

## Respiratory system

It comprises respiratory tract and respiratory organs.

The organs of respiratory system include:

- Nose – Nasal cavity – Paranasal sinuses – Pharynx – Larynx – Trachea – Bronchi – bronchiols
- Lungs which contain alveoli

**The classification of respiratory system include:**

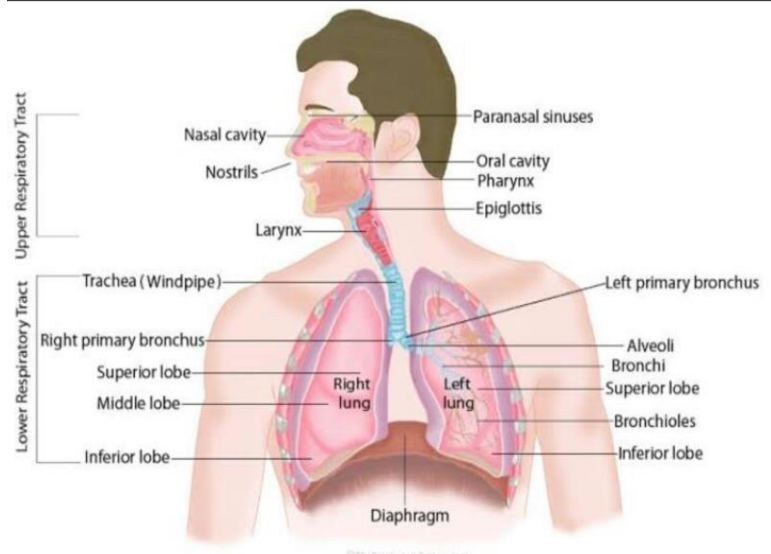
### • Structural classification

#### – Upper respiratory tract

- Nose
- Nasal cavity
- Pharynx (throat)
- Larynx(voice box),

#### – Lower respiratory tract

- Trachea (wind pipe)
- Bronchi
- bronchioles
- Lungs which contain alveoli



### • Functional classification

#### – Conducting portion(zone) air transport.

(nose,nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, and terminal bronchioles – their function is to filter, warm, and moisten air and conduct it into the lungs

#### – Respiratory portion(zone) gas exchange

(Respiratory bronchioles and the alveolar ducts are responsible for 10% of the gas exchange. – The alveoli responsible for the other 90%)

## ❖ The organs of respiratory system include:

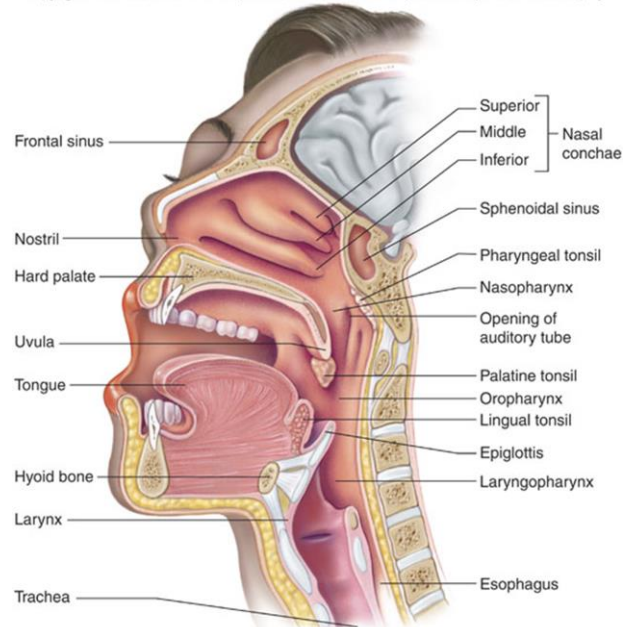
### The Nose

- ❖ ☐ Only externally visible part of the respiratory system.

