



Anatomy of the larynx, trachea and bronchi

Respiratory Block - Lecture 3

Color index:

Important

In male's slides only

In female's slides only

Extra information, explanation

Doctors notes

Objectives:

- Describe the Extent, structure and functions of the larynx.
- 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

Larynx

part of the respiratory tract which contains the **vocal cords**.

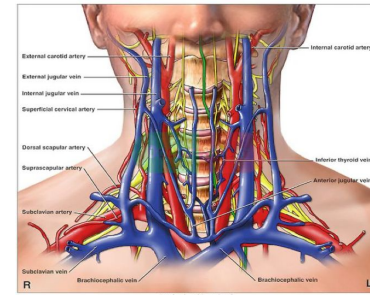
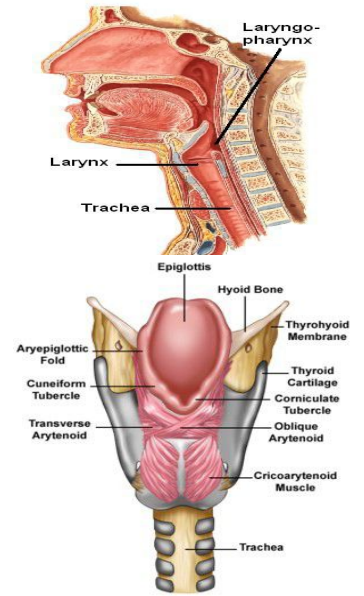
- ❖ In adult it is **2-inch-long tube**.
- ❖ It opens above into the **laryngeal** part of the pharynx.
- ❖ Below, it is continuous with the **trachea**

functions

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

Relations

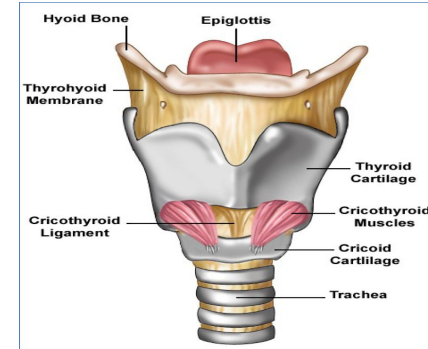
- The larynx is related to major **critical** structures in the neck.
- Arteries: **Carotid** arteries: **3** (common, external and internal),
 - **Thyroid** arteries: **3** (superior & inferior thyroid arteries and **thyroidema** artery).
 - Veins: **Jugular** veins, (external & internal)
 - Nerves: **Laryngeal** nerves: (Superior laryngeal & recurrent laryngeal), **vagus** nerve.



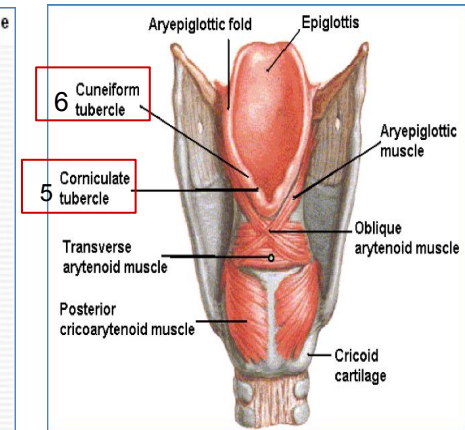
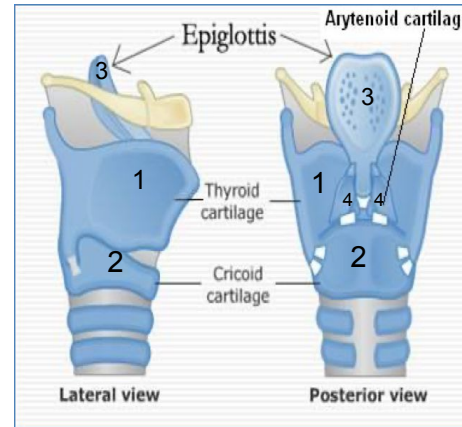
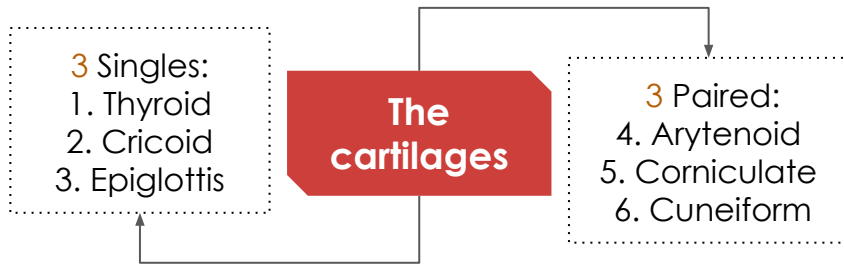
Structure:

The larynx consists of **four** basic components:

- 1) Cartilaginous skeleton.
- 2) Membranes and ligaments.
- 3) Muscles (Intrinsic & extrinsic muscles).
- 4) Mucosal lining.



