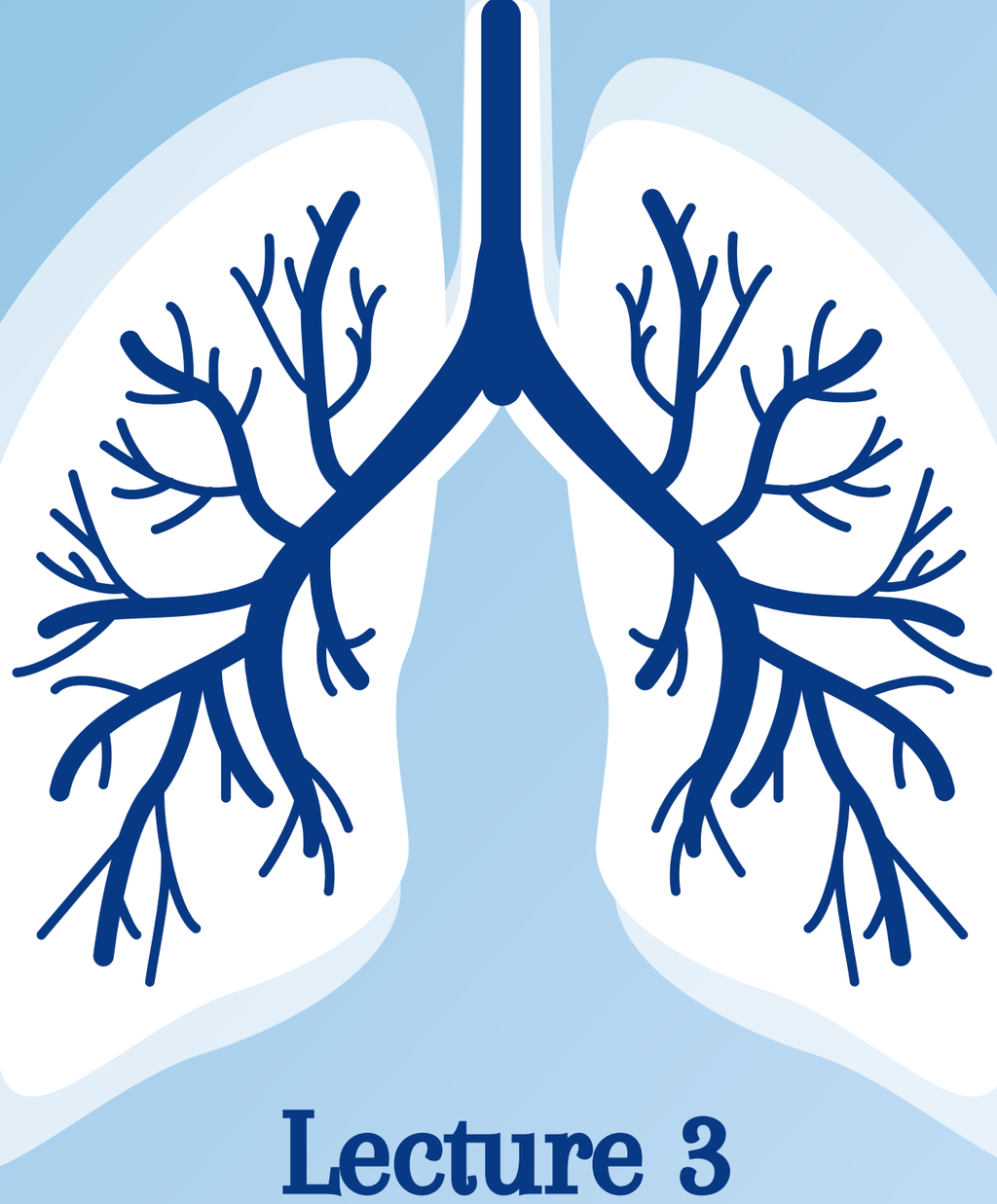


Color Index:
- Main text
- Boys' Slides
- Girls' Slides
- Important
- Dr's Notes
- Extra

Editing File

Lecture 3
ANATOMY OF LARYNX, TRACHEA, & BRONCHI

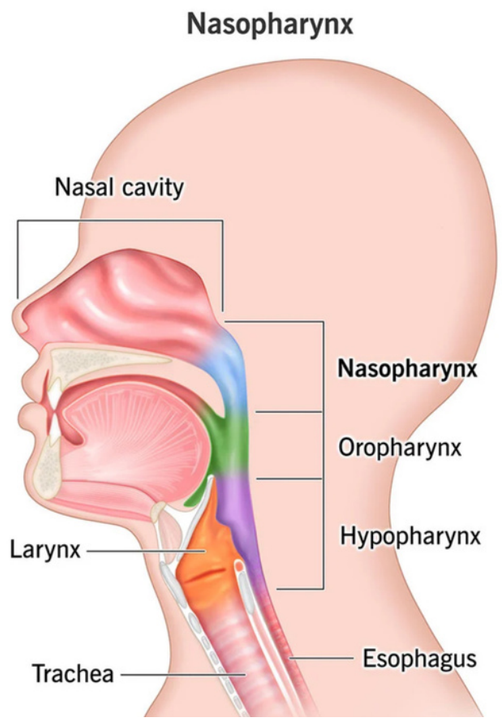
OBJECTIVES

- Describe the Extent, structure and functions of the larynx (cartilages, joints, ligaments, muscles, cavity, blood supply, nerve supply & lymphatic drainage).
- Describe the recurrent laryngeal nerve injury.
- Describe the Extent, structure and functions of the trachea.
- Describe the bronchi and branching of the bronchial tree.
- Describe the functions of bronchi and their divisions
- Clinical anatomy

Larynx

- The larynx is the part of the respiratory tract which contains the vocal cords.
- In adult it is 2-inch-long tube.
- It opens **above** into the laryngeal part of the pharynx.
- **Below**, it is continuous with the trachea

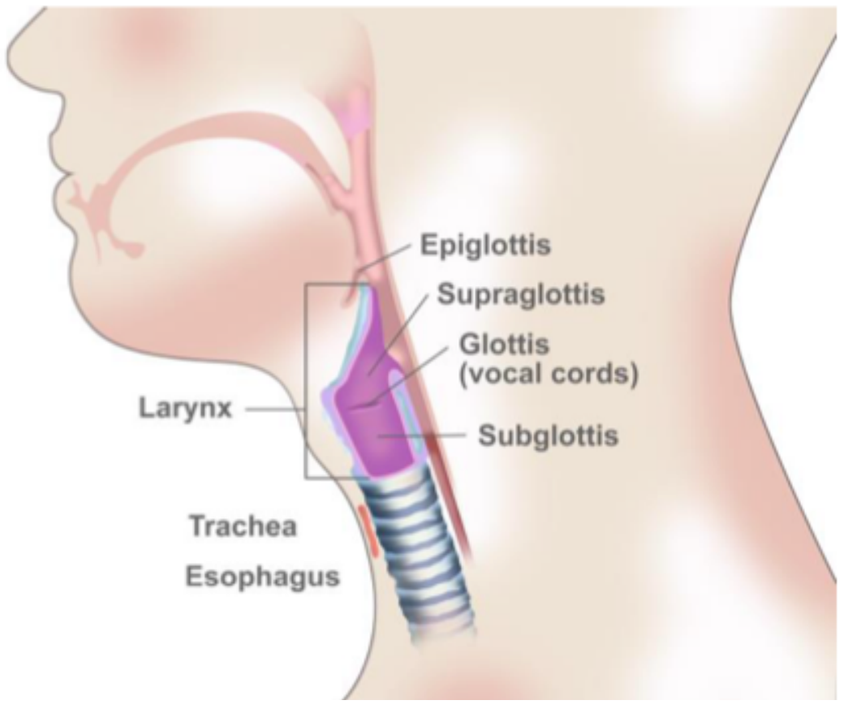
The laryngopharynx, also referred to as the hypopharynx



the function of larynx

- Phonation (voice production).
- Respiration (breathing).
- Deglutition (swallowing).

1. Protective sphincter at the air passage.
2. Regulates air passage in inspiration and expiration.
3. Phonation
4. Opens and closes during swallowing, coughing and sneezing.



Girls' Slides

Situation & Extent

Lies in the anterior midline of the neck.

From root of tongue to trachea from laryngeal inlet up to lower border of cricoid cartilage.

Opposite to C3-C6 vertebrae in men, Slightly higher in female & children.

In male, after puberty thyroid cartilage become prominent-Adam's Apple (or laryngeal prominence).

Relations

- The larynx is related to major critical structures in the neck.

1 Arteries

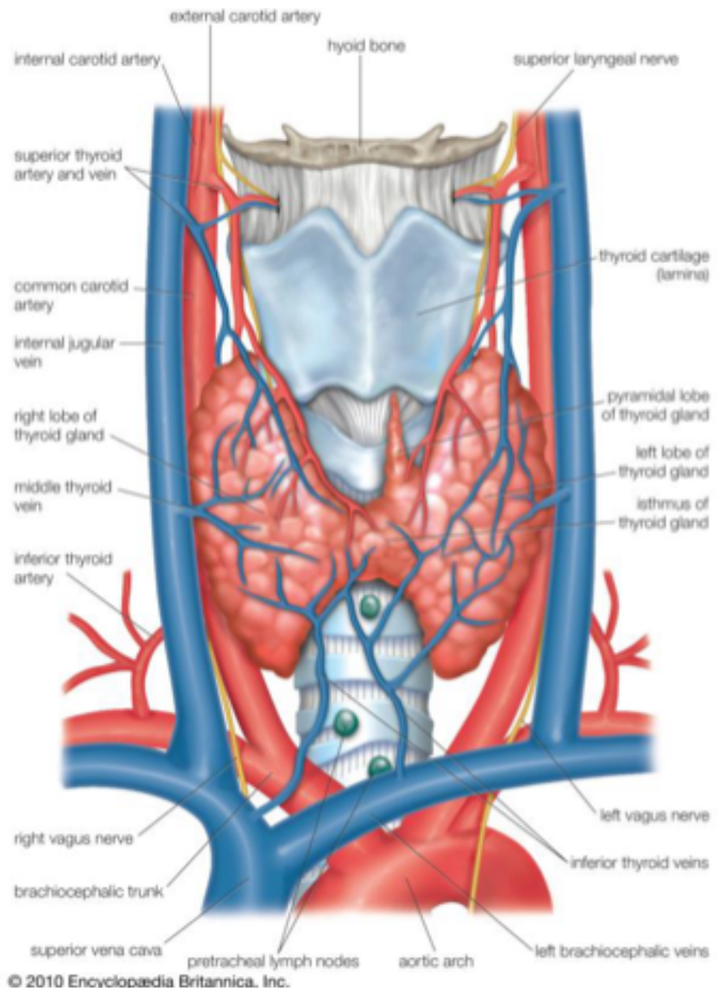
Common Carotid arteries (common, external and internal).
Thyroid arteries: (superior & inferior thyroid arteries).

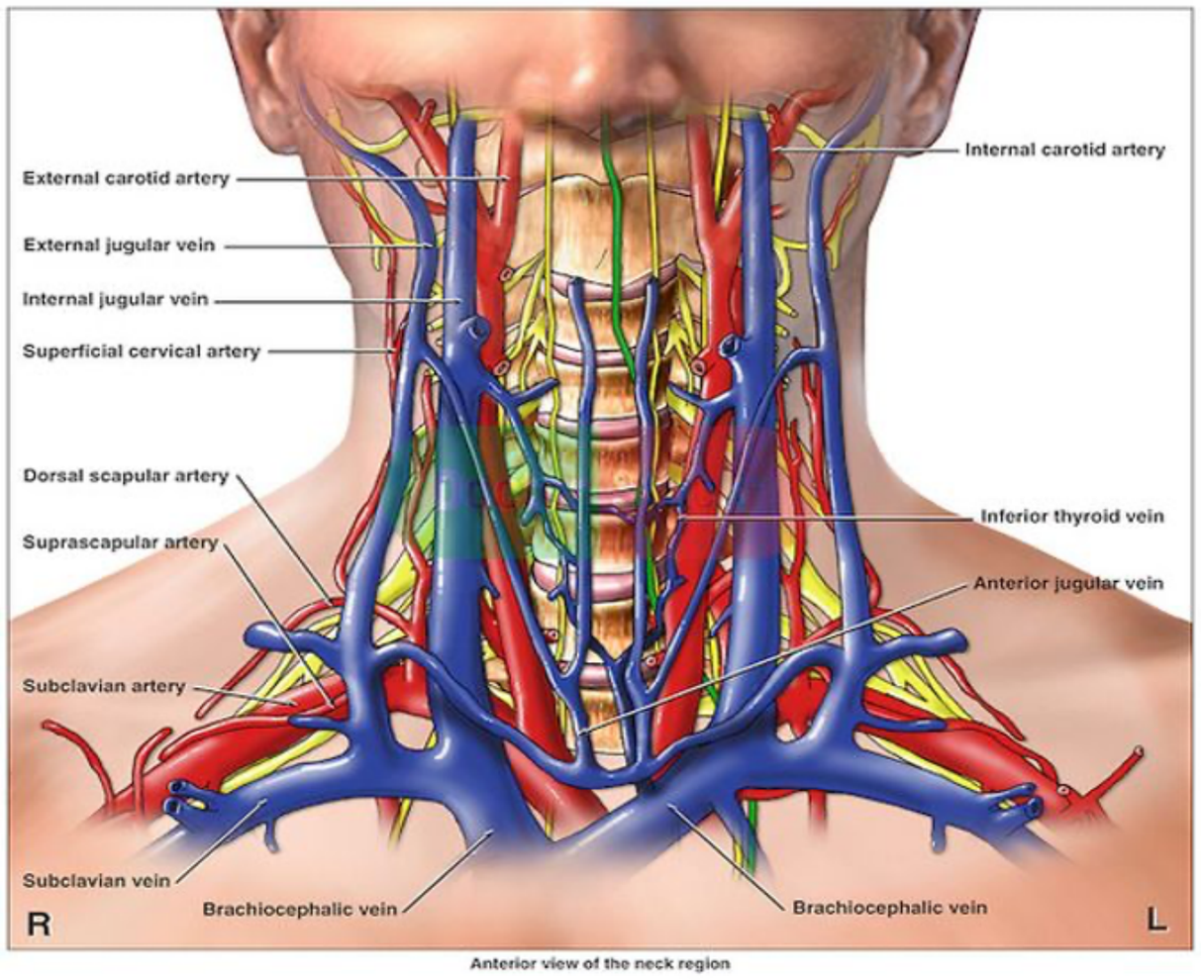
2 Veins

Jugular veins, (external & internal)

3 Nerves

Laryngeal nerves: (Superior laryngeal & recurrent laryngeal). • Vagus nerve.



