The Respiratory System :

This system is composed of :

1. **Nose**
2. **Para nasal Sinuses**
3. **Pharynx**
4. **Larynx**
5. **Trachea**
6. **Bronchi**
7. **Bronchioles**
8. **Alveoli of the lungs.**

These organs can also be subdivided into:

- **Upper respiratory tract: Nose , Pharynx & Larynx**
- **Lower respiratory tract: Fills most of the thorax as : Trachea , Primary two bronchi and two Lungs .**

The lungs are the organs of respiration. They are located in the thorax, either side of the mediastinum within the thoracic cavity .The function of the lungs is to oxygenate blood . They achieve this by bringing inspired air into close contact with oxygen-poor blood in the pulmonary capillaries

The respiration is consist of two mechanisms :

1. Inspiration ⟶ active process

2. Expiration ⟶ passive process

There are two types of respiration :

1. External respiration :

Means absorption of oxygen & removal of CO_2 from the body as a whole by lungs. The O_2 flow from alveoli into capillaries & CO_2 moves from capillaries to alveoli across the respiratory membrane by passive diffusion along the gradient of partial pressure of gases .

2. ***Internal respiration*** **:**

Is the gaseous exchange between the tissues & their fluid medium . In tissues the O_2 flows from blood within capillaries into tissues & CO_2 moves from tissues to capillaries along this gradient also .

Anatomical position & relation of the lungs :

Each lung is surrounded by double serous membranes called pleura which is divided into :

1. visceral pleura ⟶ covered the lung

2. parietal pleura ⟶ lined the thoracic cavity.

They are suspended from the mediastinum by the lung root – a collection of structures entering and leaving the lungs. The medial surfaces of both lungs lie in close proximity to several mediastinal structures as :

Left Lung	*Right Lung*
• *Heart* • *Esophagus* • *Arch of aorta* • *Thoracic aorta*	• *Heart* • *Esophagus* • *Inferior vena cava & Superior vena cava* • *Azygous vein*

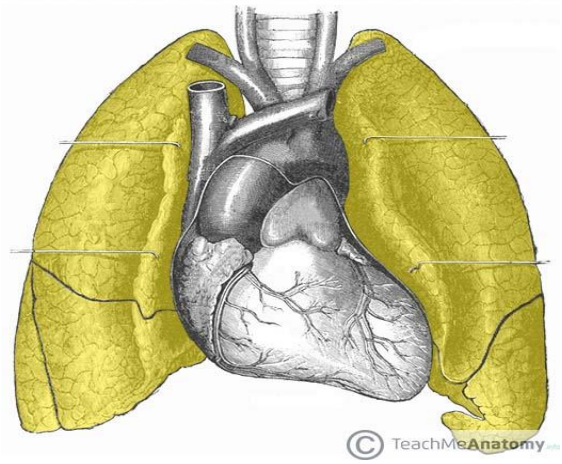

Fig 1 – Anatomical position of the lungs.

Lung Structure :

The lungs are roughly cone shaped, with an apex, base, three surfaces and three borders . The left lung is slightly smaller than the right – this is due to the presence of the heart .

Each lung consists of :

- **Apex – The blunt superior end of the lung. It projects upwards, above the level of the 1st rib and into the floor of the neck.**
- **Base – The inferior surface of the lung , which sits on the diaphragm .**
- **Lobes (two or three) : These are separated by fissures within the lung .**
- **Surfaces (three) : These correspond to the area of the thorax that they face . They are named costal, mediastinal and diaphragmatic.**
- **Borders (three) : The edges of the lungs , named the anterior, inferior and posterior borders .**

Lobes :

The right and left lungs do not have an identical lobular structure.

- **The right lung has three lobes; superior, middle and inferior. The lobes are divided from each other by two fissures:**
  - **Oblique fissure .**
  - **Horizontal fissure .**
- **The left lung contains superior and inferior lobes, which are separated by a similar oblique fissure.**

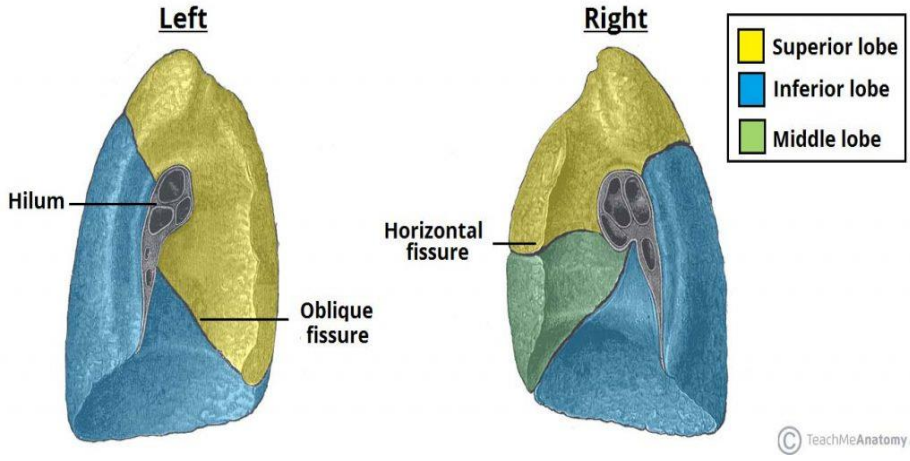

Fig 2 – The lobes and fissures of the lungs. The oblique fissures are similar in both lungs

Surfaces :

There are three lung surfaces, each corresponding to an area of the thorax .