★ All the cartilages, are **hyaline** except the **epiglottis** which is **Elastic** cartilage.
The cartilages are: Connected by joints, ligaments, lined by membranes, and moved by muscles.



Membranes & Ligaments

1

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**.

2

Quadrangular membrane:

(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).

3

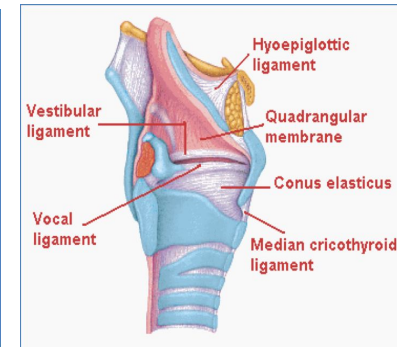
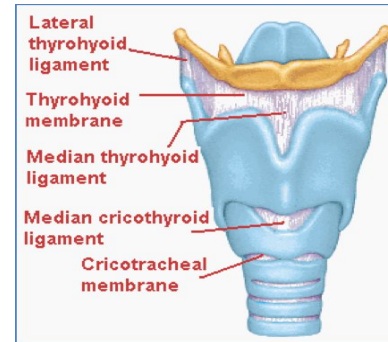
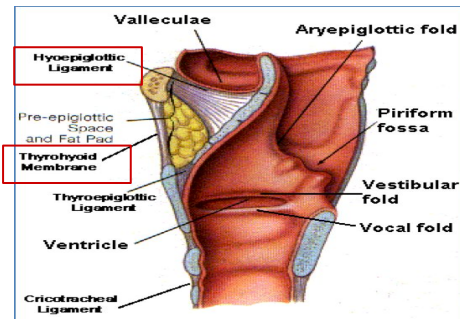
*Cricothyroid membrane:

(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).

4

Cricotracheal membrane

Ligaments:
Hyoepiglottic ligament.
Thyroepiglottic ligament



Laryngeal Inlet

Larynx

Laryngeal Cavity

It is the **upper opening** of the larynx. It faces **upward** and **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)**

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

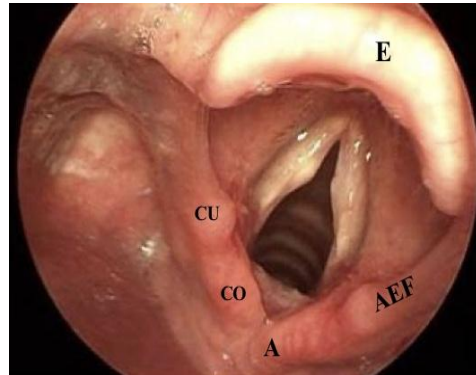
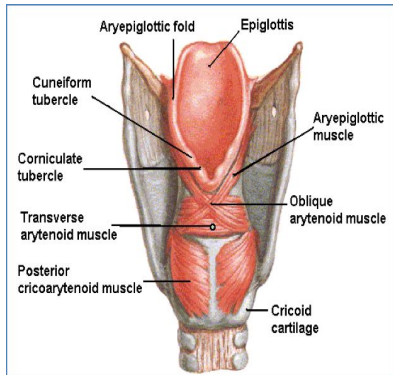
- **Narrow** in the region of the vestibular folds (**rima vestibuli**)
- **Narrowest** in the region of the vocal folds (**rima glottidis**)