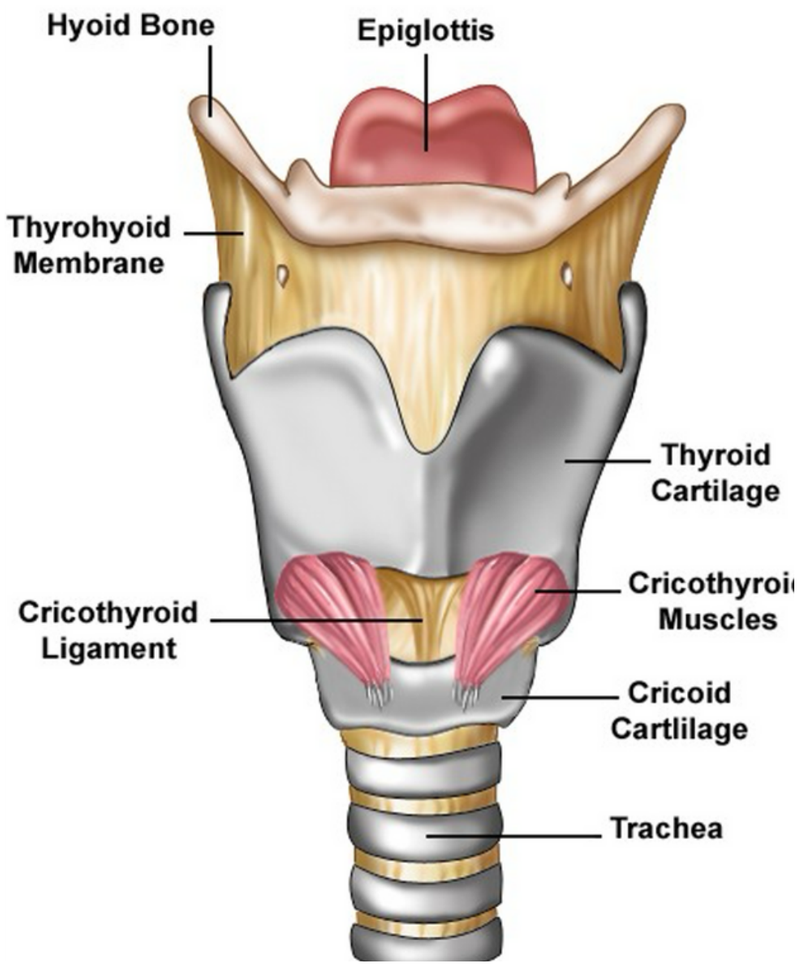


Anterior view of the neck region

Structure

- The larynx consists of four basic components:

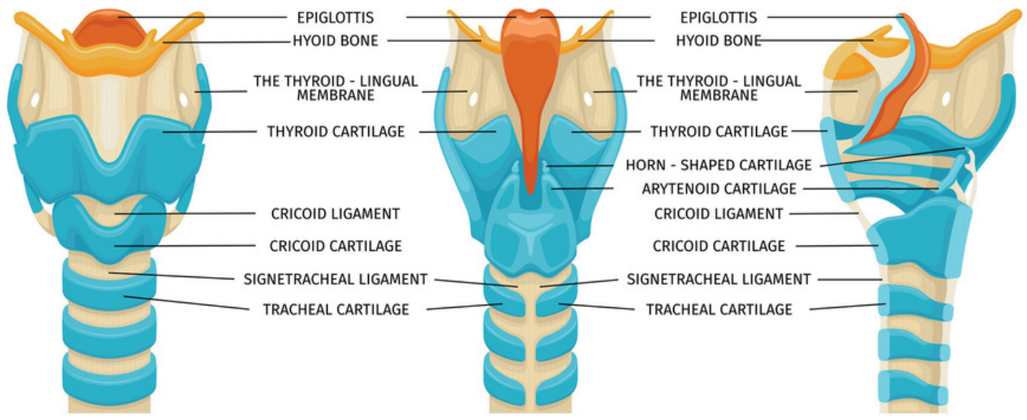
1. Cartilaginous skeleton. (mainly)
2. Membranes & ligaments. (connect the cartilages together)
3. Muscles (Intrinsic & extrinsic muscles). (Internal: within the larynx & External: surrounding the larynx) (Muscles help moving the cartilages)
4. Mucosal lining. (Lubrication)



The Cartilages

- The cartilages are:
  - Connected by joints, membranes & ligaments.
  - Moved by muscles.

- All cartilages are hyaline
  - Except the epiglottis is elastic cartilage (For more elasticity to open & close the inlet)
  (corniculate and coneiform cartilages are also elastic)



The cartilaginous skeleton is divided to:

Paired (small):
-Arytenoid (pyramid shape)
-Corniculate (very small)
-Cuneiform

unpaired Single (large):
-Thyroid
-Cricoid
-Epiglottis

Boys' Slides

Cartilages

THYROID CARTILAGE

It is the largest of the laryngeal cartilages.

It is formed of two laminae; each has superior and inferior horns.

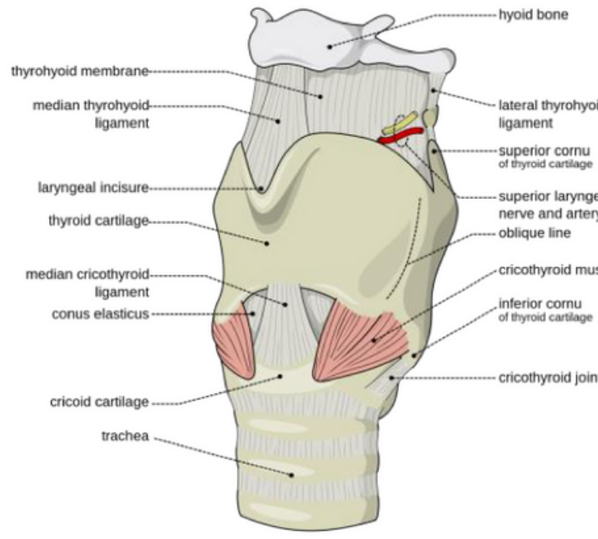
The angle between two laminae is 90 in male and 120 in female.

It has two notches superior and inferior at the meeting of the two laminae.

Connections:

Superior : To hyoid bone by thyrohyoid membrane.

Inferior: To cricoid cartilage by the cricothyroid joint and cricothyroid membrane.



CRICOID CARTILAGE

It is hyaline cartilage.

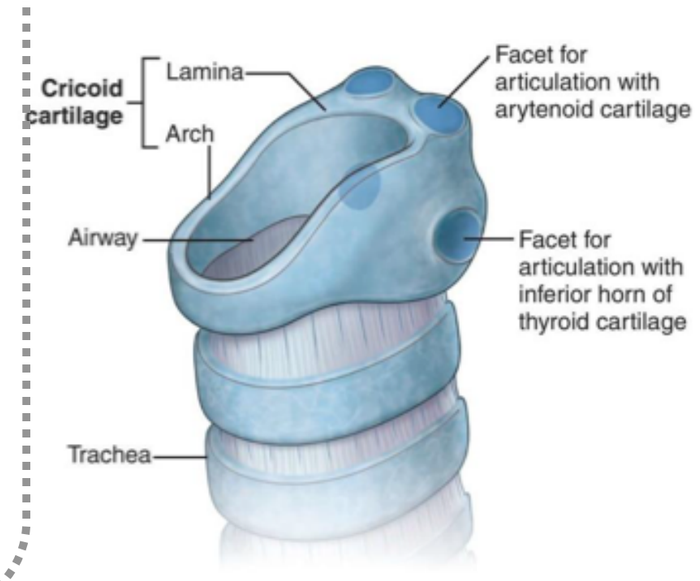
Ring shaped, having a narrow anterior arch and wide posterior lamina.

It is the only complete ring of cartilage around the trachea.

Connected superiorly to thyroid cartilage by cricothyroid joint and cricothyroid membrane.

Inferiorly is connected to the 1st ring of cartilages around the trachea by the coracobrachial ligament.

It is involved in opening and closing the airway and in speech production.



EPIGLOTTIS

It is leaf-shaped elastic cartilage.

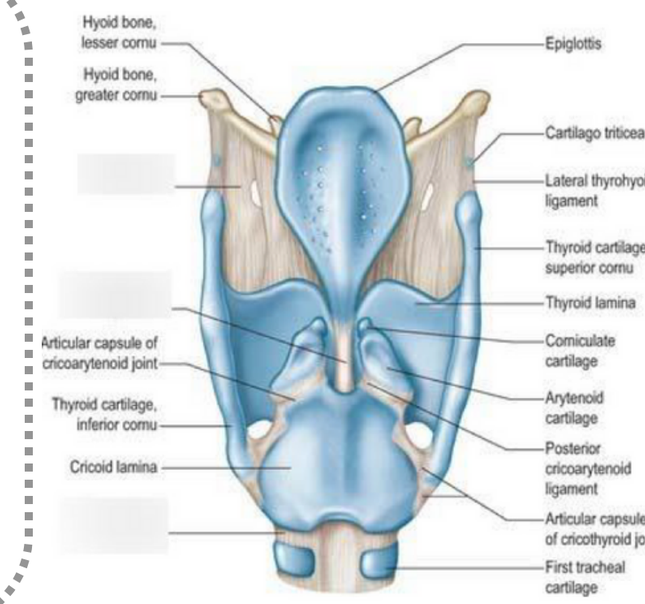
It projects obliquely upwards behind the tongue and the hyoid bone.

Stands open during breathing allowing air pass into the larynx

.It closes during swallowing to prevent aspiration, forcing the swallowed liquids or food to the esophagus.

It is connected by its stalk to the back of the thyroid cartilage.

Its upper end is free.



Membranes

thyrohyoid membrane

The thyrohyoid membrane is thickened in the median plane to form median thyrohyoid ligament and on both sides to form lateral thyrohyoid ligaments.

Quadrangular membrane

Quadrangular membrane: Or aryepiglottic membrane:

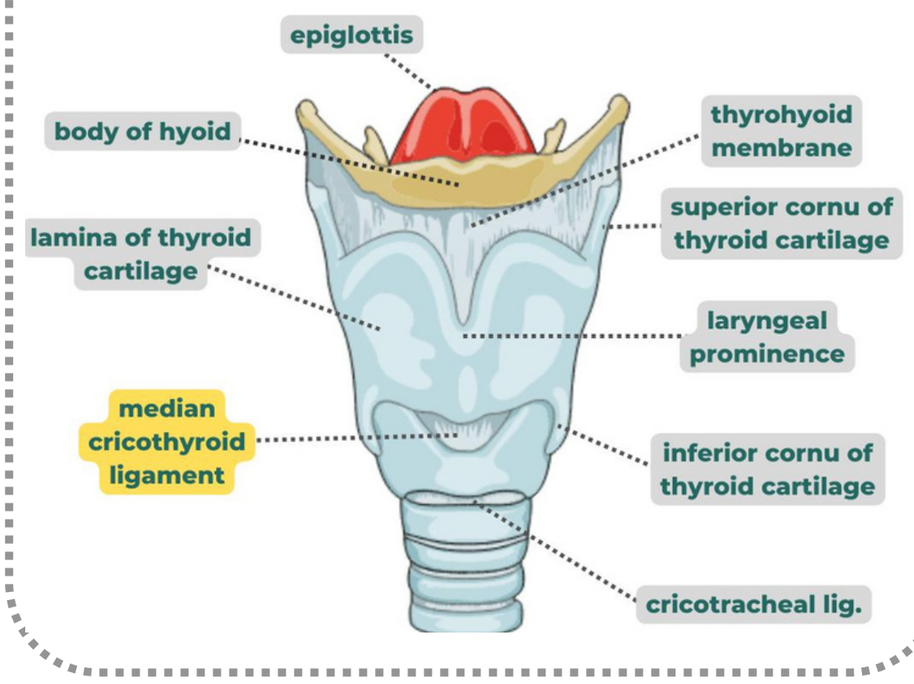
- It extends between the arytenoid and epiglottis.
- Its lower free margin forms the vestibular ligament which forms the vestibular fold (false vocal cord).

