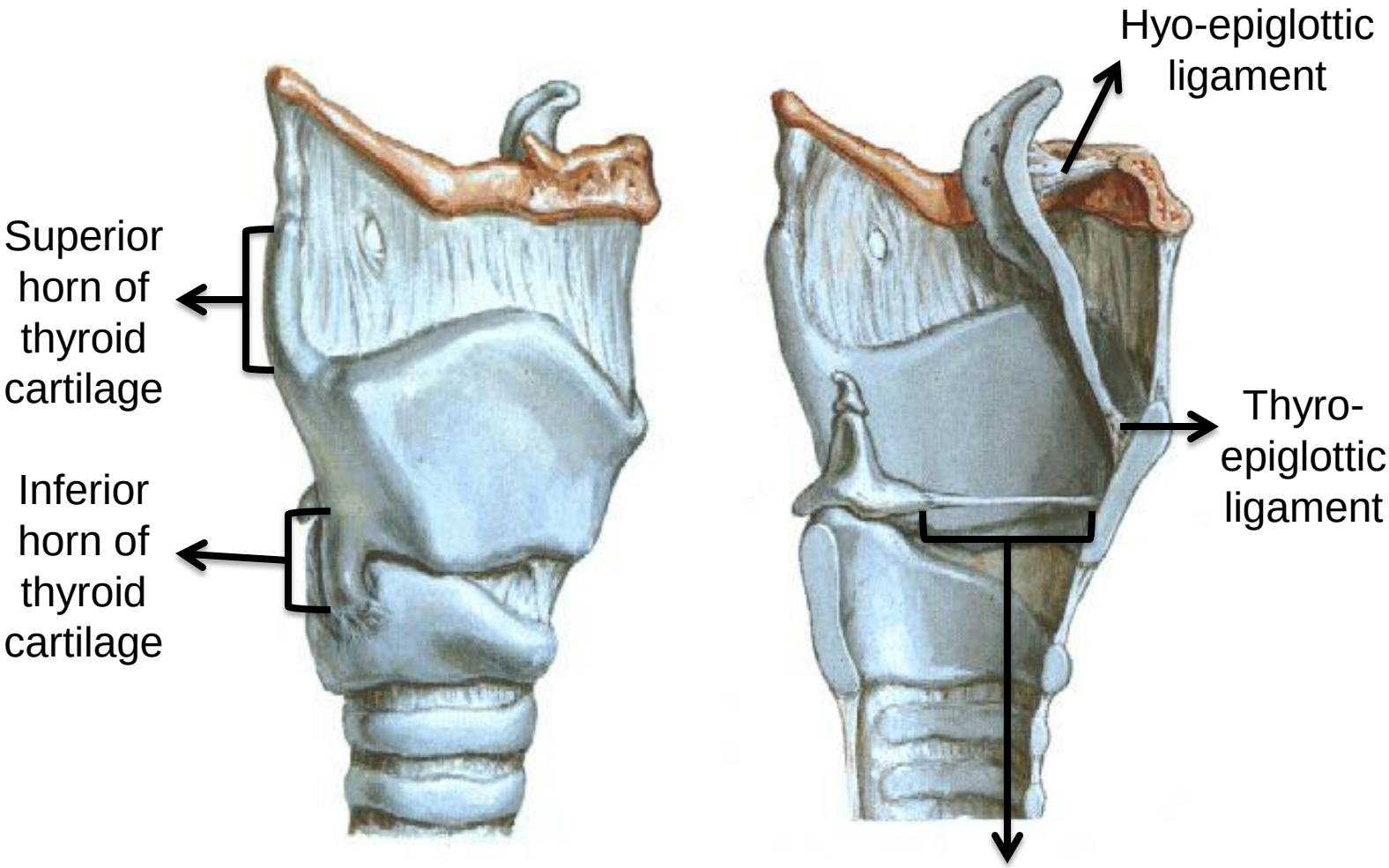

Nerves of the pharynx
Vagus X (laryngopharynx)
Glossopharyngeal nerve IX (Oropharynx)
Maxillary nerve V2 (Nasopharynx)
Pharyngeal branch of X
Superior laryngeal nerve
Pharyngeal branch of IX: innervating the stylopharyngeus muscle
Pharyngeal branch of V2
External laryngeal branch: innervate the cricothyroid muscles
Internal laryngeal branch: sensory for structures superior to vocal folds

- **Structure of the Larynx:**
  - The larynx is a tubular organ for **air passage** and **voice production (by the vocal cords).**
  - Above it **opens into the pharynx** at the level of C_3 (hyoid) and **continuous below with trachea** at C_6 (cricoid).
  - **The wall of larynx is made up of:**
    - **Nine Cartilages**:
      - 3 single cartilages: **Thyroid**, **Cricoid** and **Epiglottis**.
      - 3 paired cartilages: **2 Arytenoids**, **2 Corniculates** and **2 Cuneiforms**
    - **Membranes and ligaments.**
    - **Muscles (Extrinsic & Intrinsic)**
  - **The Cavity (Lumen) of the larynx:**
    - Lined by respiratory mucosa.
    - 2 Horizontal mucosal folds (cords): **Vestibular folds** which superior to **vocal folds**.
    - 3 regions: **vestibule**, **middle part of the cavity (glottis)** and **infraglottic space.**