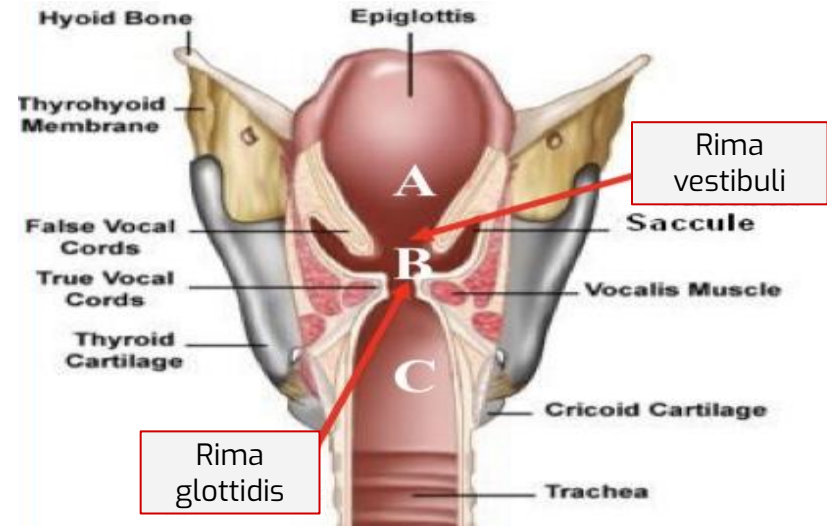
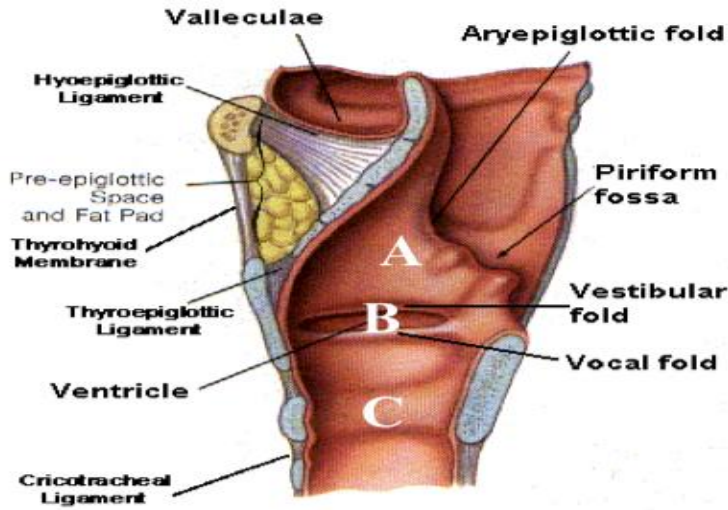
Divided into three parts:

1. **Supraglottic part or vestibule:** it is the part above the vestibular folds.(A)
2. **Ventricle:** it is the part between the vestibular folds & the vocal folds.(B)
3. **Infraglottic part,** the part below the vocal folds.(C)

*The ventricle has an upward invagination called **sacculus** which is rich in goblet cells.

(Pictures are in the next slide)





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).

Laryngeal muscles

Laryngeal muscles are divided into two main groups:

- **Extrinsic muscles:**

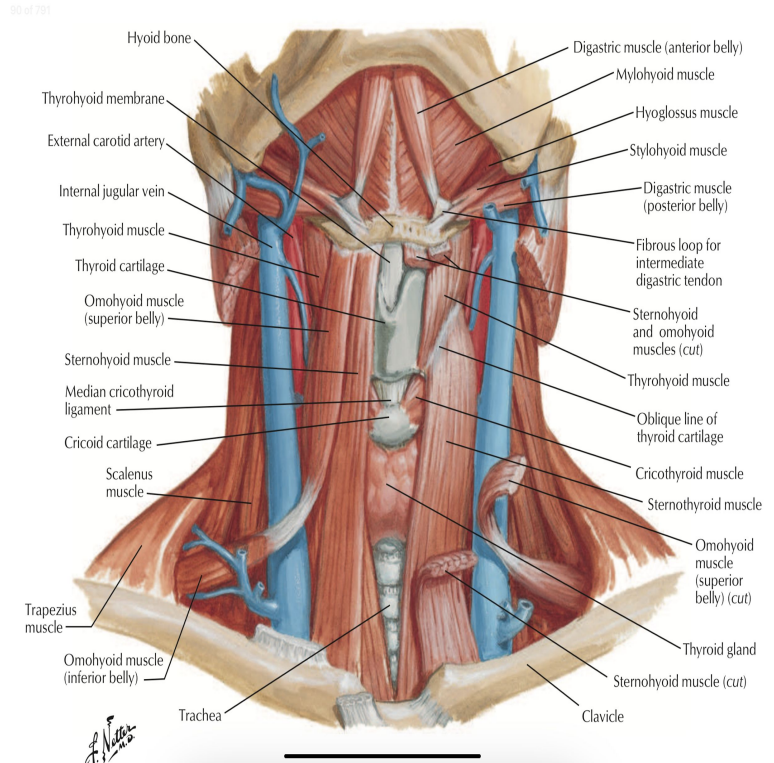
subdivided into two groups:

- 1- **Elevators** of the larynx.
- 2- **Depressors** of the larynx.

- **Intrinsic muscles:**

subdivided into two groups:

- 1- Muscles controlling the **laryngeal inlet**.
- 2- Muscles controlling the movements of the **vocal cords**.