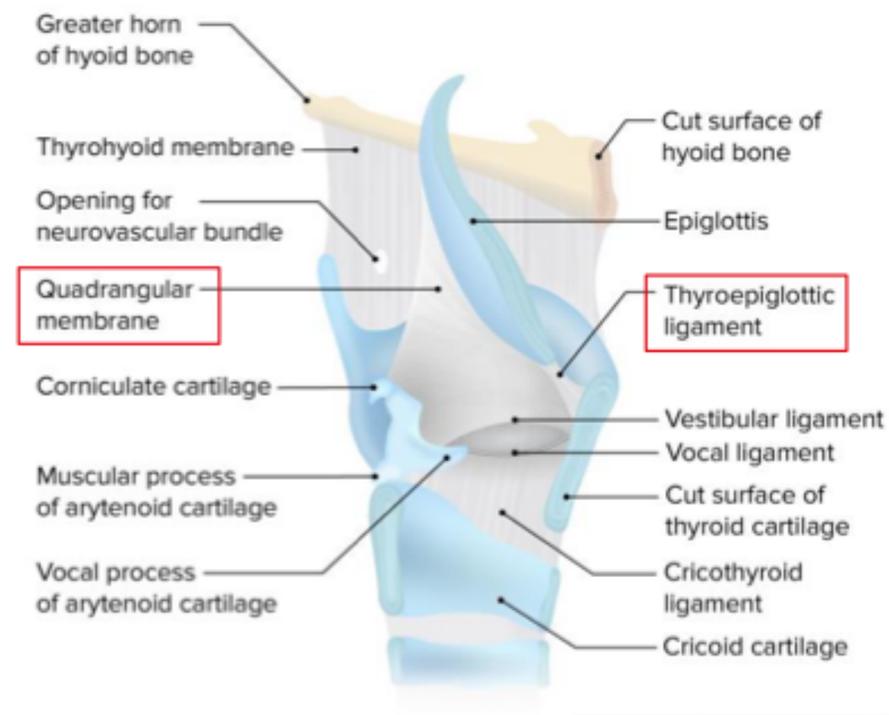
Cricothyroid membrane (conus elasticus)

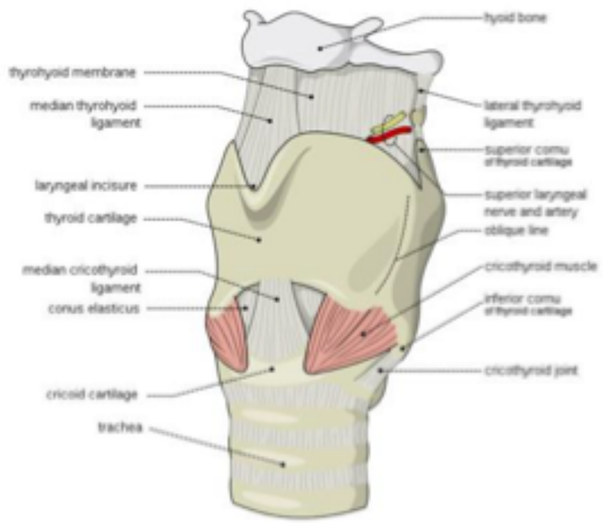
Its lower margin is attached to the upper border of cricoid cartilage.

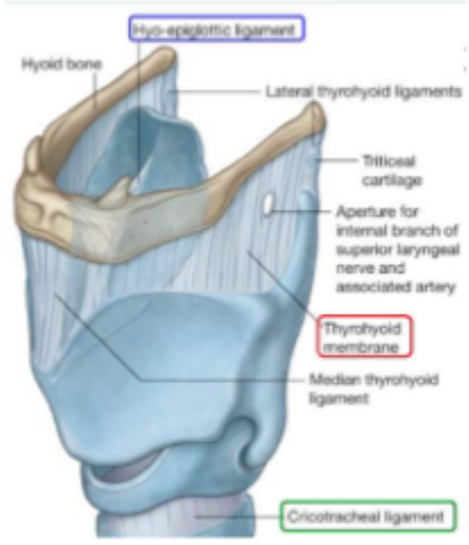
Upper free margin forms Vocal ligament which forms the true vocal cord.

Crico-tracheal



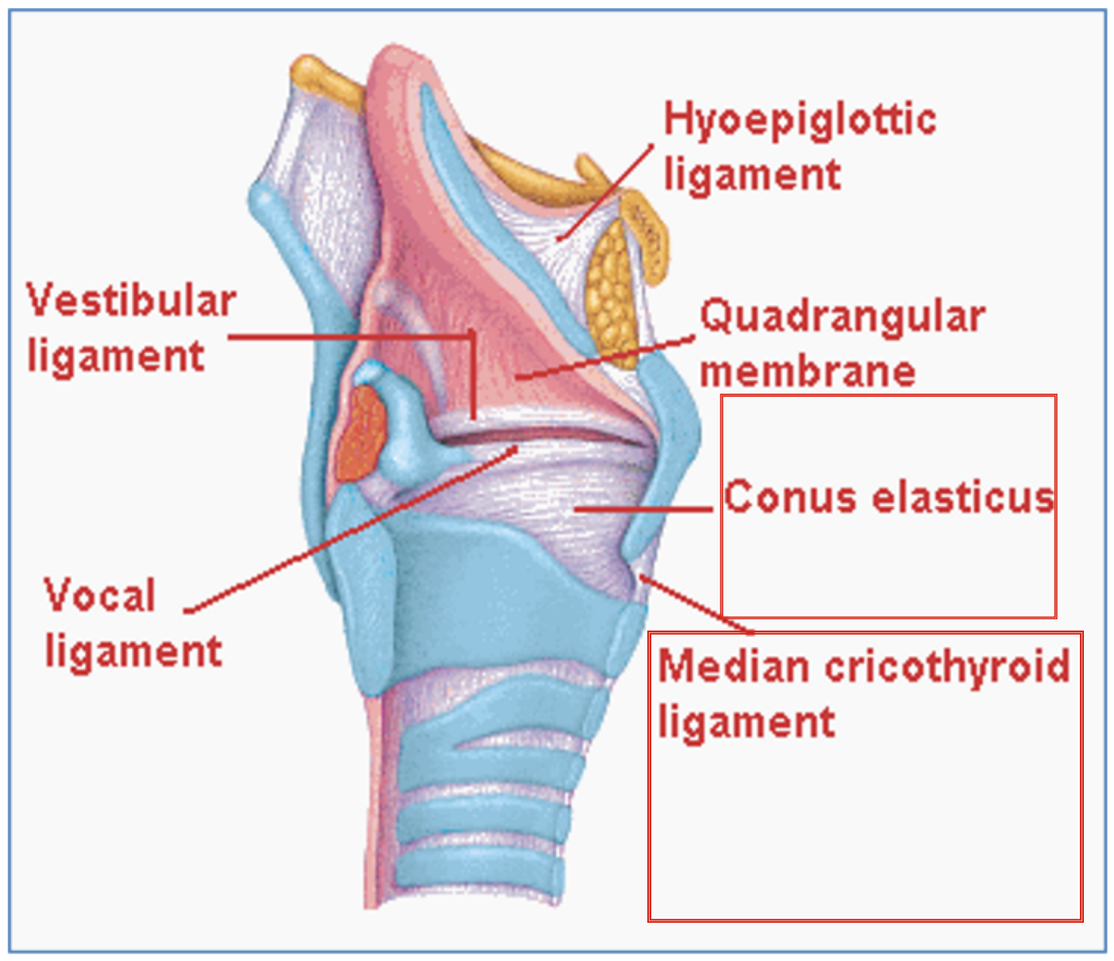






Girls' Slides

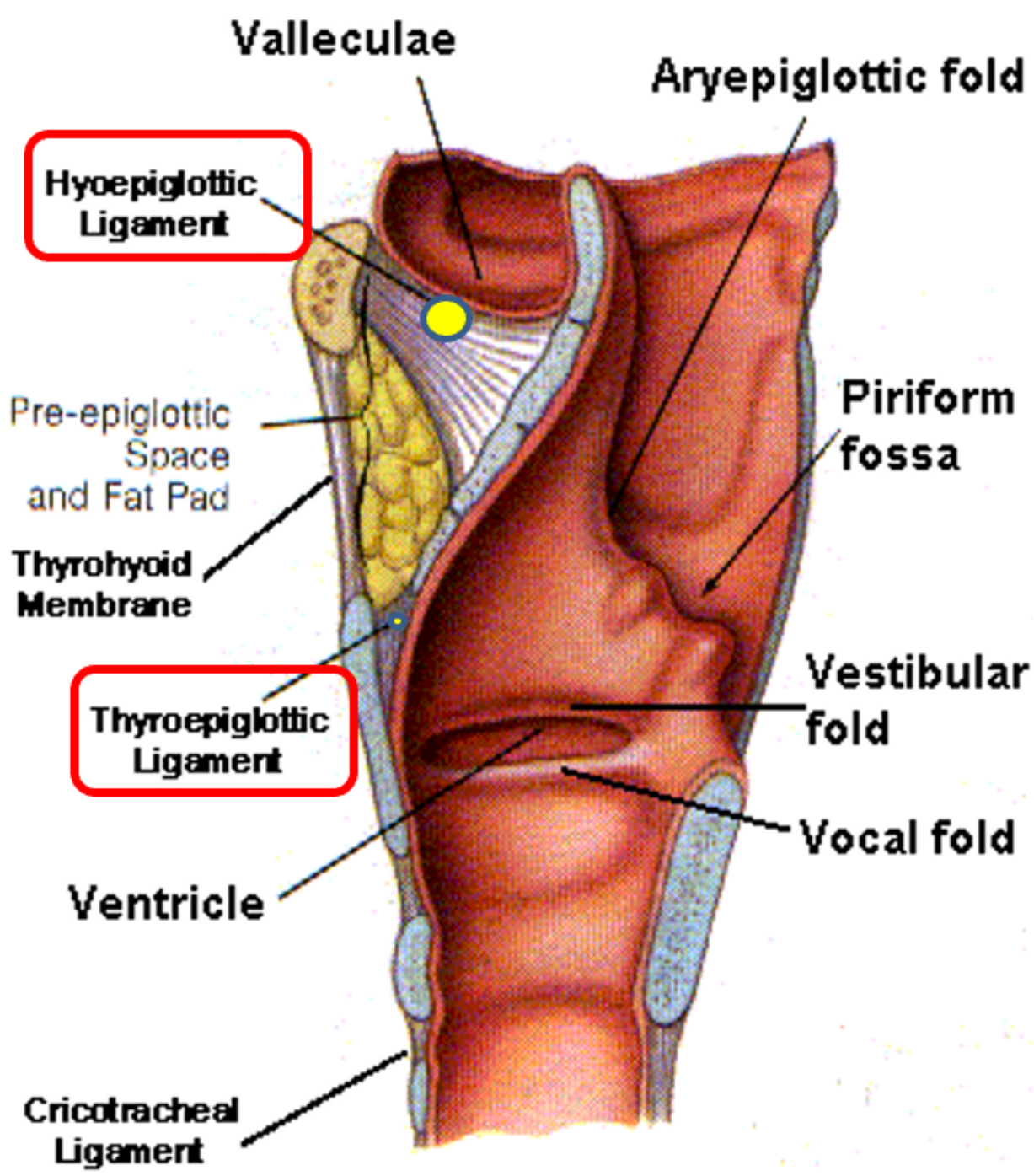
The arytenoid cartilage has two processes: the vocal process where the vocal ligament is attached and the muscular process where the cricoarytenoid dorsalis muscle (the laryngeal abductor muscle) inserts.