### Nasal cavity

- ❖ ☐ It is the large cavity lined by mucous secreting epithelium and is divided into two nasal chambers by nasal septum.
- ❖ ☐ Anteriorly, the nasal cavity merge with the external nose, and posteriorly it communicates with the pharynx through two openings called the internal nares. In nasal chamber air is cleaned, warmed and filtered

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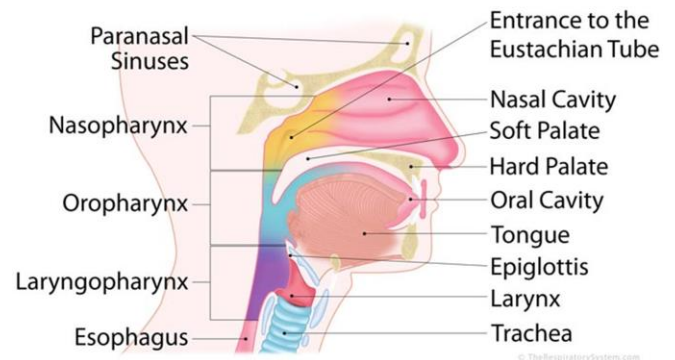


### Pharynx

Pharynx is a conical fibromuscular tube forming the upper part of air and food passages.

- 12-14cm long
- Divided into three sections by location
  - **Nasopharynx**
  - **Oropharynx**
  - **Laryngopharynx**

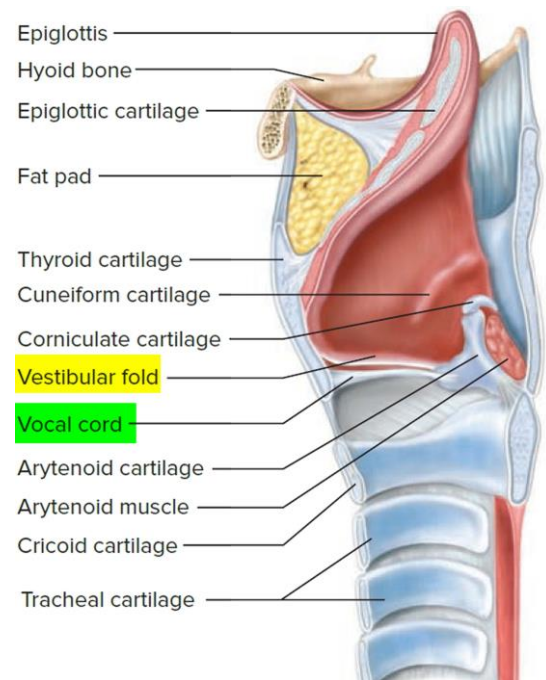
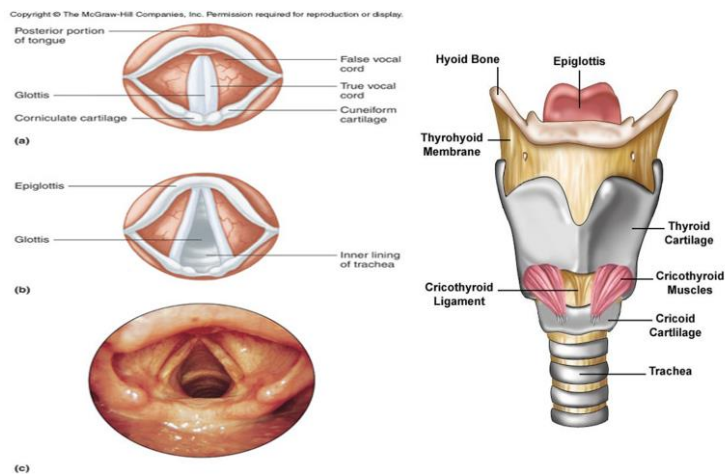
### Anatomy of the Pharynx



## LARYNX (VOICE BOX)

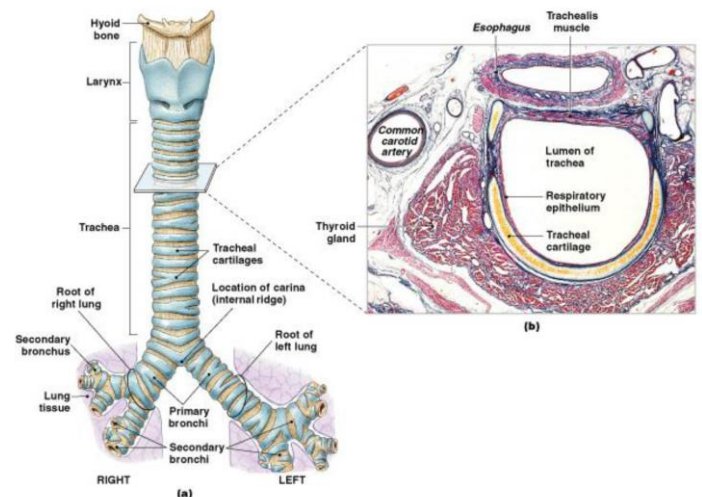
It is a small box like structure situated in the neck, anterior to oesophagus and is supported by these cartilages:

- Thyroid cartilage (Adam's apple)
- Cricoid cartilage
- Arytenoid cartilage



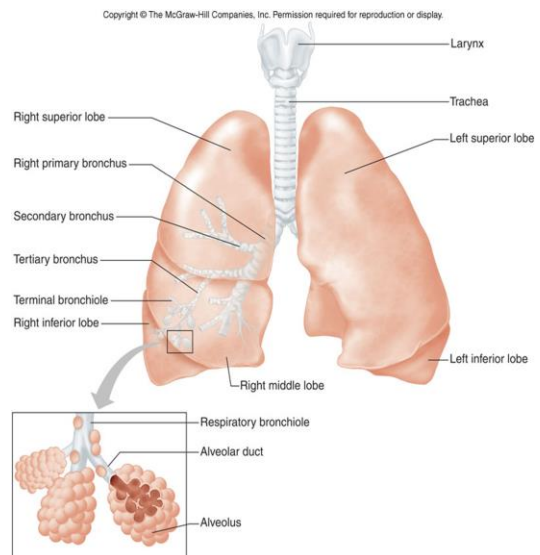
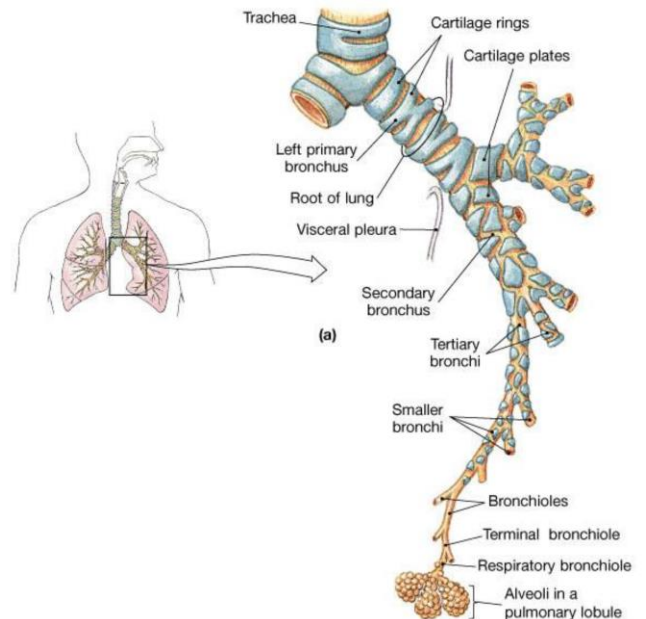
## Trachea

- ❖ A flexible tube also called **windpipe**.
- ❖ □ Extends through the mediastinum and **lies anterior to the esophagus** and inferior to the larynx.
- ❖ □ descends vertically from sixth cervical vertebra between the two lungs. In the thoracic region, it divides into pair of pulmonary bronchi.
- ❖ □ Anterior and lateral walls of the trachea supported by 15 to 20 C-shaped **tracheal cartilages**.
- ❖ □ Cartilage rings reinforce and provide rigidity to the tracheal wall to ensure that the trachea remains open at all times
- ❖ □ Posterior part of tube lined by **trachealis muscle**
- ❖ □ Lined by **ciliated pseudostratified columnar epithelium**.



### Bronchial tree(Bronchi, Bronchiol)

- ❖ □ At the level of the sternal angle, the trachea bifurcates into two smaller tubes, called the **right and left primary bronchi**.
- ❖ □ Each primary bronchus projects laterally toward each lung.
- ❖ □ A highly branched system of air-conducting passages that originate from the left and right primary bronchi.
- ❖ □ Incomplete rings of hyaline cartilage support the walls of the primary bronchi to ensure that they remain open.
- ❖ □ Right primary bronchus is shorter, wider, and more vertically oriented than the left primary bronchus.
- ❖ □ Each primary bronchus branches into several **secondary bronchi** (or lobar bronchi).
- ❖ □ The left lung has two secondary bronchi. The right lung has three secondary bronchi.
- ❖ □ They further divide into **tertiary bronchi**.
- ❖ □ Each tertiary bronchus is called a segmental bronchus because it supplies a part of the lung called a **bronchopulmonary segment**.
- ❖ □ **Secondary bronchi** □ **tertiary bronchi** □ **bronchioles** □ **terminal bronchioles**
- ❖ □ epithelium gradually changes from **ciliated pseudostratified columnar epithelium to simple cuboidal epithelium** in terminal bronchioles