Extrinsic muscles

Elevators of the larynx:

A-The Suprahyoid(MSGD):

- Mylohyoid.
- Stylohyoid.
- Geniohyoid.
- Digastric

B-The longitudinal muscles of pharynx:

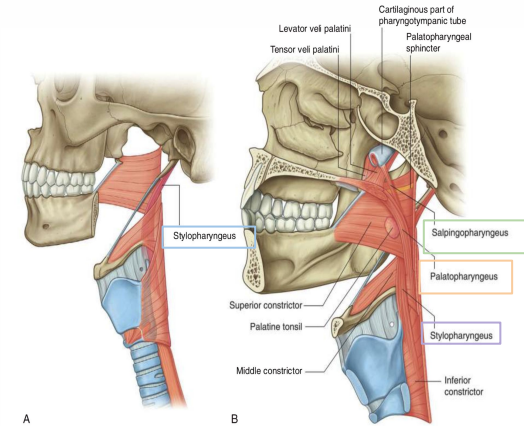
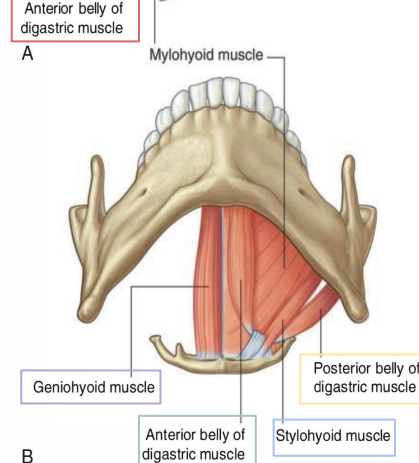
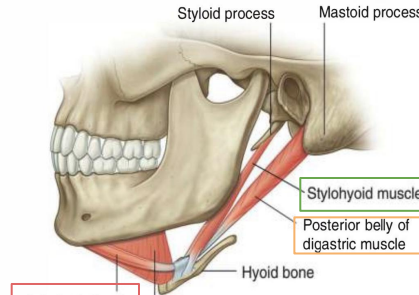
- Stylopharyngeus.
- Salpingopharyngeus.
- Palatopharyngeus.

Depressors of the larynx:

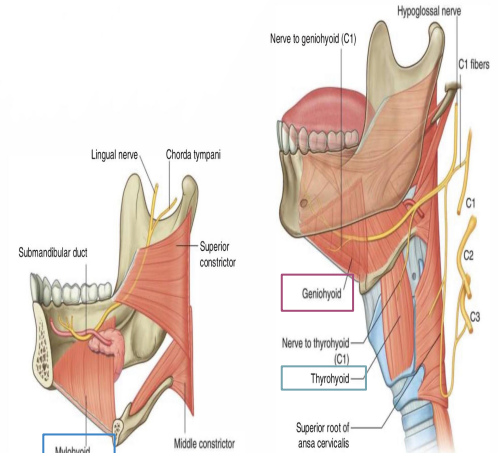
-The Infrahyoid Muscles:

- Sternohyoid.
- Sternothyroid.
- Omoxyoid.

note:
all Extrinsic muscles ends with "hyoid" except digastric, sternothyroid and the longitudinal muscles



1044 Fig. 8.199 Longitudinal muscles of the pharynx. A. Stylopharyngeus muscle. B. Medial view.



Intrinsic muscles

Muscles Controlling the Laryngeal Inlet:

- Oblique arytenoid.
- Aryepiglottic muscle.

Muscles controlling the vocal cords:

-Muscle decreasing the Length & Tension of Vocal Cords (relax vocal cords):

- Thyroarytenoid (vocalis).

-Muscle increasing the Length & Tension of Vocal Cords.

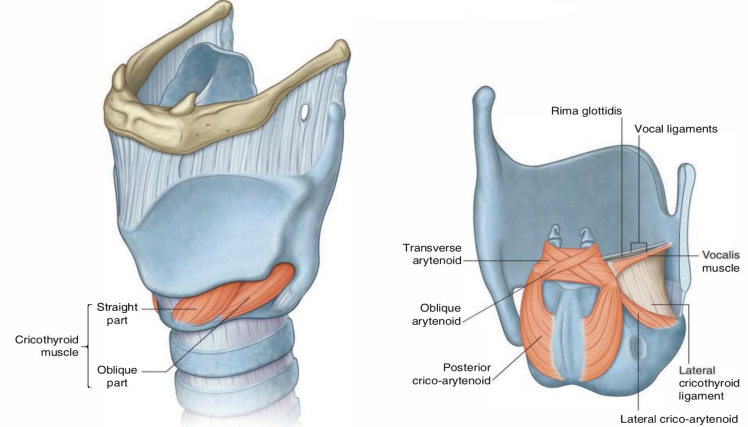
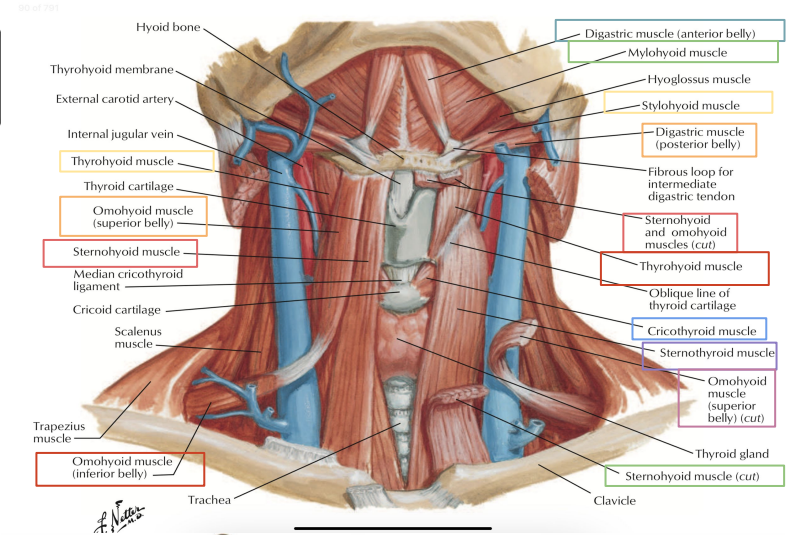
- Cricothyroid. **the only intrinsic muscle which found outside the larynx.**