Ligaments

Hyo-epiglottic ligament

Thyro-epiglottic ligament



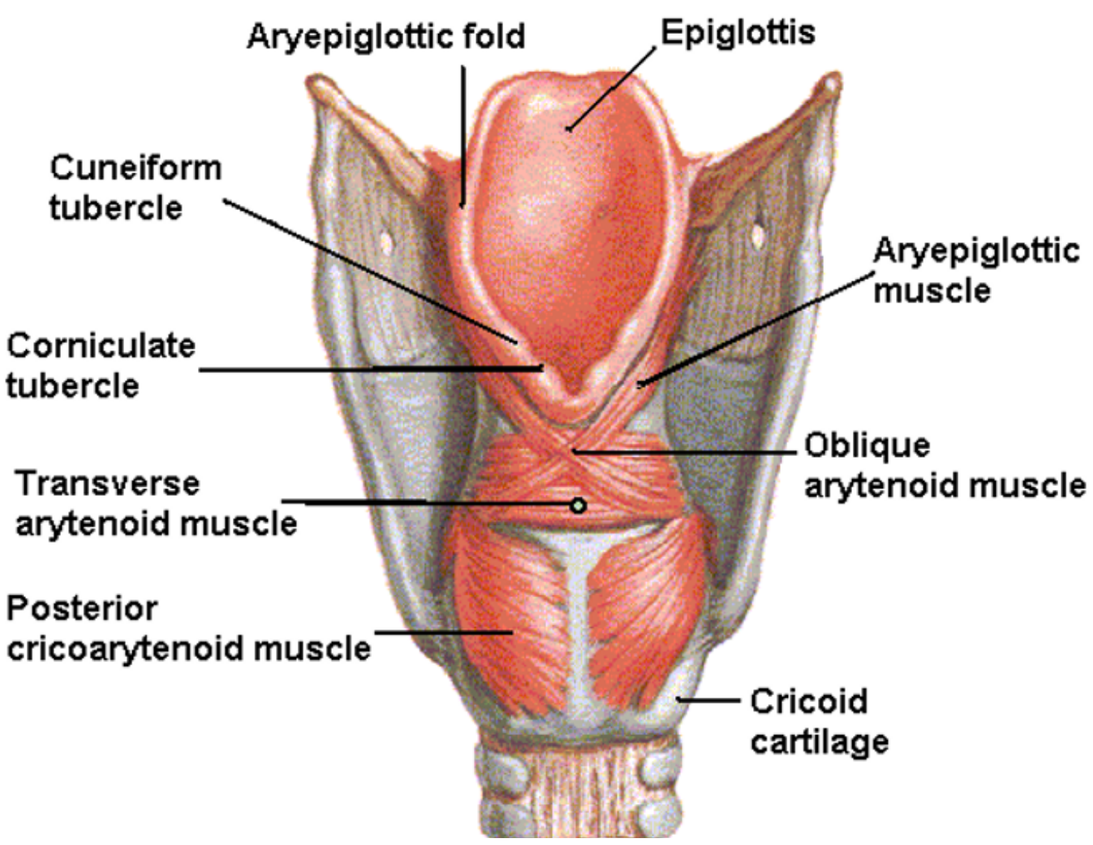
Laryngeal Inlet

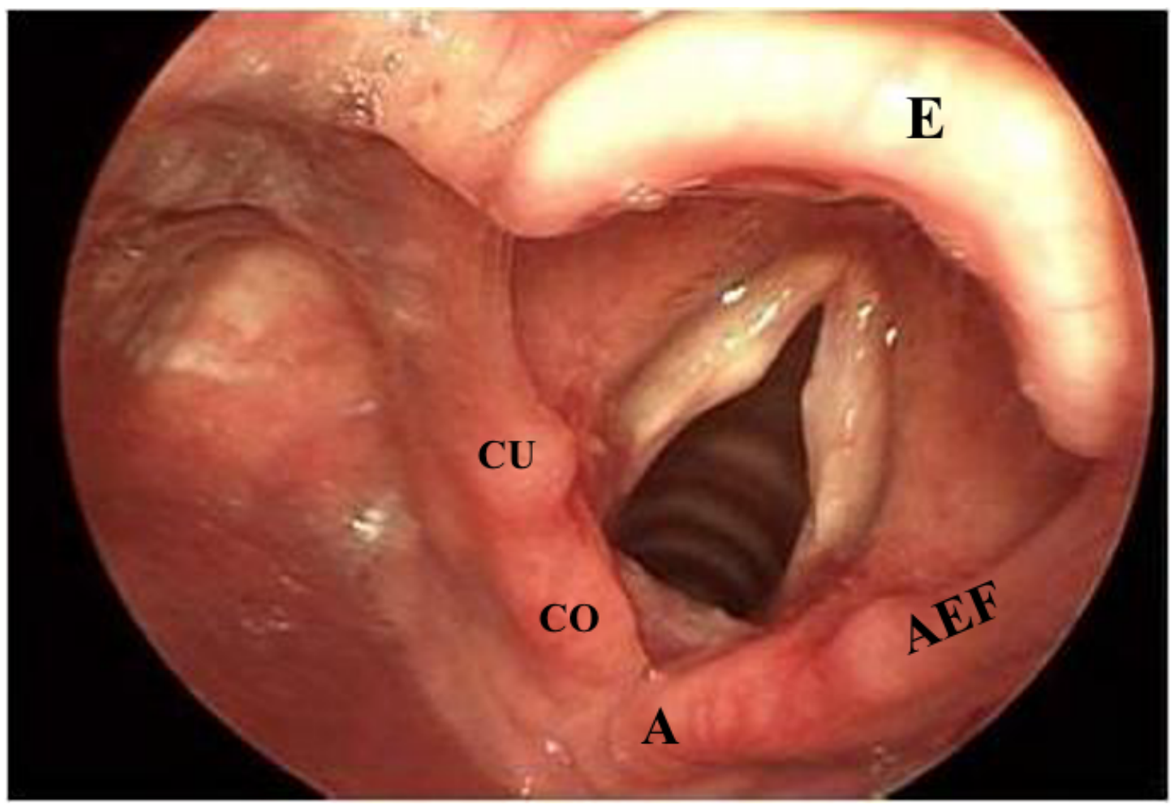
- It is the upper opening of the larynx.
- It faces upward & backward and opens into the laryngeal part of the pharynx, (laryngopharynx).

Bounded by:

- Anteriorly: by the upper margin of epiglottis (E)
- Posteriorly & below: by arytenoid cartilages (A)
- Laterally: by the Aryepiglottic folds (AEF)

Closure by apposition of AEF





Laryngeal Cavity

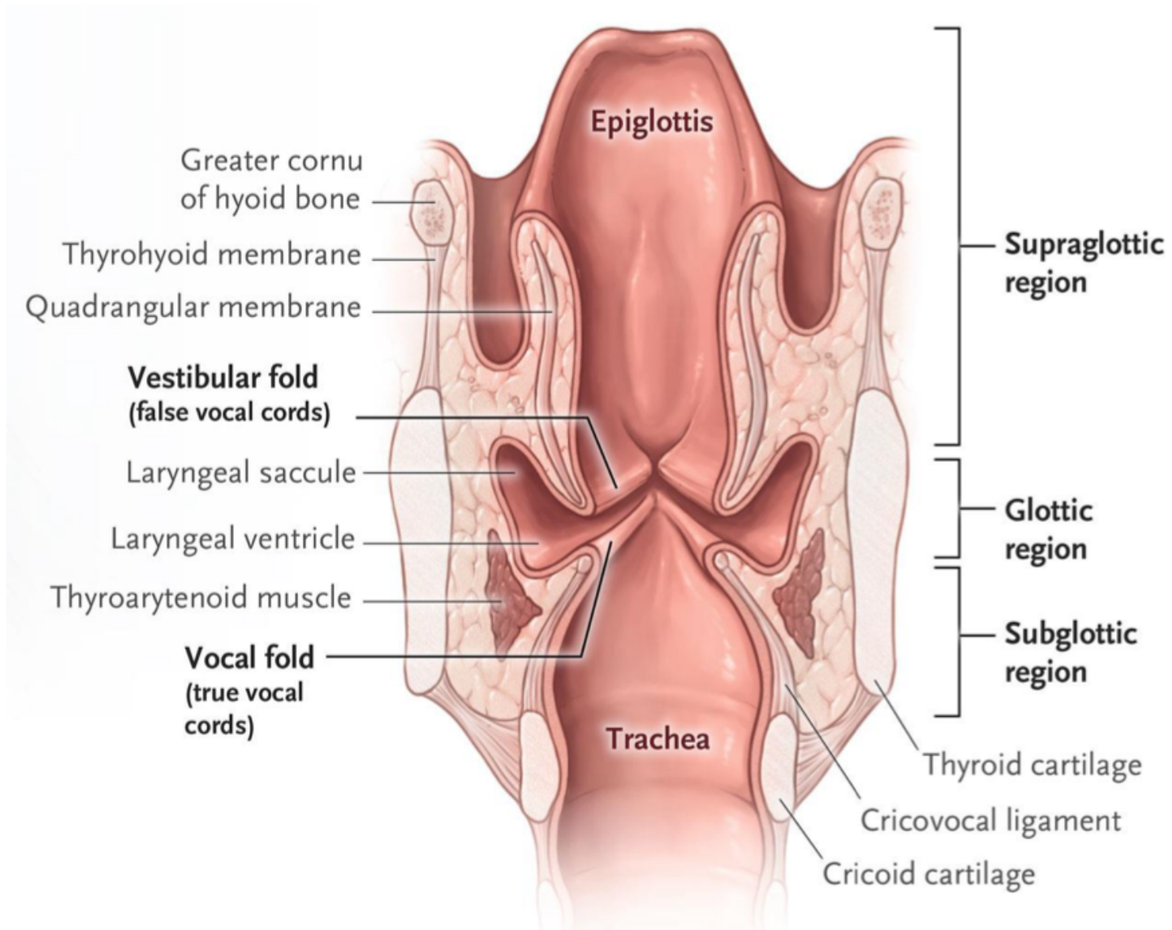
Extends from laryngeal inlet to lower border of the cricoid cartilage.

Rima Vestibuli: an opening between two adjacent vestibular folds.

- It narrow in the region of the vestibular folds.

Rima glottidis: Lies inferior to the vestibular folds.

- Is a narrower triangle between the vocal folds.

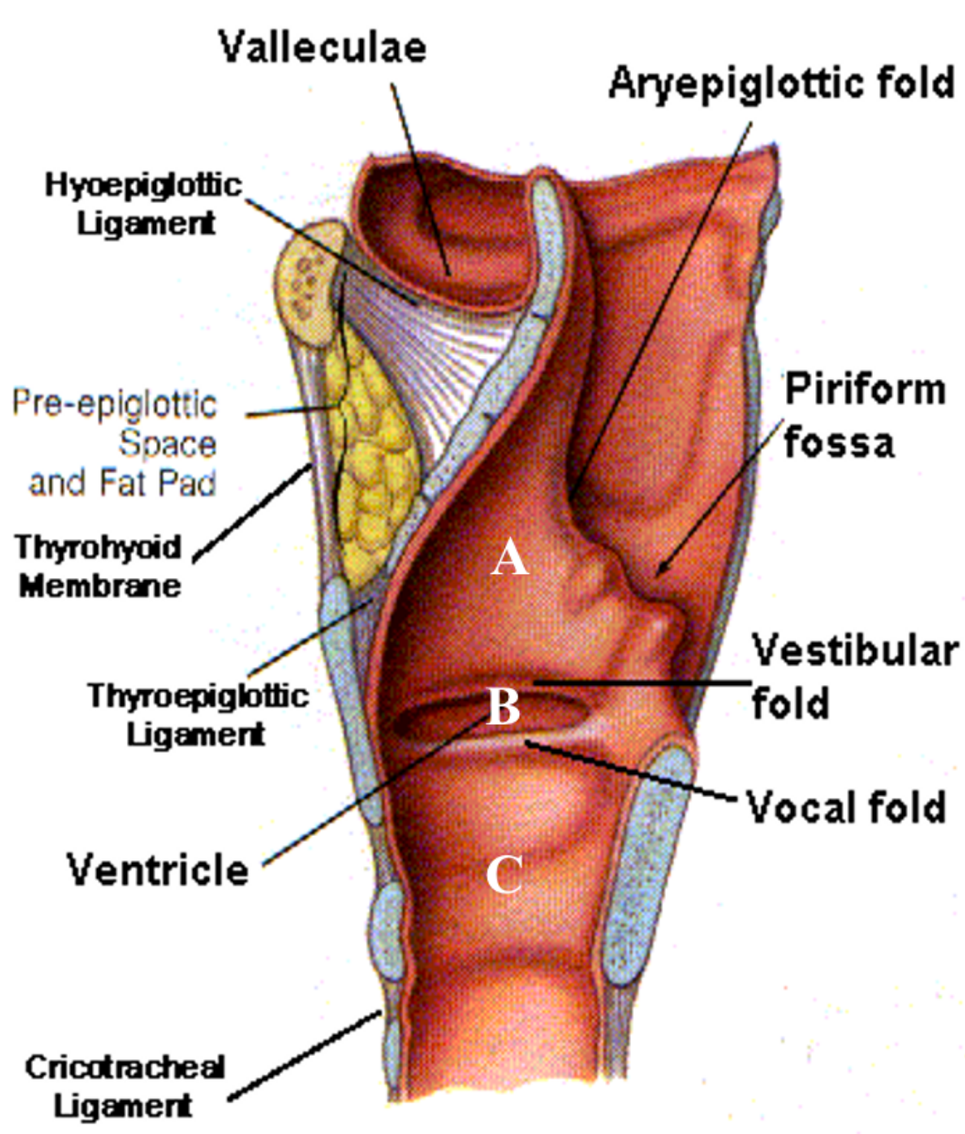


Divided into three parts:

(A) Supraglottic part or vestibule: it is the part above the vestibular folds.