## Lungs

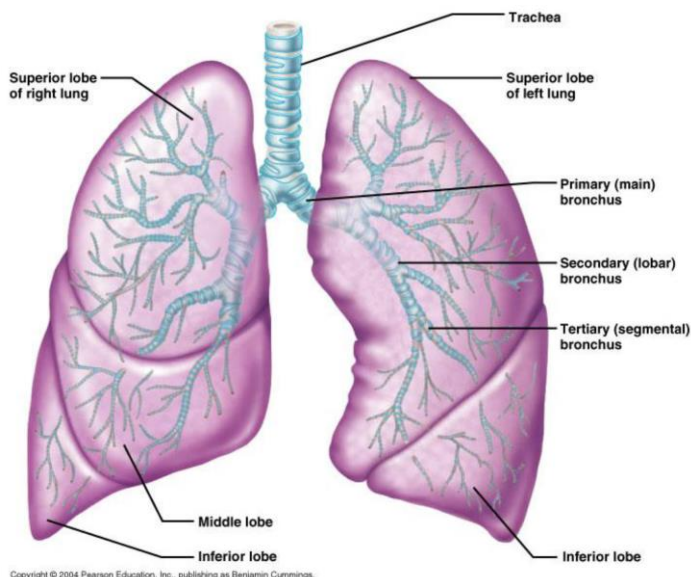
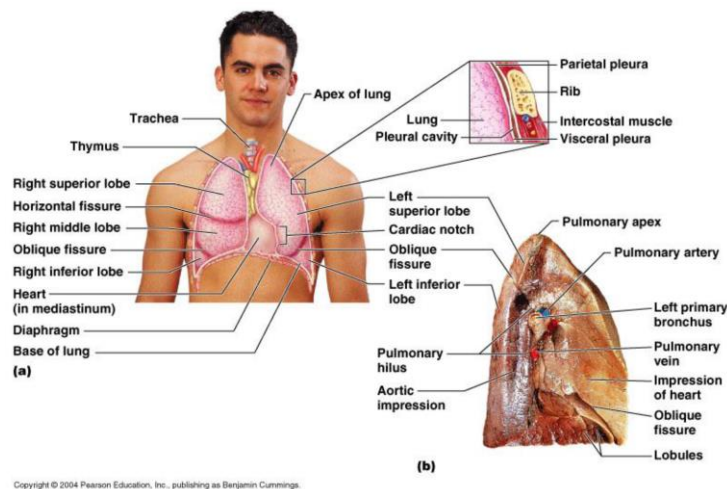
- ❖ Each lung has a conical shape. Its wide, **concave base** rests upon the muscular diaphragm.
- ❖ Its superior region called the **apex** projects superiorly to a point that is slightly superior and posterior to the clavicle.
- ❖ Both lungs are bordered by the thoracic wall anteriorly, laterally, and posteriorly, and supported by the rib cage.
- ❖ Toward the midline, the lungs are separated from each other by the mediastinum.
- ❖ The relatively broad, rounded surface in contact with the thoracic wall is called the costal surface of the lung.

❖ **Left lung**

- ❖ divided into 2 lobes by **oblique fissure**
- ❖ smaller than the right lung
- ❖ **cardiac notch** accommodates the heart

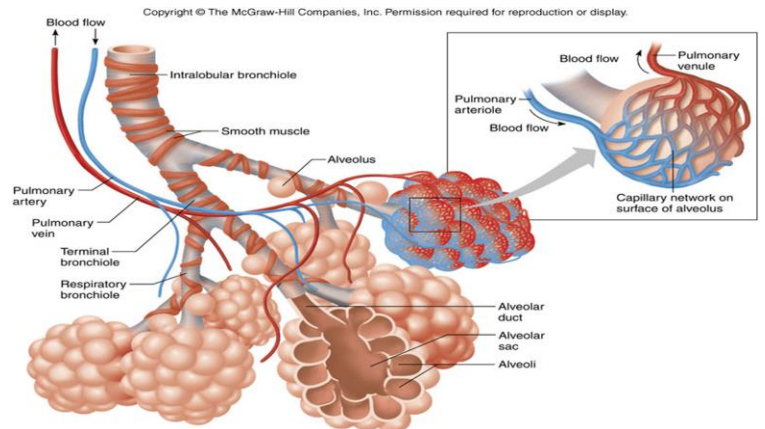
❖ **Right**

- ❖ divided into 3 lobes by **oblique and horizontal fissure**
- ❖ located more superiorly in the body due to liver on right side