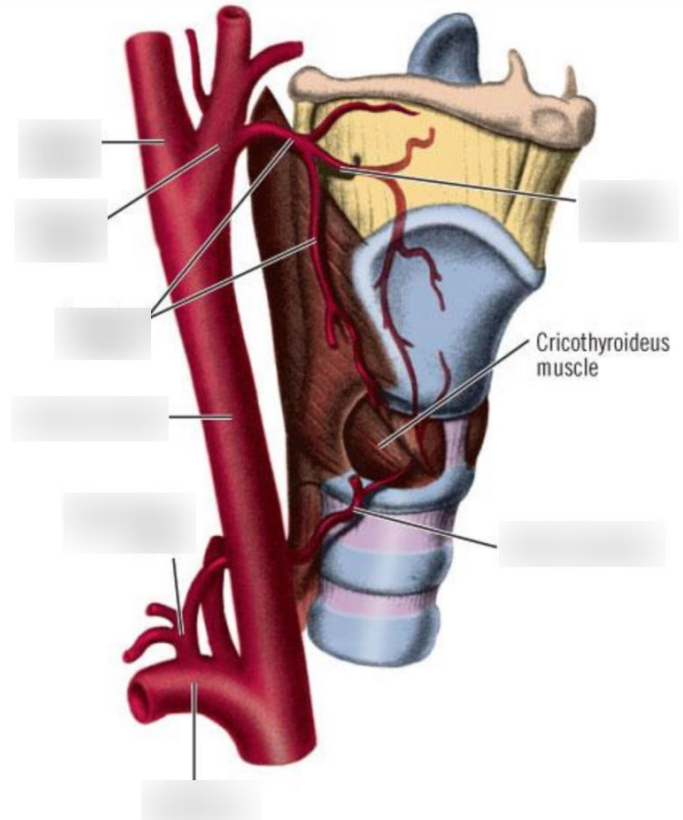
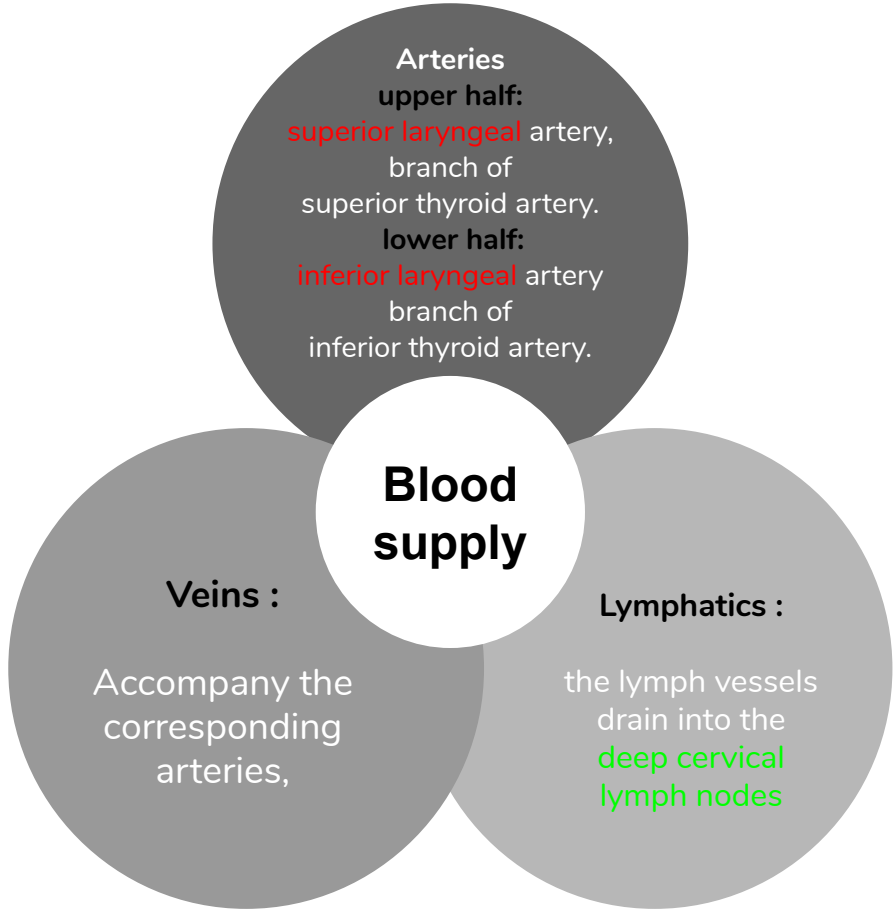
-Adductors (close rima glottis):