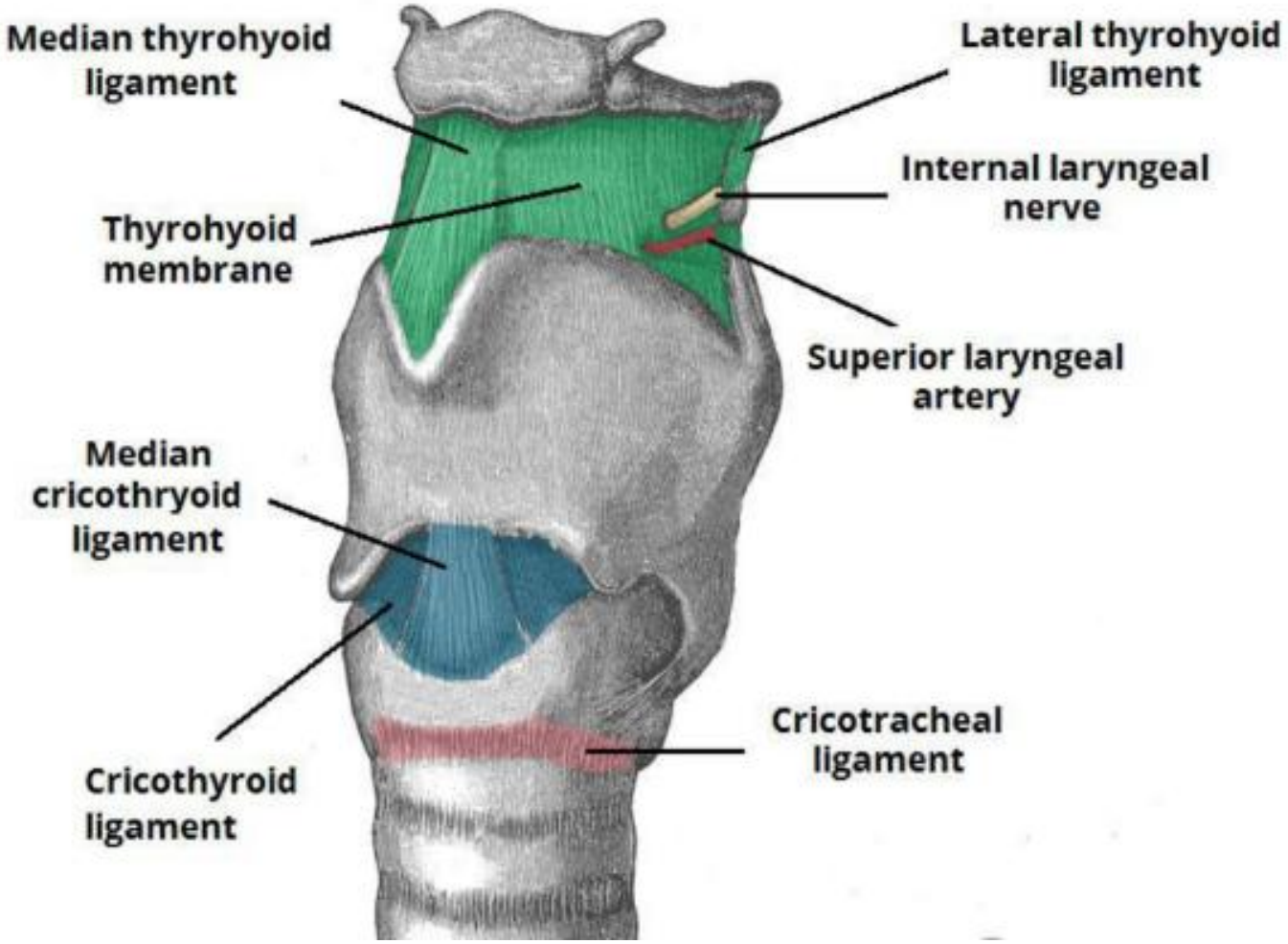

Median glosso-epiglottic fold
Vallecula
Epiglottis
Tubercle of epiglottis
Vocal fold
Ventricular fold
Aryepiglottic fold
Cuneiform cartilage
Corniculate cartilage
Trachea


Superior thyroid notch
Epiglottis
Hyoid bone (C3)
Lateral thyrohyoid ligament
Thyrohyoid membrane
Corniculate cartilage
Arytenoid cartilage
Cricoid cartilage (C6)
Thyroid cartilage (C4)
Cuneiform cartilage
Cricothyroid ligament or membrane
Cricotracheal membrane