(B) Laryngeal Ventricle: it is the part between the vestibular folds & the vocal folds.

(C) Infraglottic part: the part below the vocal folds.



Laryngeal Cavity

- NB. The ventricle has an upward invagination called saccule. which is rich in goblet cells.

Mucous membrane:

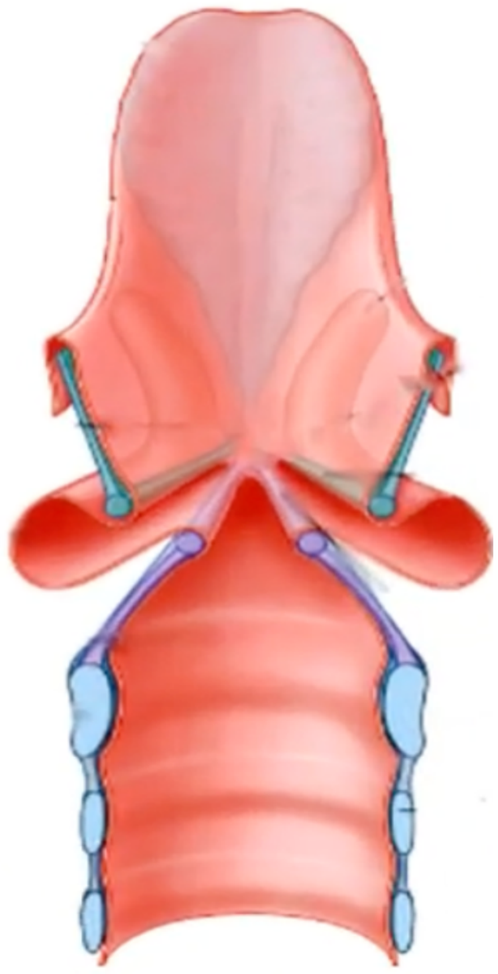
The cavity is lined with ciliated columnar epithelium except the surface of the vocal cords.

The surface of vocal folds, is covered with stratified squamous epithelium because of exposure to continuous trauma during phonation

It contains many mucous glands, more numerous in the region of the saccule (for lubrication of vocal folds).

1 The Laryngeal Ventricle

- One each side.
- The mucosa of the middle laryngeal cavity bulges laterally.



2 The Laryngeal Saccule

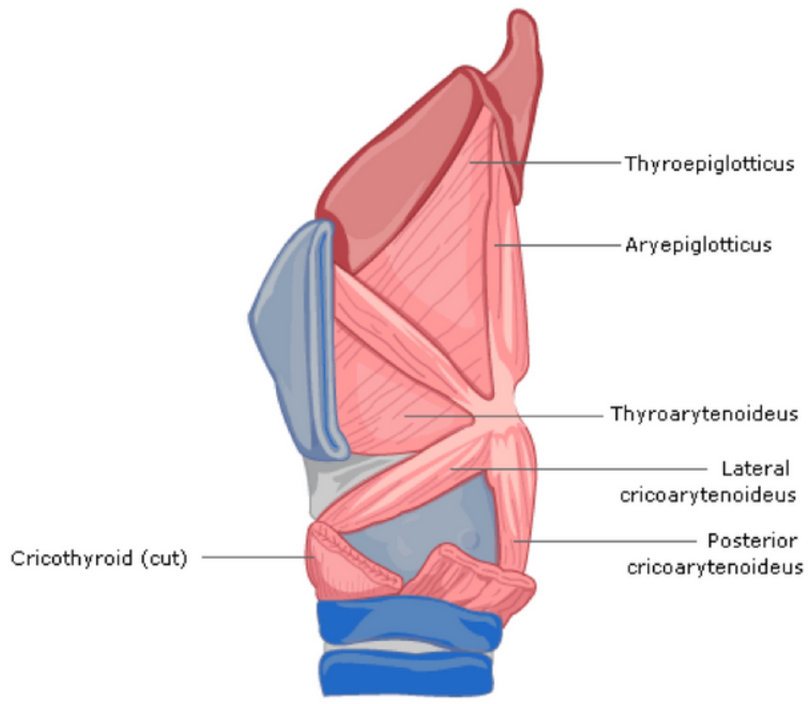
- An elongate tubular extension of each ventricle.
- Projects upwards in front of the thyroid cartilage.
- Rich in goblet cells.

Laryngeal Muscles

- Are divided into two groups:

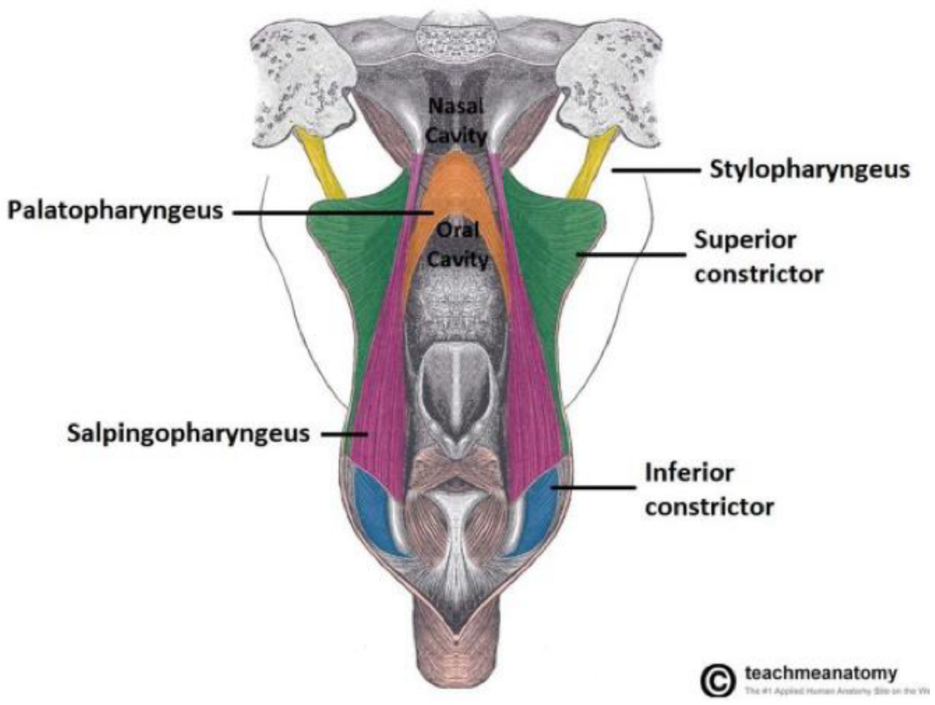
Extrinsic muscles

Extrinsic muscles:
subdivided into two groups:
• Elevators of the larynx.
• Depressors of the larynx.



Intrinsic muscles

Intrinsic muscles:
subdivided into two groups:
• Muscles controlling the laryngeal inlet
• Muscles controlling the movements of the vocal cords.

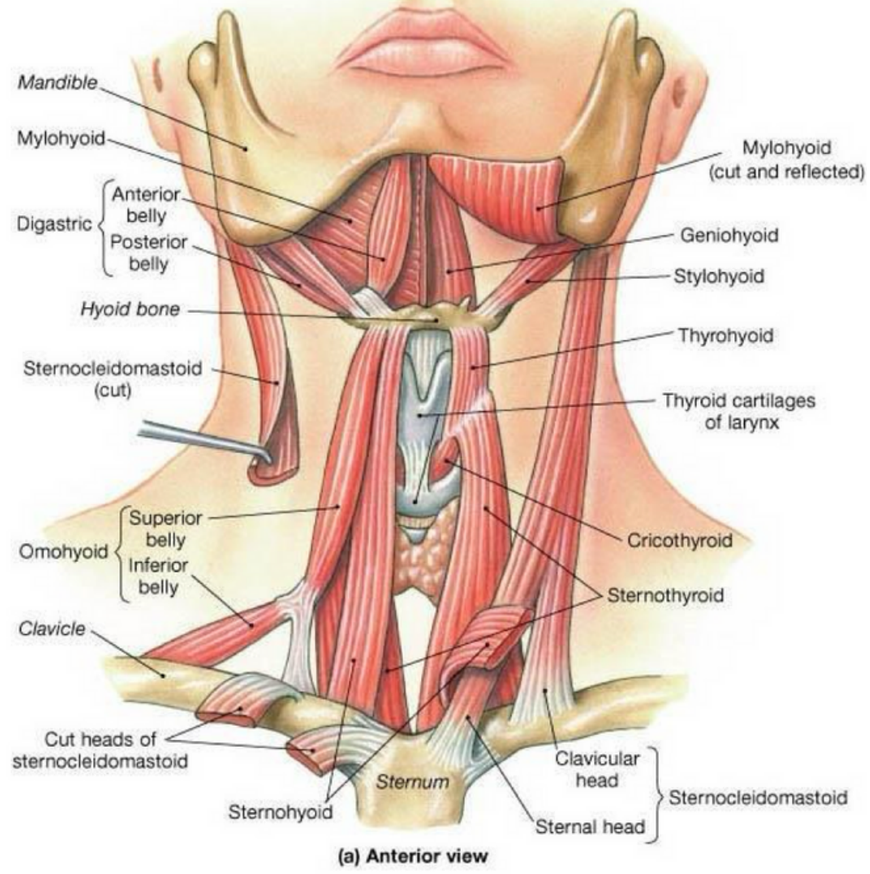


Extrinsic muscles of Larynx

Elevators of the Larynx

A- The Suprahyoid Muscles: (MSGD)

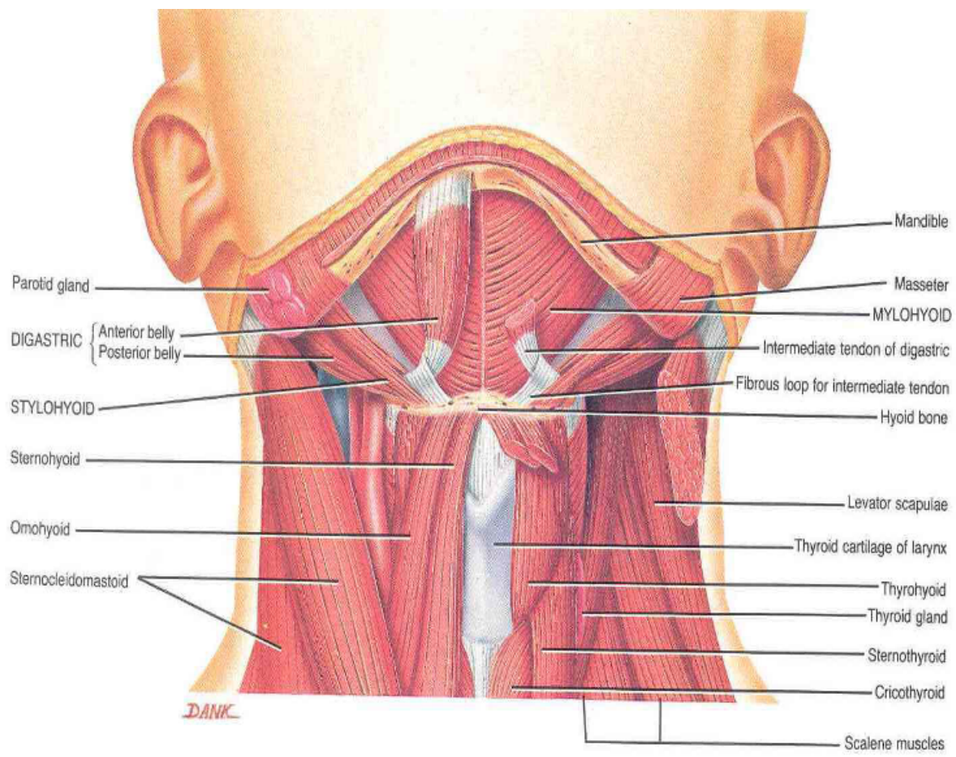
- Mylohyoid
- Stylohyoid
- Geniohyoid
- Digastric



(a) Anterior view

B- The Longitudinal Muscles of the Pharynx.

- Stylopharyngeus
- Salpingopharyngeus
- Palatopharyngeus



Depressors of the Larynx
The Infrahyoid Muscles:

- Sternohyoid
- Sternothyroid
- Omohyoid

Intrinsic muscles of Larynx

Very helpful to understand functions of muscles!