- Lateral **cricoarytenoid**.
- Transverse **arytenoid**.

-Abductor (open rima glottis):

- *Posterior **cricoarytenoid**.





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Nerve supply and semon's law

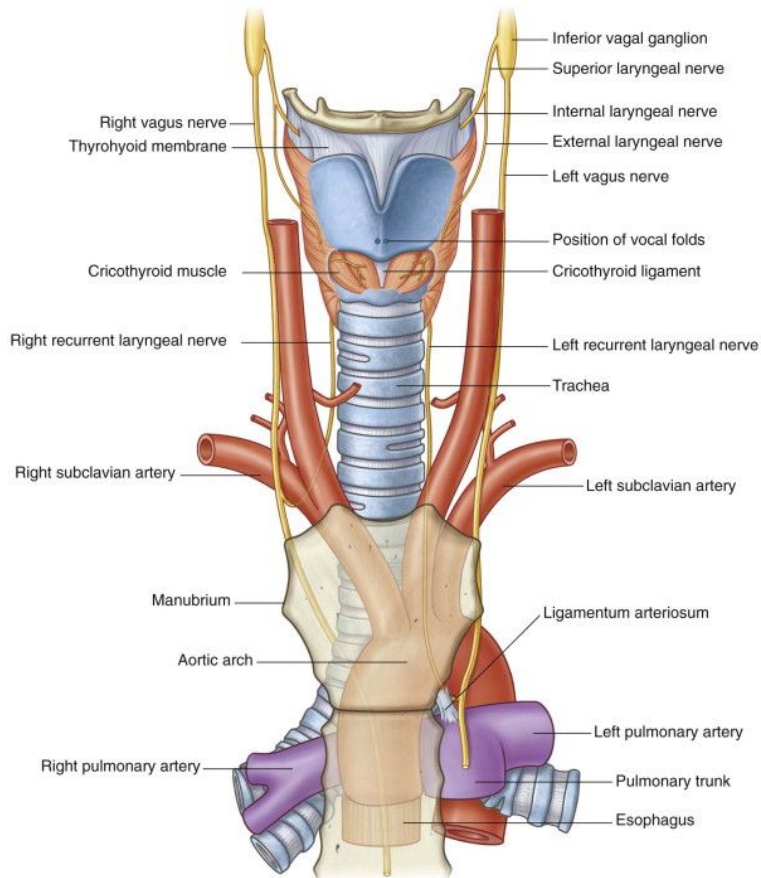
Motor:

All intrinsic muscles are supplied by **recurrent laryngeal nerve of vagus nerve** EXCEPT **cricothyroid** which is supplied by **external laryngeal nerve** of superior laryngeal of vagus

Sensory:

above the vocal cords = **internal laryngeal nerve** branch of the superior laryngeal of the vagus nerve

below the vocal cords = **recurrent laryngeal nerve** of the vagus nerve



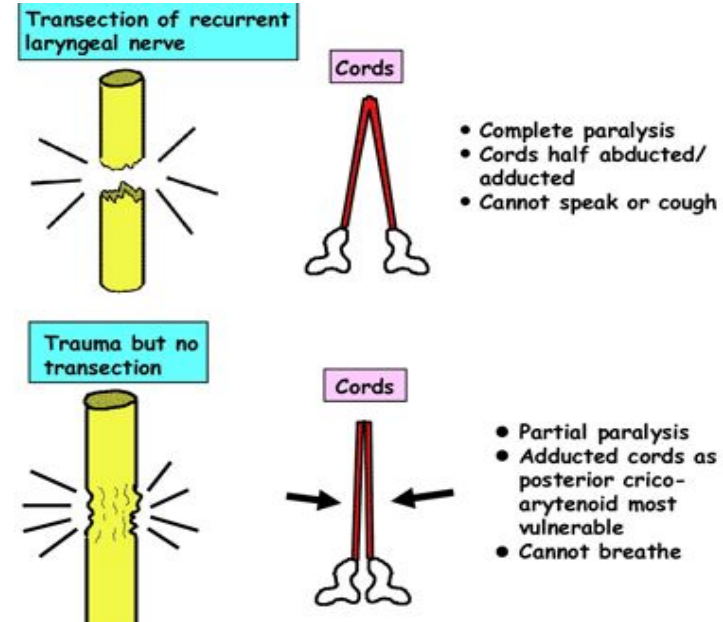
Semon's law :