Lamina of cricoid cartilage
Vocal process
Arc of cricoid cartilage

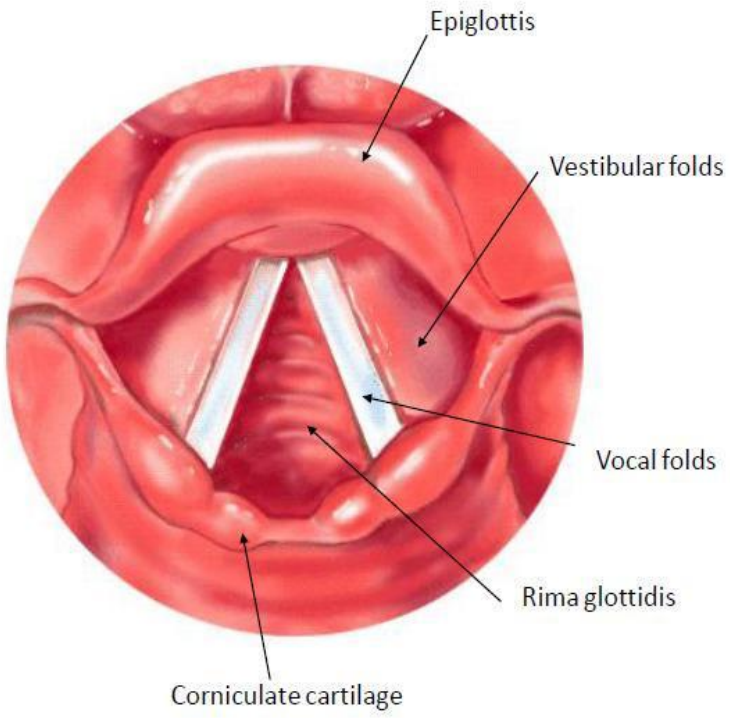

Superior horn of thyroid cartilage
Inferior horn of thyroid cartilage
Hyo-epiglottic ligament
Thyro-epiglottic ligament
Vocal ligament, when surrounded by mucosa it is called: vocal folds or vocal cords

Laryngeal Membranes



•Laryngeal Cavity:

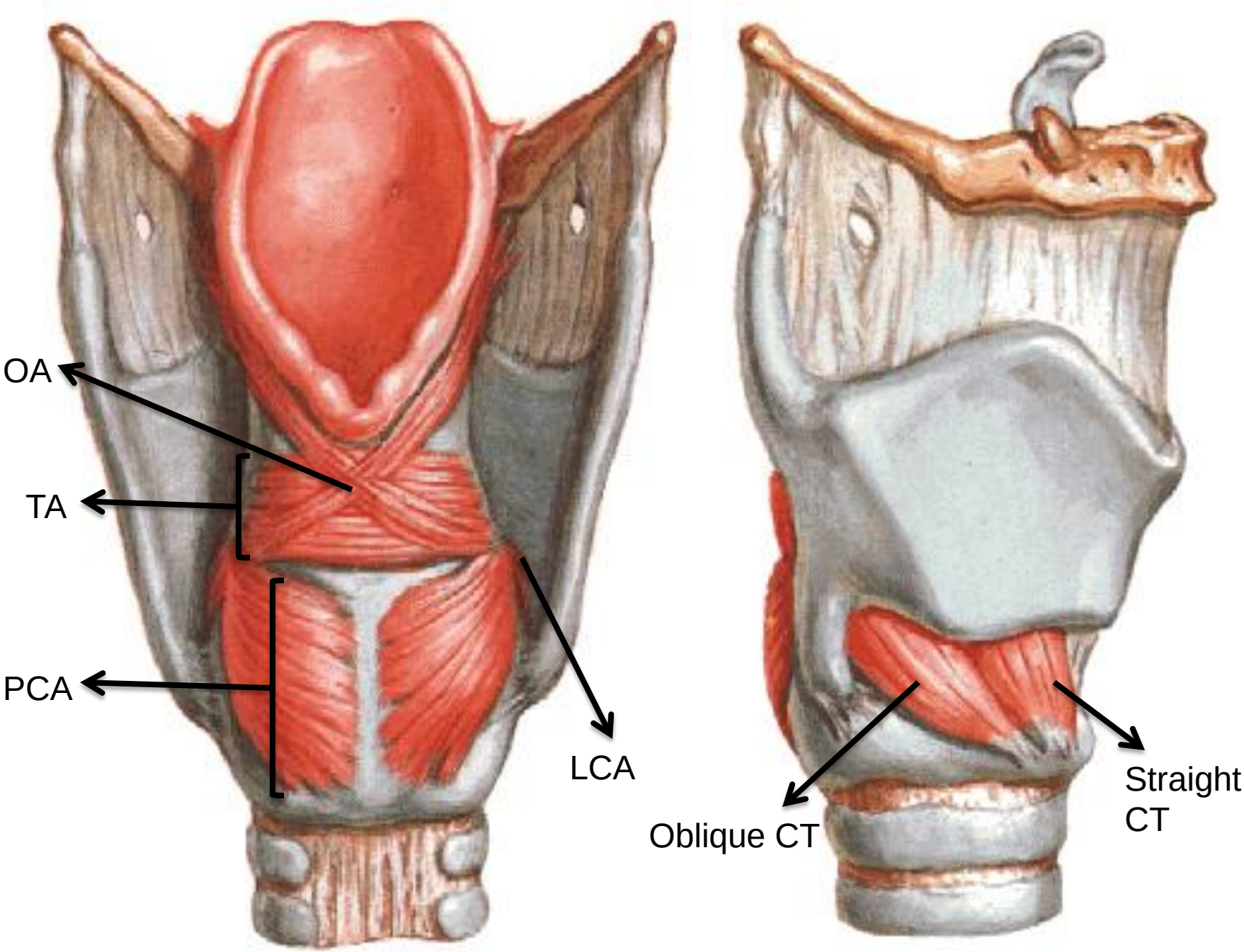
1. **Vestibule**: from inlet to vestibular folds.
2. **Ventriclea (sinus):** between vestibular folds.
3. **Infraglottic**: from vocal folds to cricoid cartilage.
   - Vocal ligament: thick free edge of lateral cricothyroid ligament (conus elasticus) **extending from tip of vocal process to thyroid cartilage.**
   - Glottis = vocal folds; vocal process; conus
   - Rima Glottidis: **aperture فتحة between vocal folds**
   - Rima Vestibuli**: aperture between vestibular folds.**