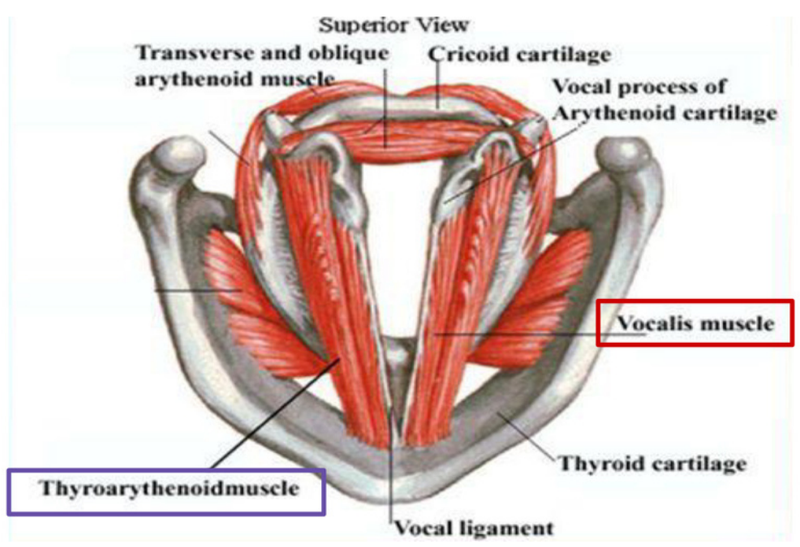
Helpful Video

Muscles controlling the vocal cords

Muscles **decreasing** the length & tension of vocal cords (relax vocal cords)

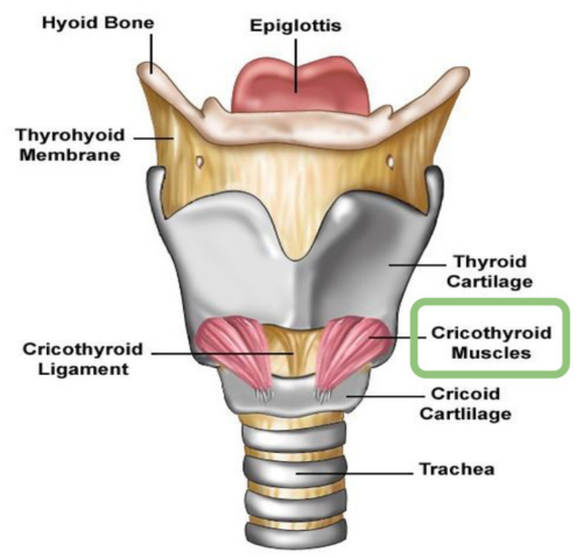
Thyroarytenoid

Vocalis (the lower fibers of thyroarytenoid muscle)



Muscles **increasing** the length & tension of vocal cords

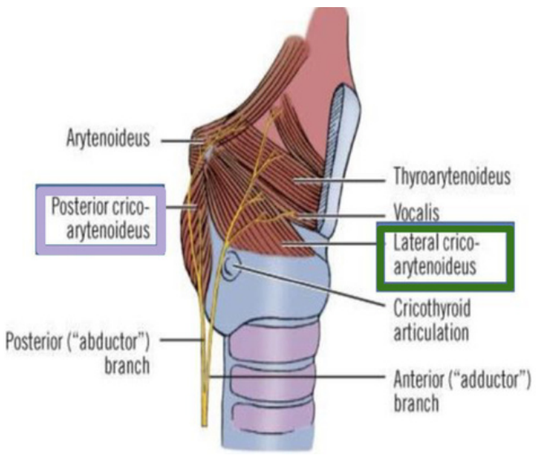
Crycothyroid *the only intrinsic muscle which found outside the larynx*

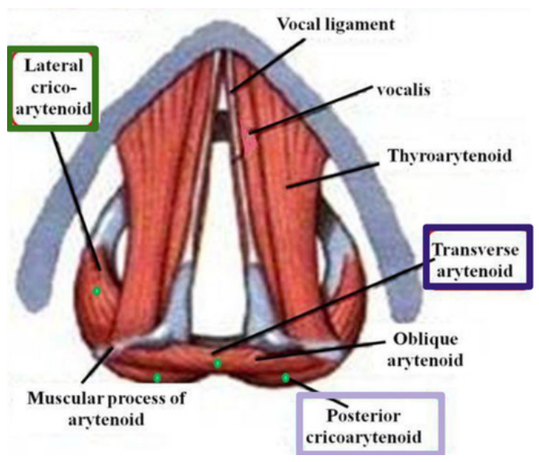


Adductors (**close** rima glottis)

Transverse arytenoid

Lateral cricoarytenoid





Abductors (**open rima glottis**)

Posterior cricoarytenoid

Muscles controlling the laryngeal inlet

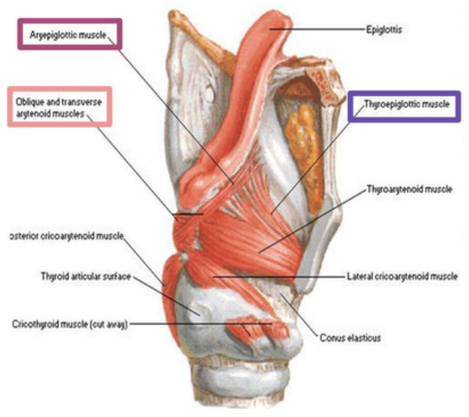
Muscles that **close** laryngeal inlet

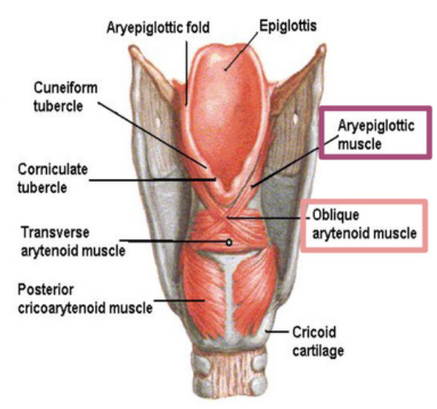
Oblique arytenoid

Aryepiglottic muscle

Muscles that **open** laryngeal inlet

Thyroepiglottic





Blood Supply of Larynx:

Arteries

- Upper half of larynx is supplied by **superior laryngeal artery** which is branch of **superior thyroid artery**

- lower half of larynx is supplied by **inferior laryngeal artery** which is branch of **inferior thyroid artery** from **thyrocervical trunk** of **subclavian artery**

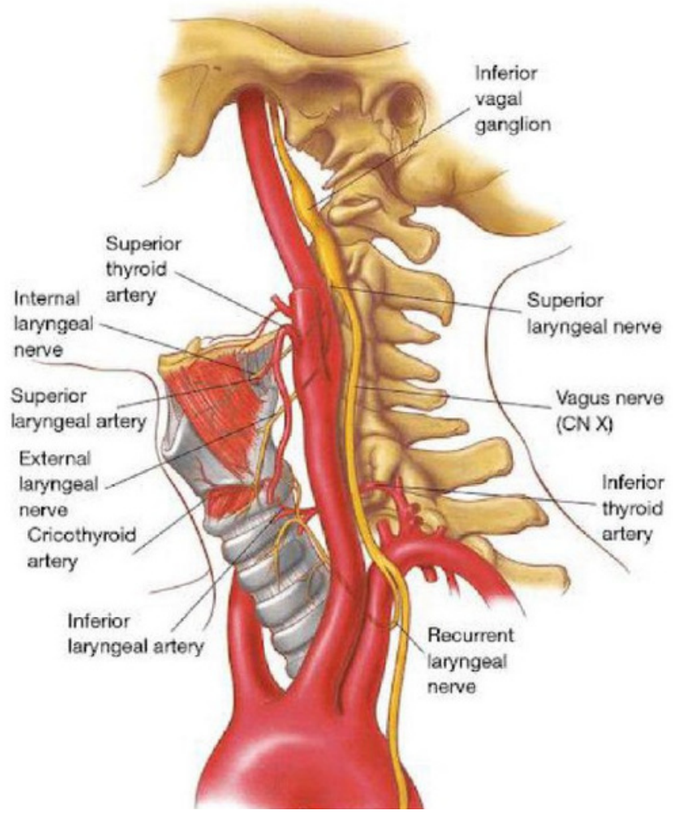
Veins

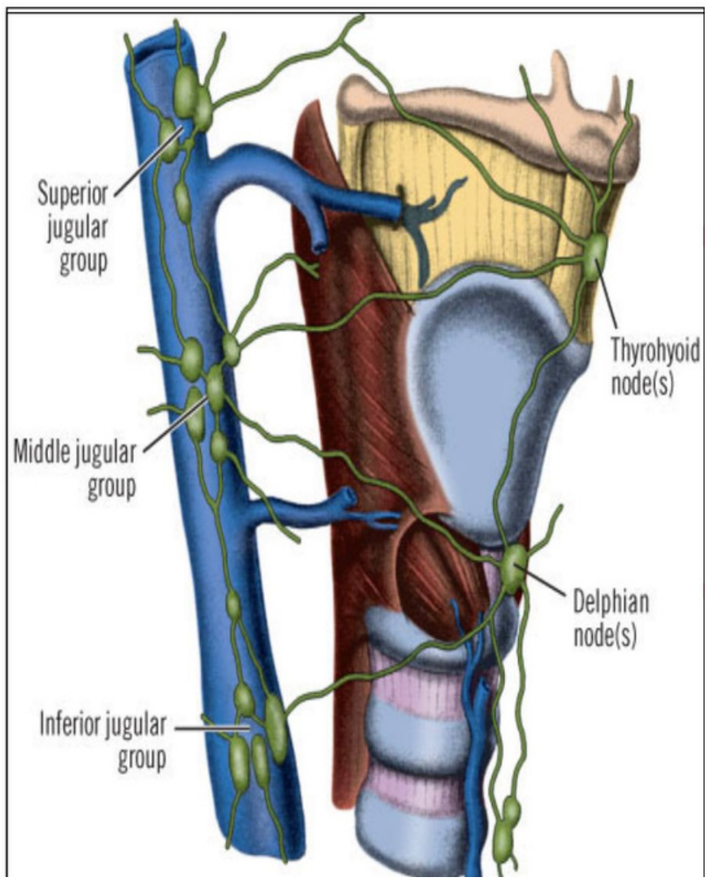
The superior and inferior laryngeal veins drain the larynx and share the same course as the arteries (accompany corresponding arteries)

- **Superior laryngeal vein** drains into the **superior thyroid veins**, which empty into the **internal jugular veins**

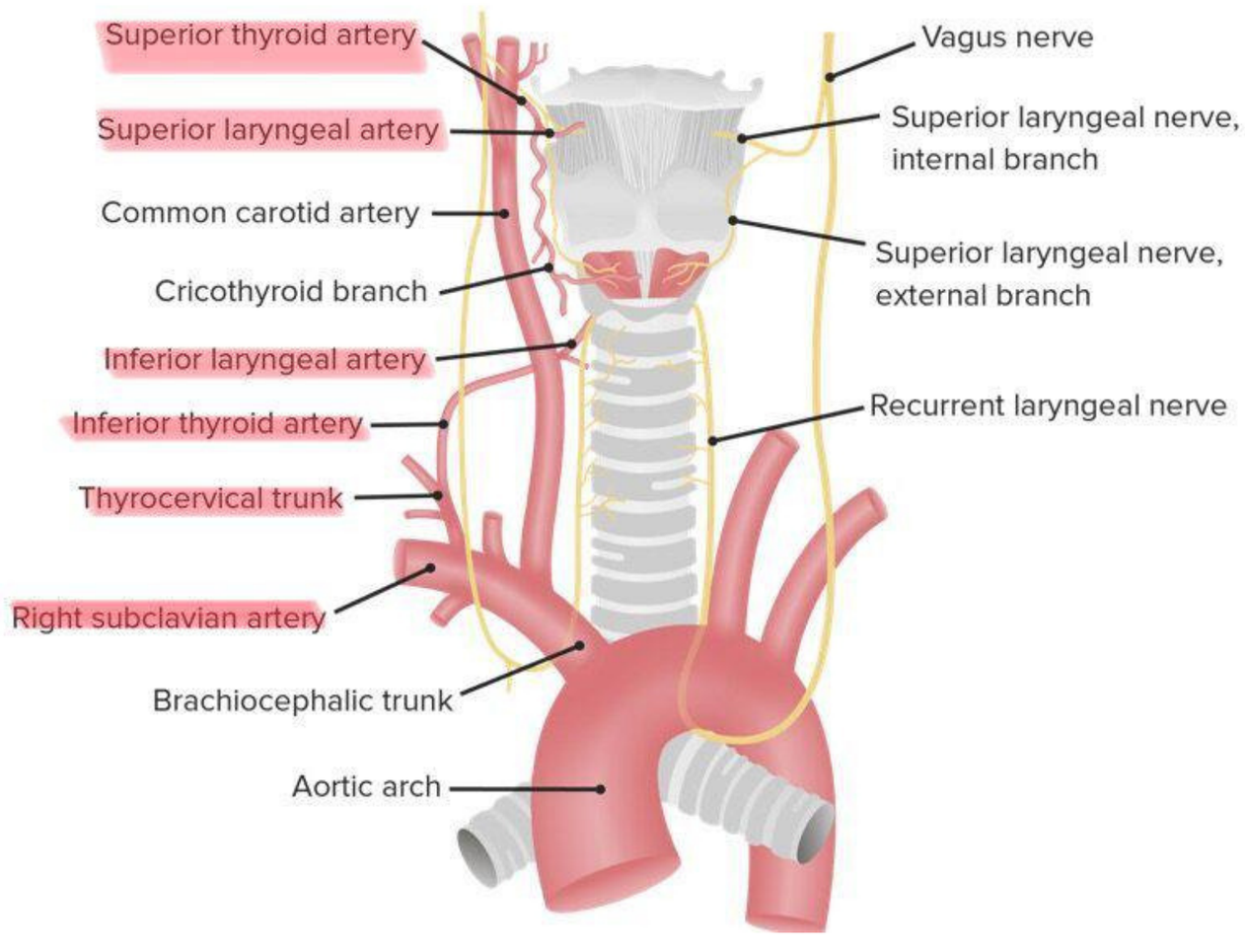
- **Inferior laryngeal vein** drains into the **inferior thyroid veins**, which empty into the **left brachiocephalic vein**