Semon's law : (damage of **recurrent laryngeal nerve**) 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).

Transected: complete paralysis, cannot speak, cannot cough, cords half abducted/adducted , **can breath**

Trauma without transected: partial paralysis, adducted vocal cords as posterior crico-arytenoid most vulnerable and **cannot breath** in non transected damage:

- Bilateral(both sides)= VERY dangerous (**disaster**)
- Unilateral= CAN partially compensate



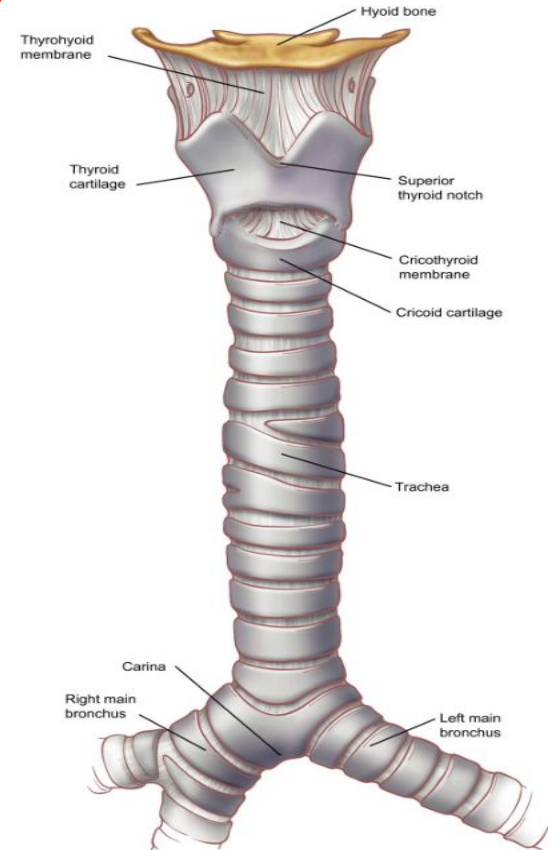
N.B : The nerve fibers supplying the abductors of the vocal folds lie in the periphery of the recurrent laryngeal nerve and any progressive lesion involves these fibers first before involving the deeper.

Trachea (windpipe)

- Mobile, fibrocartilaginous tube
- **5 inches** long, 1 inch in diameter
- **Begins:** In the neck below the cricoid cartilage of larynx (at lower border of cricoid cartilage at C6)
- **Ends:** Thorax (at level of sternal angle) lower border of T4

Divides into :

- **Left** and **Right** primary (main) bronchi
- its wall supported by 16-20 horse shoe cartilage.
- the ridge at bifurcation from inside called **Carina**
- it is the **most sensitive** part of the respiratory tract
- it's associated with the **cough reflex**



Relation in trachea :

Anterior	Posterior	Right	Left
-sternum -thymus(remains of thymus gland) -Left brachiocephalic vein -Arch of aorta origin of: brachiocephalic artery left common carotid artery	-esophagus -left recurrent laryngeal nerve	- Azygos vein - Right vagus nerve - Right pleura	-Arch of aorta -Left common carotid artery -Left pleura -Left subclavian artery -Left phrenic nerve -Left vagus nerve

Nerve & Blood Supply

Artery Supply	Venous supply	Nerve Supply	Lymphatics
inferior thyroid and bronchial arteries(from descending thoracic aorta)	Drain inferior thyroid vein	Branches of the vagus and recurrent laryngeal nerve give sensory fibers to supply the mucus membrane. -Trachealis and blood vessels is supplied by branches from the sympathetic trunk	Into the pretracheal and paratracheal lymph nodes.