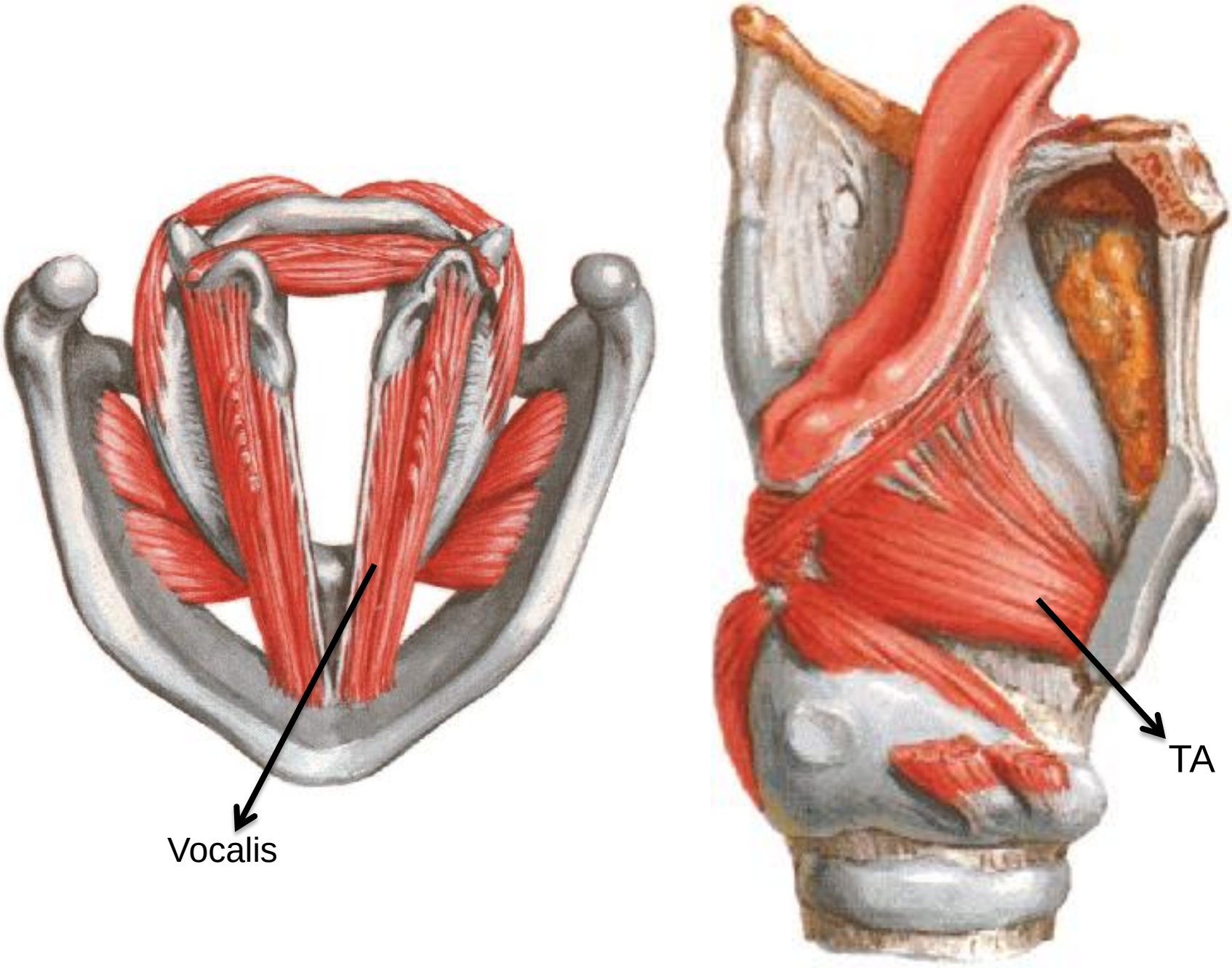


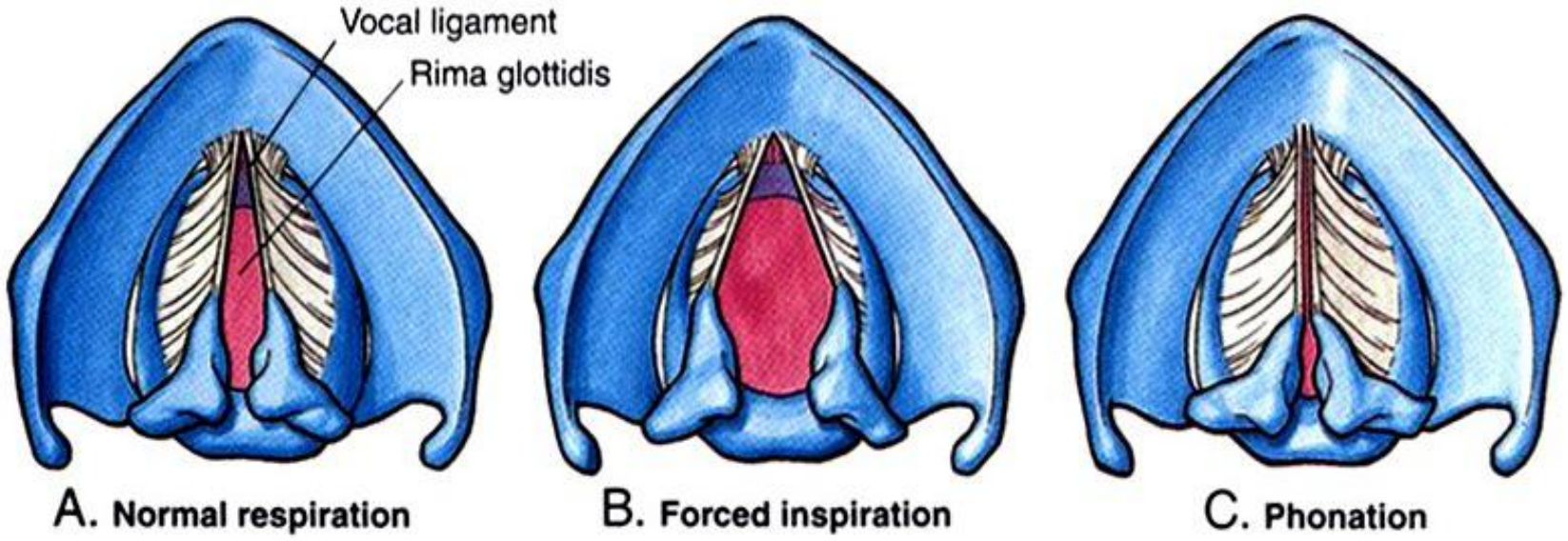
•Laryngeal Muscles:

A. **Extrinsic**: moves larynx up or down:
    1. Depressors: **Infrahyoid muscles**
    2. Elevators: **Suprahyoid muscles**
B. **Intrinsic (important)**: vocal folds:
    1. **Abductors (during respiration)**: **Posterior cricoarytenoid muscle (PCA).**
    2. **Adductors (during speech): Lateral cricoarytenoid (LCA)** + **Transverse (TA)** and **Oblique (OA) Arytenoids**
    3. **Tensors: Cricothyroids (straight and oblique)**
    4. **Relaxers: Thyroarytenoids** + **vocalis**
    5. **Sphincters**: Adductors of vocal folds + Aryepiglottics (inlet)

All of these muscles are innervated by recurrent laryngeal nerve except for cricothyroid muscles (external laryngeal nerve).