- **The mediastinal surface of the lung faces the lateral aspect of the middle mediastinum. The lung hilum (where structures enter and leave the lung) is located on this surface .**
- **The diaphragmatic surface : The base of the lung is formed by the diaphragmatic surface. It rests on the dome of the diaphragm, and has a concave shape. This concavity is deeper in the right lung, due to the higher position of the right dome overlying the liver .**
- **The costal surface is smooth and convex . It faces the internal surface of the chest wall. It is related to the costal pleura, which separates it from the ribs and innermost intercostal muscles .**

Borders:

- **The anterior border of the lung is formed by the convergence of the mediastinal and costal surfaces. On the left lung, the anterior border is marked by a deep notch, created by the apex of the heart. It is known as the cardiac notch .**
- **The inferior border separates the base of the lung from the costal and mediastinal surfaces**
- **The posterior border is smooth and rounded (in contrast to the anterior and inferior borders, which are sharp). It is formed by the costal and mediastinal surfaces meeting posteriorly.**

Root and Hilum :

The lung root is a collection of structures that suspends the lung from the mediastinum. Each root contains a bronchus, pulmonary artery, two pulmonary veins, bronchial vessels, pulmonary plexus of nerves and lymphatic vessels.

All these structures enter or leave the lung via the hilum – a wedge shaped area on its mediastinal surface.

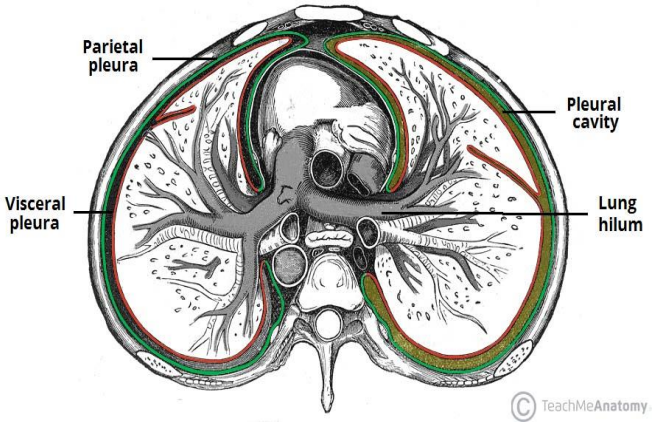

Fig 3 – The parietal and viscera pleura, and the pleural cavity. Note how the two layers of pleura are continuous at the hilum of the lung.

Bronchial Tree :

The bronchial tree is a series of passages that supplies air to the alveoli of the lungs. It begins with the trachea, which divides into a left and right bronchus .

Note: The right bronchus has a higher incidence of foreign body inhalation due to its wider shape and more vertical course.

Each bronchus enters the root of the lung, passing through the hilum . Inside the lung , they divide to form lobar bronchi – one supplying each lobe . Each lobar bronchus then further divides into several tertiary segmental bronchi . Each segmental bronchus provides air to a bronchopulmonary segment – these are the functional units of the lungs.

The segmental bronchi give rise to many conducting bronchioles , which eventually lead into terminal bronchioles which then end with the alveoli – the site of gaseous exchange.

Vasculature :

- **The lungs are supplied with deoxygenated blood by the paired *pulmonary arteries* . Once the blood has received oxygenation, it leaves the lungs via four *pulmonary veins* (two for each lung).**

- **The bronchi , lung roots , visceral pleura and supporting lung tissues require an extra nutritive blood supply. This is delivered by the bronchial arteries, which arise from the descending aorta.**

- **The bronchial veins provide venous drainage . The right bronchial vein drains into the azygos vein, whilst the left drains into the accessory hemiazygos vein .**

Nerve Supply :

The nerves of the lungs are derived from the pulmonary plexuses. They feature as the following :

- **Parasympathetic – derived from the vagus nerve . They stimulate secretion from the bronchial glands, contraction of the bronchial smooth muscle, and vasodilation of the pulmonary vessels.**
- **Sympathetic – derived from the sympathetic trunks . They stimulate relaxation of the bronchial smooth muscle, and vasoconstriction of the pulmonary vessels .**
- **Visceral afferent – conduct pain impulses to the sensory ganglion of the vagus nerve .**