Bronchi

Right Bronchus :

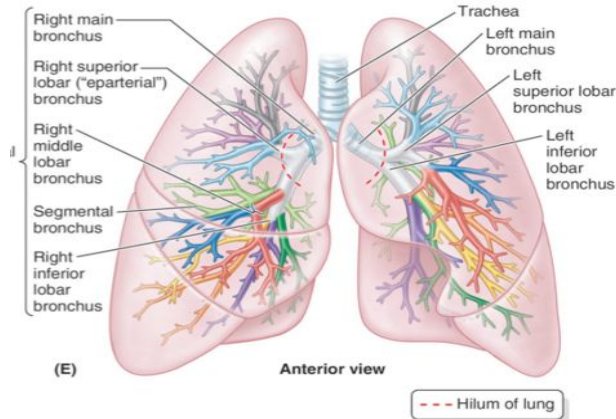
- **one inch long**,wide,short,more vertical bronchus (in line with trachea)
- gives **superior lobar before** entering the hilum of the right lung and gives the **inferior** and **middle** lobar after

Left bronchus :

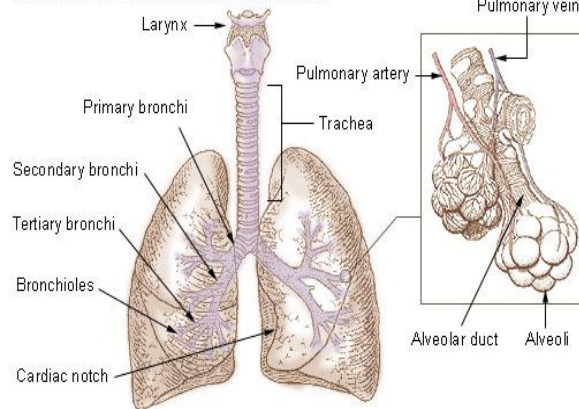
- **Two inch long**,narrow,long,more horizontal bronchus
- Gives superior and inferior lobar **after** entering the hilum.(no middle lobar)
- Passes to the left below the aortic arch and in front of the esophagus.

Divisions :

within the lung each bronchus divides and re-divides into number of branches.



Bronchi, Bronchial Tree, and Lungs



Conducting zone branches:

1. Primary bronchi (main)
2. secondary bronchi (lobar)
3. tertiary bronchi (segmental) supplied by **bronchopulmonary segment**
4. Smaller bronchi
5. Bronchioles
6. Terminal bronchioles

Respiratory zone branches:

1. Respiratory bronchioles
2. Alveolar ducts
3. Alveolar sacs
4. Alveoli

MCQ

Q1: the larynx has function in:

- A.**respiration
- B.**phonation
- C.**deglutition
- D.**all above

Q4: lower margin of Cricothyroid membrane is attached to the upper border of

- A.**thyroid cartilage
- B.**cricoid cartilage
- C.**epiglottis
- D.**none

Q2: which one of these is a single cartilage?

- A.**Epiglottis
- B.**arytenoid
- C.**cuneiform
- D.**none

Q5: It extends between the arytenoid and epiglottis:

- A.**Quadrangular membrane
- B.**aryepiglottic membrane
- C.**both A and B
- D.**cricotracheal membrane

Q3: which one is an elastic cartilage

- A.**thyroid
- B.**cricoid
- C.**Epiglottis
- D.**arytenoid

Q6: The cavity of larynx is lined with:

- A.**ciliated columnar epithelium
- B.**stratified squamous epithelium
- C.**sacculles
- D.**none

answer key:
1:D
2:A
3:C
4:B
5:C
6:A

MCQ

Q7: Semon's law due to ?

- A.** damage of recurrent laryngeal nerve
- B.** damage of internal laryngeal nerve
- C.** damage of external laryngeal nerve
- D.** damage of accessory nerve

Q10: Right bronchus is ?

- A.** short
- B.** narrow
- C.** vertical
- D.** A & C

Q8: Trachea ends in ?

- A.** upper border of T4
- B.** lateral border of T4
- C.** medial border of T4
- D.** inferior border of T4

Q11: Trachea are associated with ?

- A.** sneezing
- B.** cough
- C.** sweating
- D.** swallowing

Q9: Which one of the following is a posterior relation to trachea

- A.** sternum
- B.** pleural
- C.** esophagus
- D.** Arch of aorta

Q12: Venous supply of trachea drain into ?

- A.** superior arytenoid vein
- B.** inferior arytenoid vein
- C.** superior thyroid vein
- D.** inferior thyroid vein

answer key:
7:A
8:D
9:C
10:D
11:B
12:D

SAQ :

1 : List the Depressors muscles of the larynx.

2 : The Laryngeal Inlet is bounded by?

3 :List three features of left Bronchus ?

SAQ Answers

1 :Sternohyoid, Sternothyroid, Omohyoid.

2 :Anteriorly: by the upper margin of epiglottis
Posteriorly & below: by arytenoid cartilages
Laterally: by the Aryepiglottic folds

3 Narrow,long,horizontal,two inch long

Team leaders

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- Sumo Abdulrahman
- **Fatimah Saad**
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- Shahad almezel
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- Bassam Alasmari
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