OA
TA
PCA
LCA
Oblique CT
Straight CT


Vocalis
TA

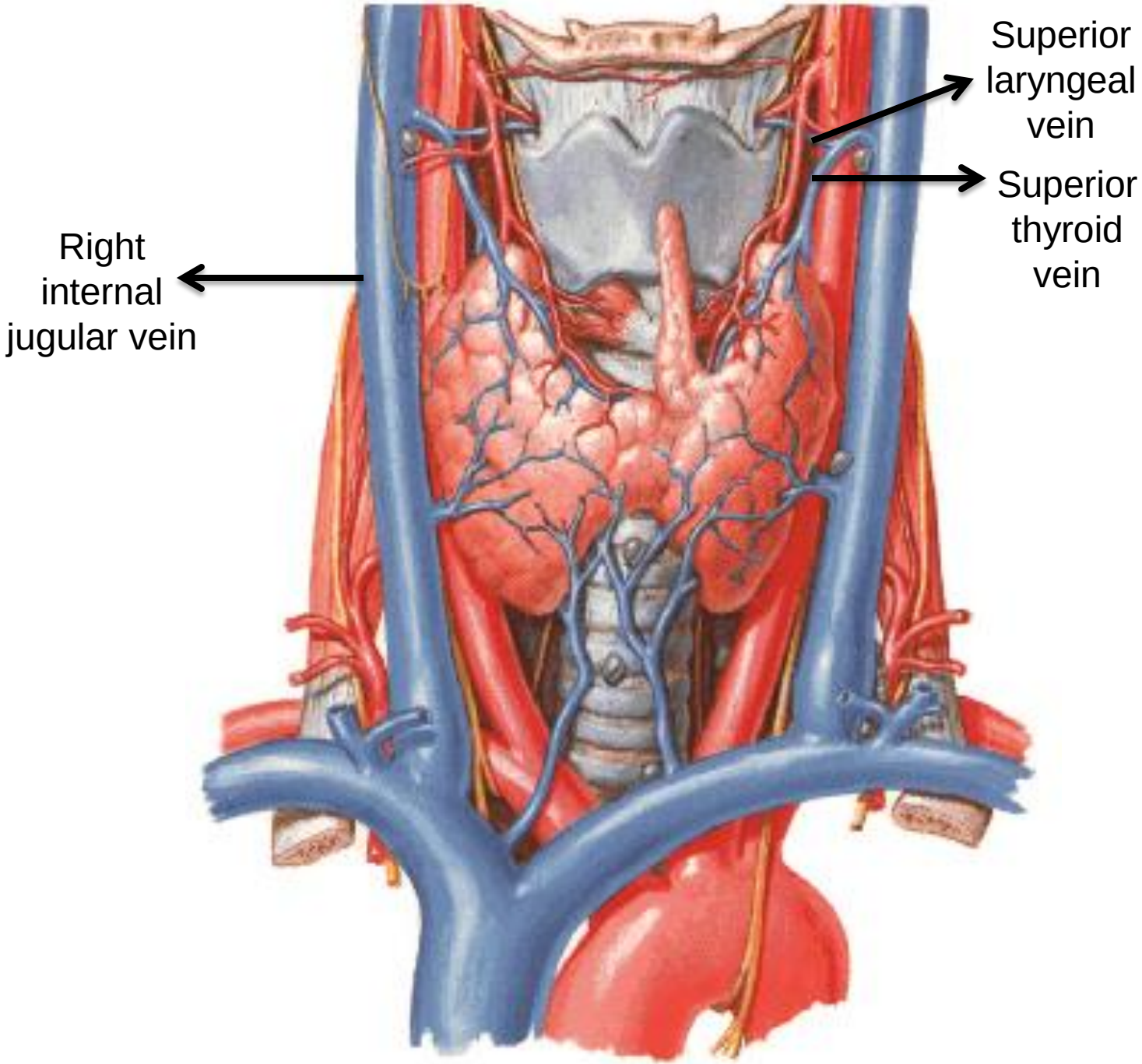


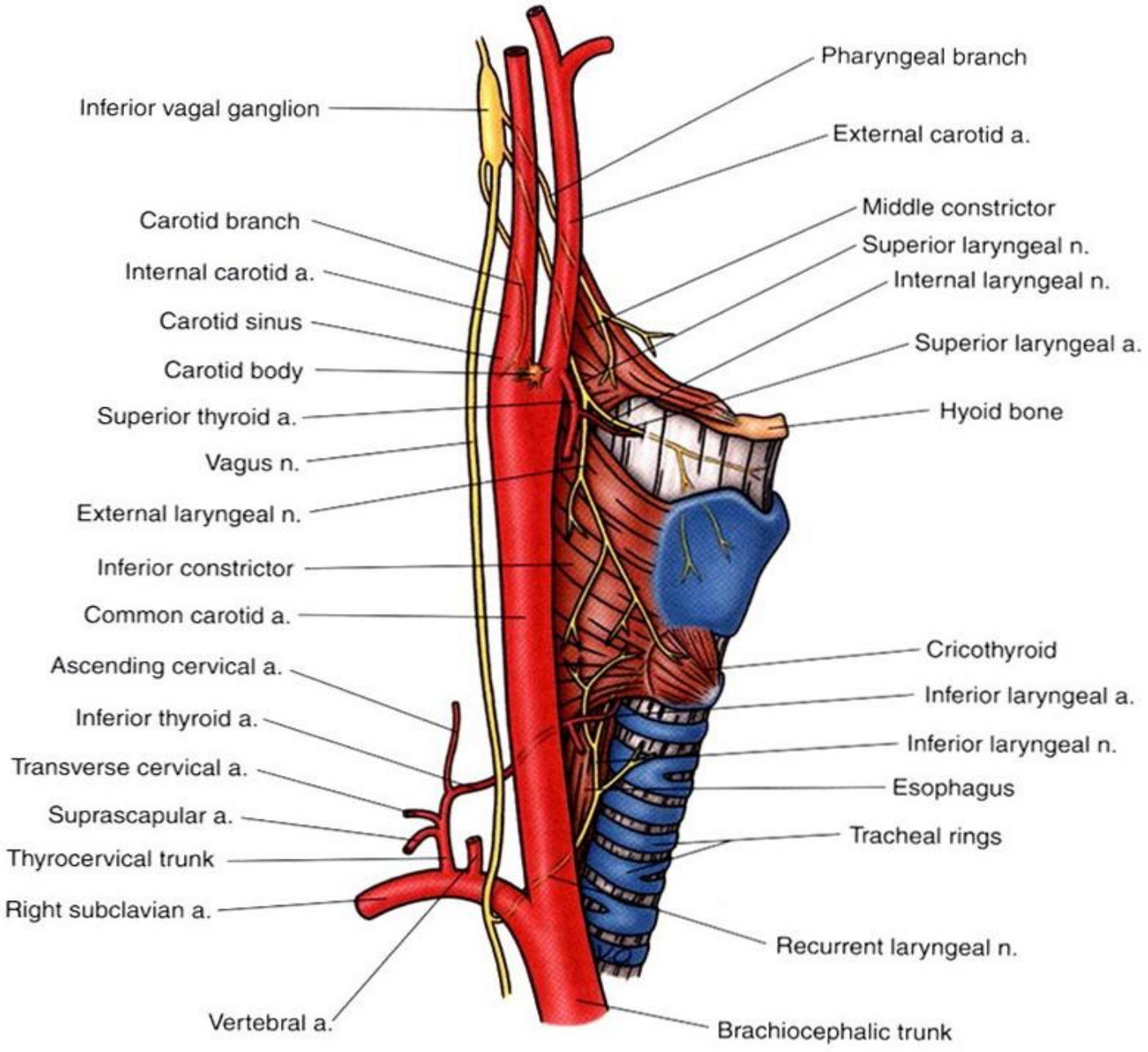
Variations in the rima glottidis. Superior views. Its shape varies according to the position of the vocal folds.