**Alveoli**

- ❖ □ Respiratory bronchioles are connected to alveoli along alveolar ducts
- ❖ □ Alveolar ducts end at alveolar sacs:
- ❖ ° common chambers connected to many individual alveoli
- ❖ Lungs contain small saccular outpocketings called **alveoli**.
- ❖ □ They have a thin wall specialized to promote diffusion of gases between the alveolus and the blood in the pulmonary capillaries.
- ❖ □ Gas exchange can take place in the **respiratory bronchioles and alveolar ducts** as well as in the **alveoli**, each lung contains approximately 300 to 400 million alveoli.
- ❖ □ The spongy nature of the lung is due to the packing of millions of alveoli together.

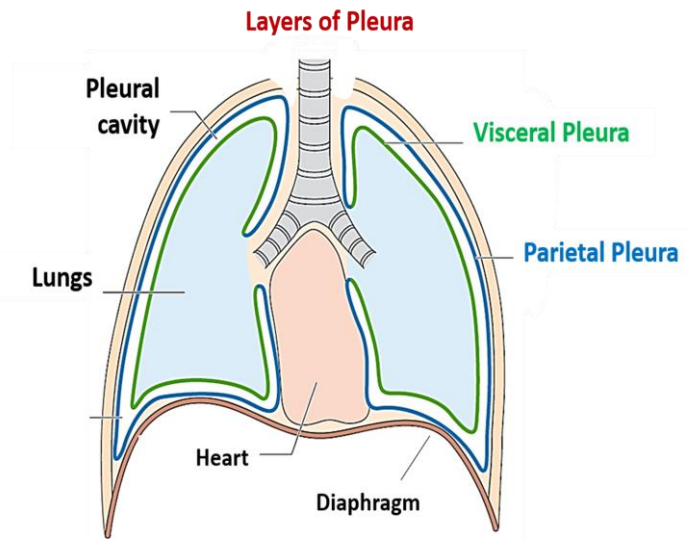


	Name	Division	Diameter (mm)	How many?	Cross-sectional area (cm)
Conducting system	Trachea	0	15-22	1	2.5
	Primary bronchi	1	10-15	2	↓
		2		4	
		3		↓	
		4		1-10	
		5		↓	
Exchange surface	Alveoli	6-11	↓	$1 \times 10^4$	↓
		Bronchioles	12-23	0.5-1	$2 \times 10^4$
				$8 \times 10^7$	$5 \times 10^3$
		24	0.3	$3-6 \times 10^8$	$>1 \times 10^9$

	Name of branches	Number of tubes in branch
Conducting zone	Trachea	1
	Bronchi	2
		4
		8
		16
Respiratory zone	Bronchioles	32
	Terminal bronchioles	$6 \times 10^4$
	Respiratory bronchioles	$5 \times 10^5$
	Alveolar sacs	$8 \times 10^6$

### Pleura and Pleural Cavities

- ❖ □ The outer surface of each lung and the adjacent internal thoracic wall are lined by a serous membrane called **pleura**.
- ❖ □ The outer surface of each lung is tightly covered by the **visceral pleura**.
- ❖ □ While the internal thoracic walls, the lateral surfaces of the mediastinum, and the superior surface of the diaphragm are lined by the **parietal pleura**.
- ❖ □ The parietal and visceral pleural layers are continuous at the **hilus** of each lung.



### Pleural Cavities

- ❖ □ The potential space between the serous membrane layers is a **pleural cavity**.
- ❖ □ The pleural membranes produce a thin, serous **pleural fluid** that circulates in the pleural cavity and acts as a lubricant, ensuring minimal friction during breathing.
- ❖ □ **Pleural effusion** – pleuritis with too much fluid