صور إضافية للي حاب يطلع :





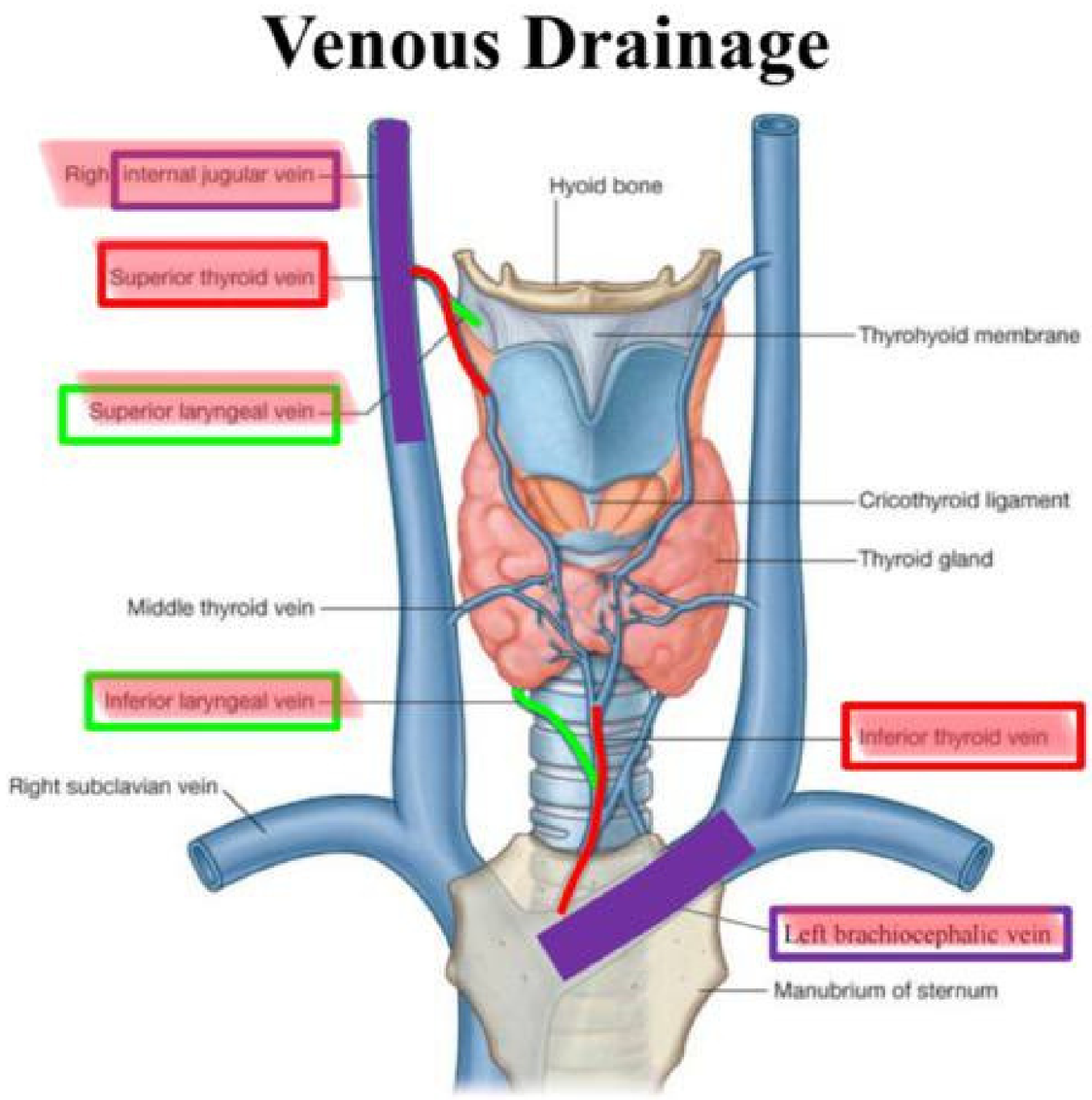
Explanation of previous slide:



بخصوص ال arteries سلمكم الله (شوفوا اللون الاحمر):

1- لاحظوا ان ال superior laryngeal artery عباره عن فرع من ال superior thyroid artery

2- لاحظوا ان ال inferior laryngeal artery عباره عن فرع من ال inferior thyroid artery اللي يعتبر فرع من thyrocervical trunk اللي يعتبر فرع من subclavian artery



بخصوص ال veins سلمكم الله (شوفوا اللون الاحمر):

1- لاحظوا ان ال superior laryngeal vein يصب في superior thyroid vein اللي راح يصب ايضا في internal jugual vein

2- لاحظوا ان ال inferior laryngeal vein يصب في inferior thyroid vein اللي راح يصب ايضا في left bracchiocephalic vein

Innervation

We have two sensory nerves:

1 Internal laryngeal nerve

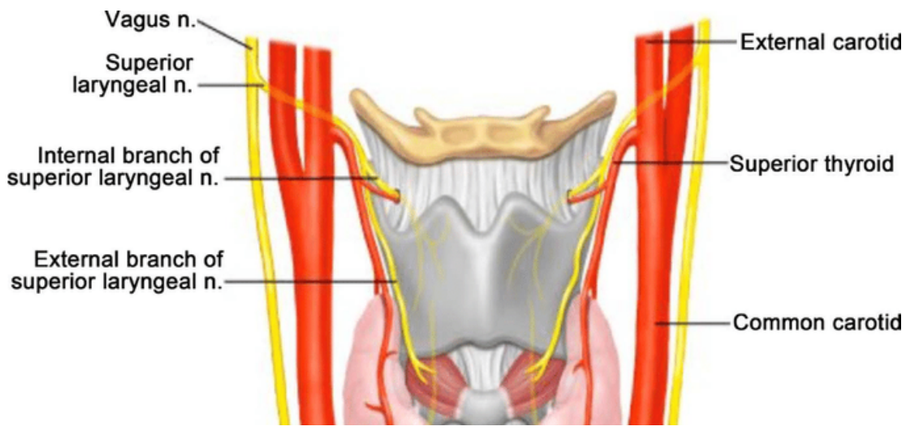
- Its located **above the vocal cord**
- Its a **branch of the superior laryngeal nerve** which is branch **of vagus nerve**

2 Recurrent laryngeal nerve

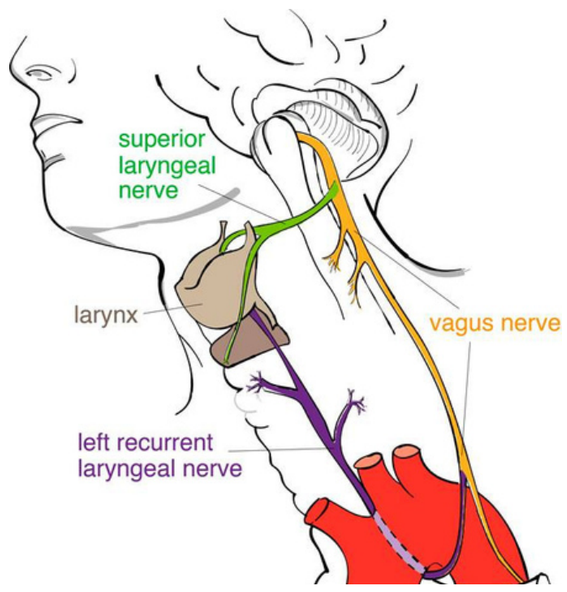
- Its located **below the vocal cord**
- Its a branch **of the vagus nerve**

تذكير:

- ال motor nerve مسؤول عن تحريك ال muscles
- ال sensory nerve مسؤول عن ارسال الاشارات العصبيه



لاحظوا معي ان ال internal laryngeal nerve عباره عن فرع من ال superior laryngeal nerve اللي يعتبر ايضا فرع من ال vagus nerve



لاحظوا معي ان ال recurrent laryngeal nerve عباره عن فرع من ال vagus nerve بحيث تفرع من اللون البرتقالي (vagus nerve) ثم طلع لفوق

We have two motor nerves:

1 Recurrent laryngeal nerve

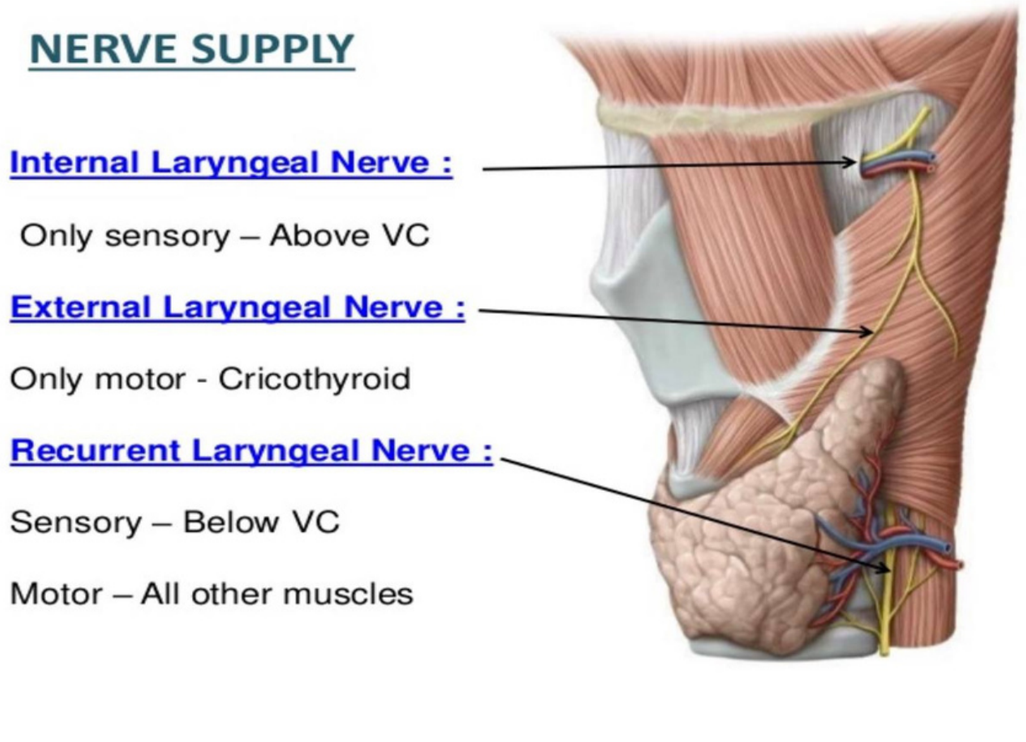
- It supplies **all intrinsic muscles except the cricothyroid** muscle

2 External laryngeal nerve

- It **supplies cricothyroid** muscle
- Its a branch **of superior laryngeal nerve** which is branch of vagus nerve

some of you may ask (why recurrent laryngeal nerve act as a sensory and motor nerve in the same time!)