- **Laryngeal Nerves:**
  1. **Superior laryngeal vagus nerve X:**
     a. **Internal laryngeal**: sensory for structures superior to vocal folds.
     b. **External laryngeal**: sensory for structures inferior to vocal folds and motor to cricothyroid muscles (tensor).
  2. **Recurrent (inferior) laryngeal nerve**: motor to all intrinsic muscles
- **Blood Supply:**
  1. **Superior laryngeal artery** branching form superior thyroid artery.

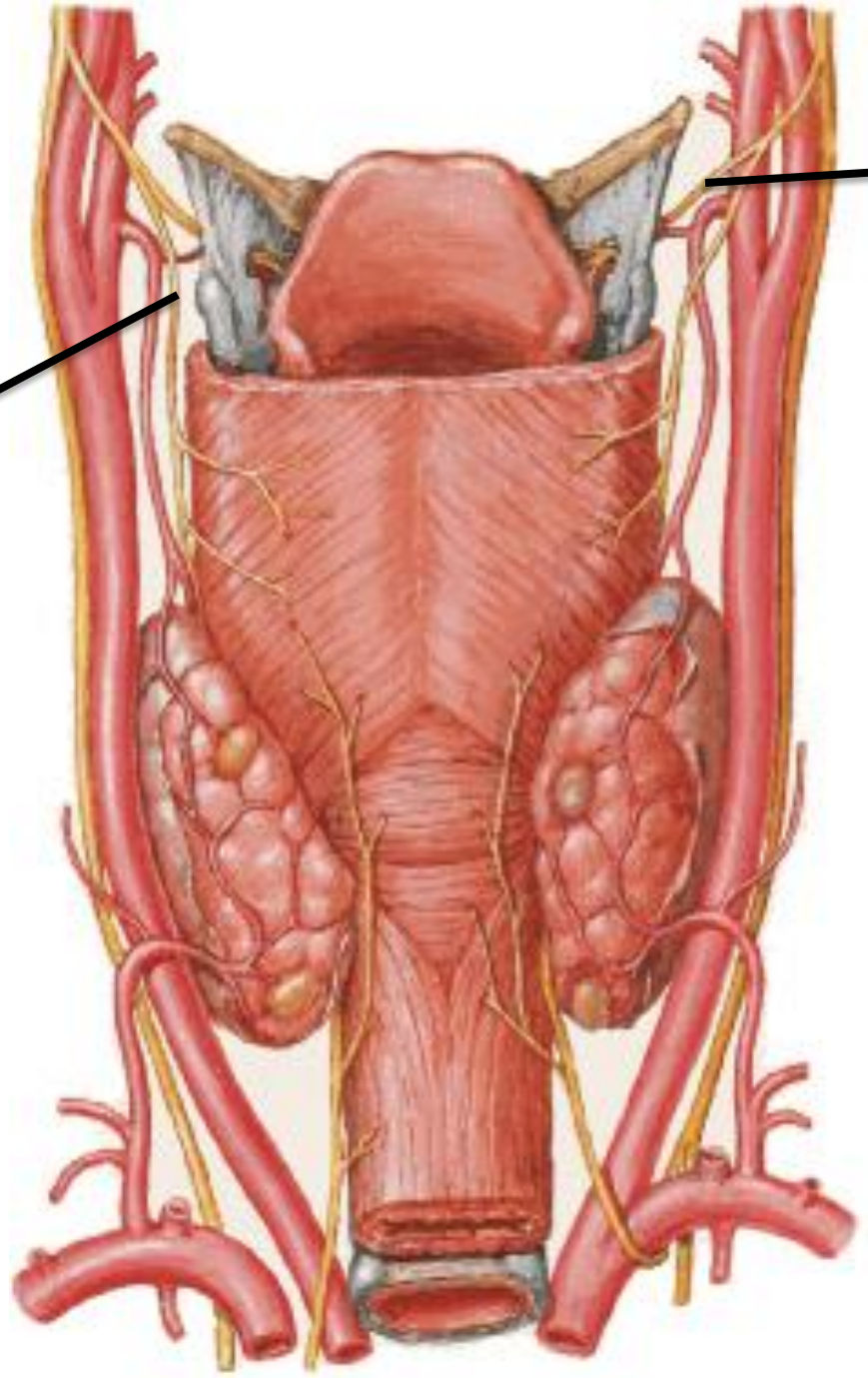
     Superior laryngeal veins drain into internal jugular vein.
  2. **Inferior laryngeal artery** branching from inferior thyroid artery.

     Inferior laryngeal veins drain into left brachiocephaalic vein.
- **Lymphatics:**
  1. Superior deep cervical (above vocal folds).
  2. Pretracheal, Paratracheal and deep cervical (below vocal folds).