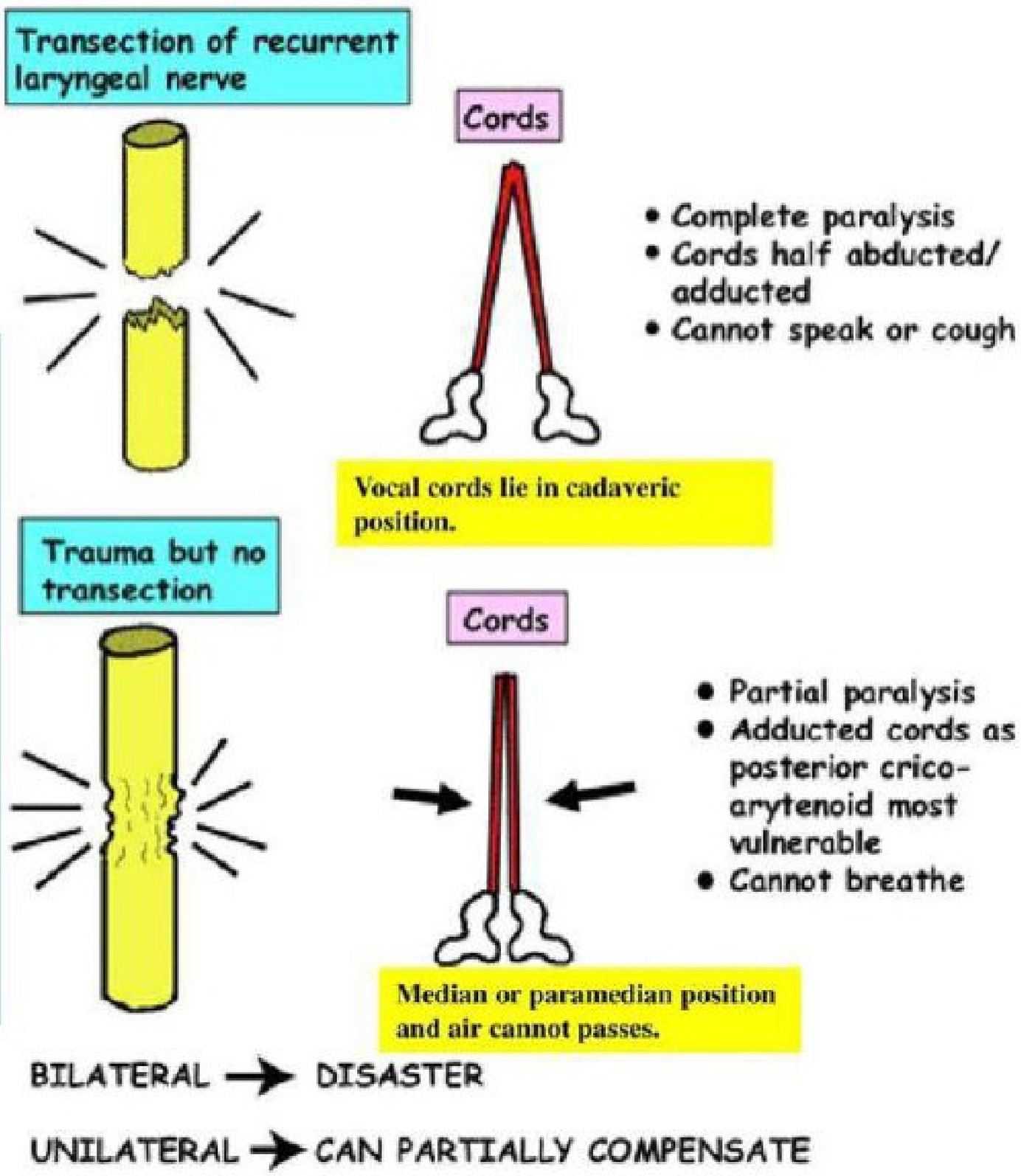
briefly ... some nerves have both sensory and motor function and they are called " mixed nerves



Semon's Law

- It is the damage of the **recurrent laryngeal Nerve**
- Semon's Law indicates the different effect between **damage** (surgical trauma) and **transection** of the **recurrent laryngeal nerve** due to surgery in region of the neck (e.g., thyroidectomy or parathyroidectomy)

N.B: The nerve fibers supplying the **abductors** of the vocal folds lie in the periphery of the recurrent laryngeal nerve and any progressive lesion involves these fibers first **before** involving the deeper fibers that supply the **adductors.**
Abductors of V.C are first to be paralysed & last to recover.



توضيح للصوره المجاوره :

مثل ما تشوفون , لو صار قطع كامل لل recurrent laryngeal nerve لاشك ان الصوت راح ينقطع والسبب بكل بساطه ان هذا العصب نفس ما قلنا هو المسؤول عن حركه العضلات المتواجده في ال larynx

اما لو صار فقط صدمه او ضربه او اذى لل recurrent laryngeal nerve من غير قطع فراح يكون في صوت ولكن مع بحه

وكذلك في بعض الاعراض لكلا الحالتين في هالصوره .....»

Girls' Slides

The Recurrent Laryngeal Nerve (RLN)

1. R.L.N is responsible about coaptation of vocal cord so, produce Voice

2. For inspiration: complete abduction of cords is needed

3. RLN has **outer fibers** for **Abductor muscles** and has **Inner fibers** for **Adductor muscles**

So, with RLN injury:

If its **partial** injury:

adductor only are acting so, cords in midline

If its **complete** injury:

abductors and **adductors** are paralysed so, cords placed midway = cadaveric position.

So, the effect of injury of RLN as follows:	
Unilateral partial	**Dyspnea** (ضيق تنفس)
Bilateral partial	**stridor & suffocation**
Unilateral complete	**hoarseness of voice** (بحه)
Bilateral complete	**Aphonia** (فقدان الصوت)

Trachea

- The windpipe
- Mobile, fibrocartilaginous tube, 5 inches long, 1 inch in diameter.
- It begins in the neck below the cricoid cartilage of the larynx (at lower border of cricoid cartilage at (C6).
- It ends in the thorax at the level of sternal angle (lower border of T4), by dividing into right and left principal (main, primary) bronchi
- The trachea is surrounded by cartilage in C-shaped rings.
- The free ends of these rings are supported by the trachealis muscle
- It is lined by ciliated pseudostratified columnar epithelium, interspersed by goblet cells to produce mucus
- The cilia and mucus act to trap inhaled particles and pathogens to be swallowed and destroyed
- At the bifurcation of the primary bronchi, a ridge of cartilage called the carina runs anteroposteriorly between the openings of the two bronchi
- It is the most sensitive part (the carina) of the respiratory tract and is associated with the **cough reflex**

Relations in superior mediastinum		
	Anterior	• Sternum • Thymus, (remains of thymus gland) • Left brachiocephalic vein • **Arch of aorta** (origin of : Brachiocephalic artery and left common carotid artery)
	Posterior	• Esophagus • Left recurrent laryngeal nerve.
	Left side	• **Arch of aorta** • **Left common carotid artery** • **left subclavian artery** • Left vagus nerve • Left phrenic nerve • Pleura
	Right side	• **Azygos vein** • Right vagus nerve • Pleura

Blood supply of trachea

Arteries	Veins	Lymphatic Drainage
branches of: • **inferior thyroid artery** • **bronchial artery** (from descending thoracic aorta)	**Drain to inferior thyroid veins**	**Into the pretracheal and paratracheal lymph nodes.**

Innervation

1. Branches of the **vagus nerve** and **recurrent laryngeal nerve** give **sensory fibers** to supply the **mucous membrane**

2. Branches from the **sympathetic trunks** supply the **trachealis muscle** and the **blood vessels.**

Boys' Slides

Introduction of Bronchi

- They are essential in the respiratory system
- They are large tubes that connect to trachea (windpipe) with the lungs to direct the air for breathing.
- The bronchi are part of the tracheobronchial tree where air passes to the lungs to exchanges gases.
- The tracheobronchial tree includes trachea, bronchi and bronchioles
- The bronchi are lined with cells that create mucus to keep your airways moist and to trap bacteria, viruses, fungi and other particles to protect the lungs and prevent infection
- They are also lined with cilia to help move mucus and particles out of the lungs
- When we cough or swallow, the particles that were trapped into the mucus will be moved out of our body or moved into the digestive system to be eliminated.

Bronchi

Right Principal Bronchus	Left Principal Bronchus
About one inch long.	About two inches long
Wider, shorter and more vertical than the left	Narrower, longer and more horizontal than the right
Gives superior lobar bronchus before entering the hilum of the right lung.	Passes to the left below the aortic arch and in front of esophagus
On entering the hilum, it divides into middle and inferior lobar bronchi	On entering the hilum of the left lung, it divides into superior and inferior lobar bronchi

Bronchial Division:

Within the lung, each bronchus divides and redivides into number of branches that can be divided into two groups:

Conduction zone branches	Respiratory zone branches
• Primary (main) bronchi • Secondary (lobar) bronchi • Tertiary (segmental) bronchi. (supply the bronchopulmonary segment). • Smaller bronchi. • Bronchioles. • Terminal bronchioles	• Respiratory bronchioles • Alveolar ducts. • Alveolar sacs. • Alveoli

Boys' Slides

Asthma

Definition

Asthma is a **chronic inflammatory** condition of the airways characterized by **airway obstruction**.

Asthma can cause:

1. bronchoconstriction
2. shortness of breath
3. wheezing
4. chest tightness
5. increased mucus production
6. coughing

The symptoms can be triggered by:

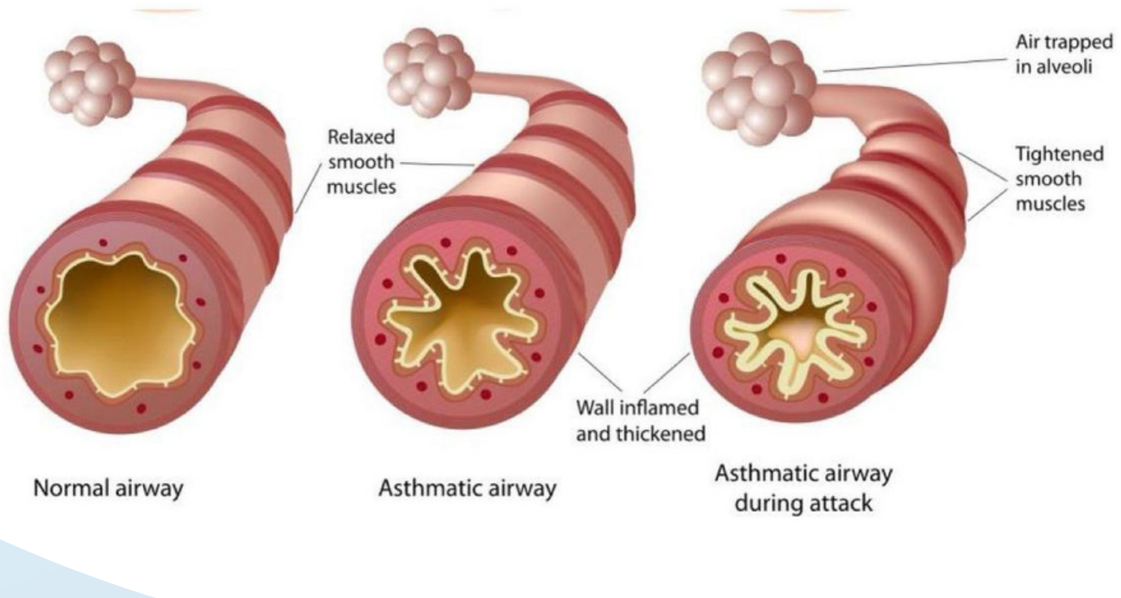
- **inhaling allergens such as:**
  - animal dander
  - dust mites
  - mould spores
  - pollens
  - certain chemical
  - tobacco smoke
- **other factors can trigger asthma such as :**
  - cold weather
  - exercise
  - stressful situations
  - respiratory infections

During an asthma attack, a person may experience:

1. tachycardia
2. difficulty breathing
3. severe anxiety

There are two types of treatment for asthma

- drugs such as **corticosteroids** to prevent an attack
- quick-relief drugs such as **bronchodilators** for use during an attack



Patients should try to avoid exposure to allergens or factors that can trigger an attack

MCQs

1 **Which of the following muscles of the larynx is the only one supplied by the external laryngeal nerve?**

A.cricothyroid	B.Thyroarytenoid	C. Oblique arytenoid	D. Lateral cricoarytenoid

2 **Which of the following cartilages of the larynx is completely closed from anterior to posterior?**

A. Thyroid	B. Corniculate	C. Epiglottis	D. Cricoid

3 **Which of the following is the most sensitive part of the respiratory tract and is associated with the cough reflex?**

A. Carina	B. Epiglottis	C. Conus elasticus	D. Vocal volds

4 **Which of the following structures is covered with stratified squamous epithelium?**

A.Saccule	B. Vocal folds	C.Aryepiglottic folds	D.A.Vestibular folds

5 **Right side of the trachea ?**

A. sternum	B. Right vagus nerve	C. Pleura	D. Both B and C

1.A 2.D 3.A 4.B 5.D

SAQs

1

Mention 2 ligaments in the larynx?

1- Hyoepiglottic ligament
2- Thyroepiglottic ligament

2

Mention 4 of the extrinsic suprahyoid muscles that elevate the larynx?

Mylohyoid
stylohyoid
geniohyoid
digastric

3

What are the arteries that supply the larynx?

Upper half: Superior laryngeal artery, branch of superior thyroid artery.
Lower half: Inferior laryngeal artery, branch of inferior thyroid artery from thyrocervical trunk of subclavian artery.

4

Mention three of the conduction zone branches?

primary bronchi
secondary bronchi
tertiary bronchi

More questions? Click here!

It's important this time
so please check it!!

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