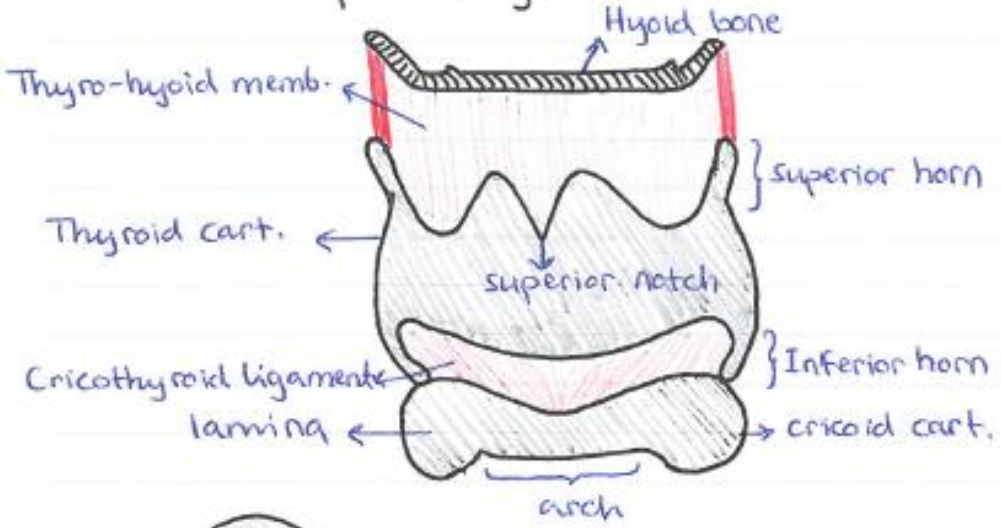

Superior laryngeal vein
Superior thyroid vein
Right internal jugular vein

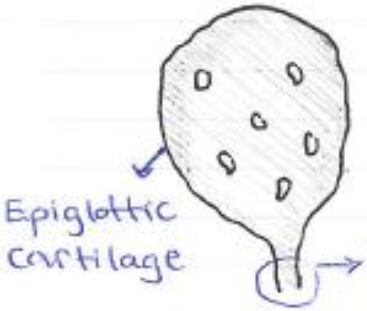


Vessels and nerves of the larynx. Anterolateral view.

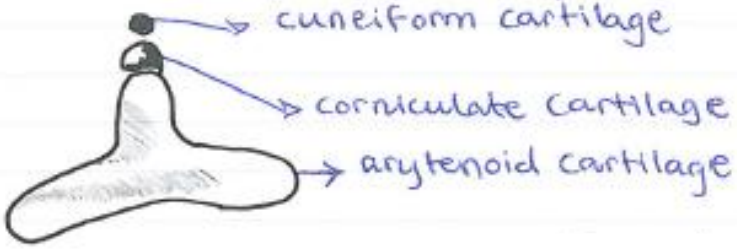

Internal branch of superior laryngeal nerve
External branch of superior laryngeal nerve

- Structure of the larynx:

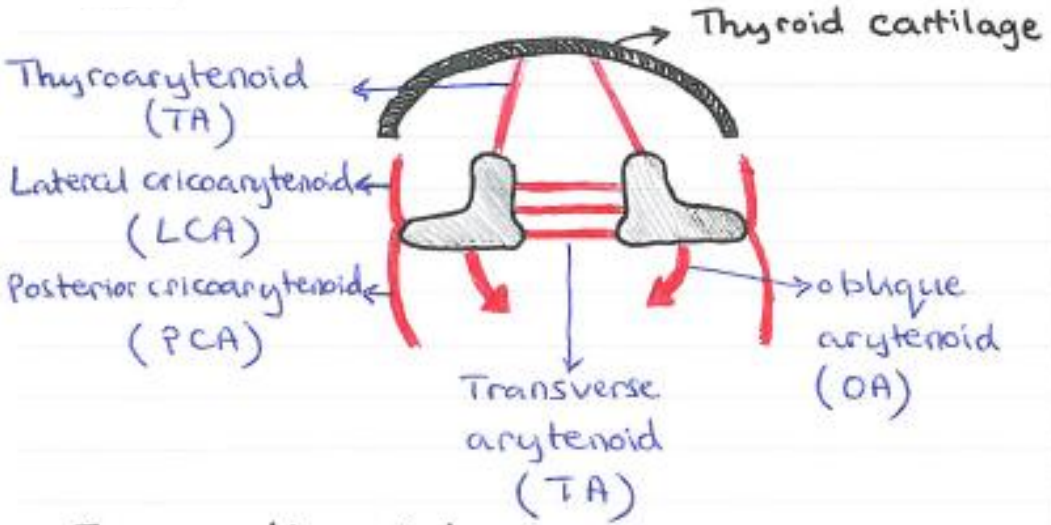




→ Thyro-epiglottic ligament: when swallowing → epiglottis moves down and food passes through piriform recess/sinus



- Laryngeal prominence (Adam's Apple): it is more prominent in males → therefore, vocal cords are longer
- Inferior horn forms a synovial joint between thyroid and cricoid cartilages.
- Characteristics of a synovial joint:
  - → Synovial membrane
  - → Synovial fluid
  - → Capsule
  - → Hyaline cartilage
- All laryngeal cartilages are hyaline except epiglottis which is elastic cartilage
- Functions of laryngeal muscles:
  - → Abduction: PCA
  - → Adduction: LCA, TA & OA
  - → Tension: Cricothyroid
  - → Relaxation: TA



- Innervation of larynx:
  - → External laryngeal nerve: innervating cricothyroid muscle.
  - → Recurrent laryngeal nerve: innerveting the rest of laryngeal muscles

- Cricothyroid muscle is an extrinsic muscle
- A cut in external laryngeal nerve causes monotonous speech → there is paralysis of CT muscle