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YAKEEN NEET 2.0

2026

BREATHING AND EXCHANGE OF GASES

ZOOLOGY

Lecture – 2

By- SAMAPTI MAM





Topics to be covered

- 1 HUMAN RESPIRATORY SYSTEM-2 MECHANISM OF BREATHING
- 2
- 3
- 4



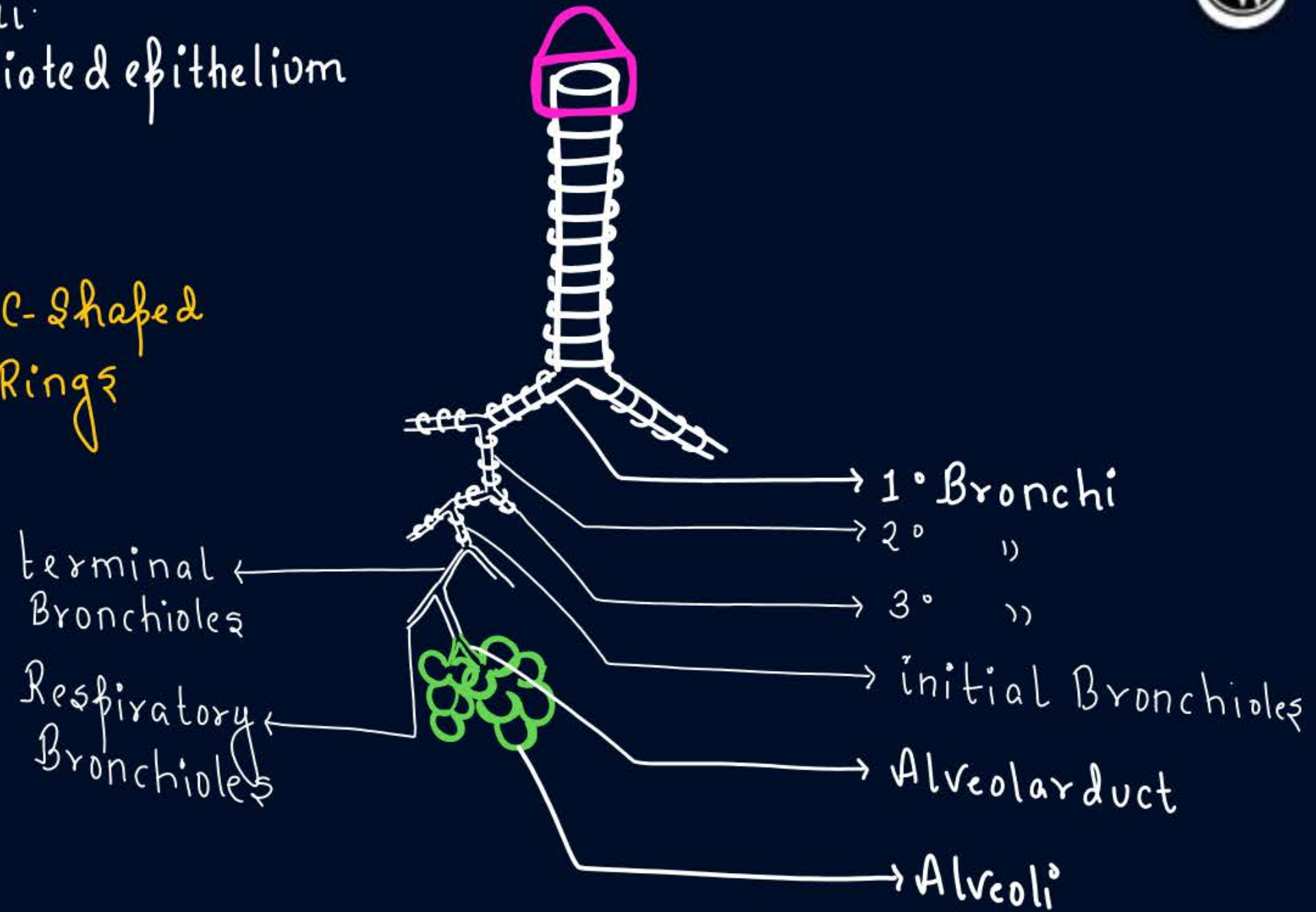
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6. Trachea: At the level of 5th thoracic vertebrae, it divides into 1° bronchi.
• has Pseudostratified Ciliated epithelium

- ↓
1. 1° Bronchi
 - ↓
 8. 2° Bronchi
 - ↓
 9. 3° Bronchi
 - ↓
 10. Initial Bronchioles
 - ↓
 11. Terminal Bronchioles
 - ↓
 12. Respiratory Bronchioles
 - ↓
 13. Alveolar Duct
 - ↓
 14. Alveoli

} has incomplete C-shaped Cartilagenous Rings



Respiratory system is divided into 2 Zones



CONDUCTING ZONE

- Ext. nostril upto terminal bronchiole
- Multiple functions

- conduct the air from atmosphere to Respiratory Zone
- Humidify the air
- Bring the air to Body temp.
- Remove the dust particles by trapping it in mucus & cilia along the respiratory passage helps moving it out.

EXCHANGE ZONE / RESPIRATORY ZONE

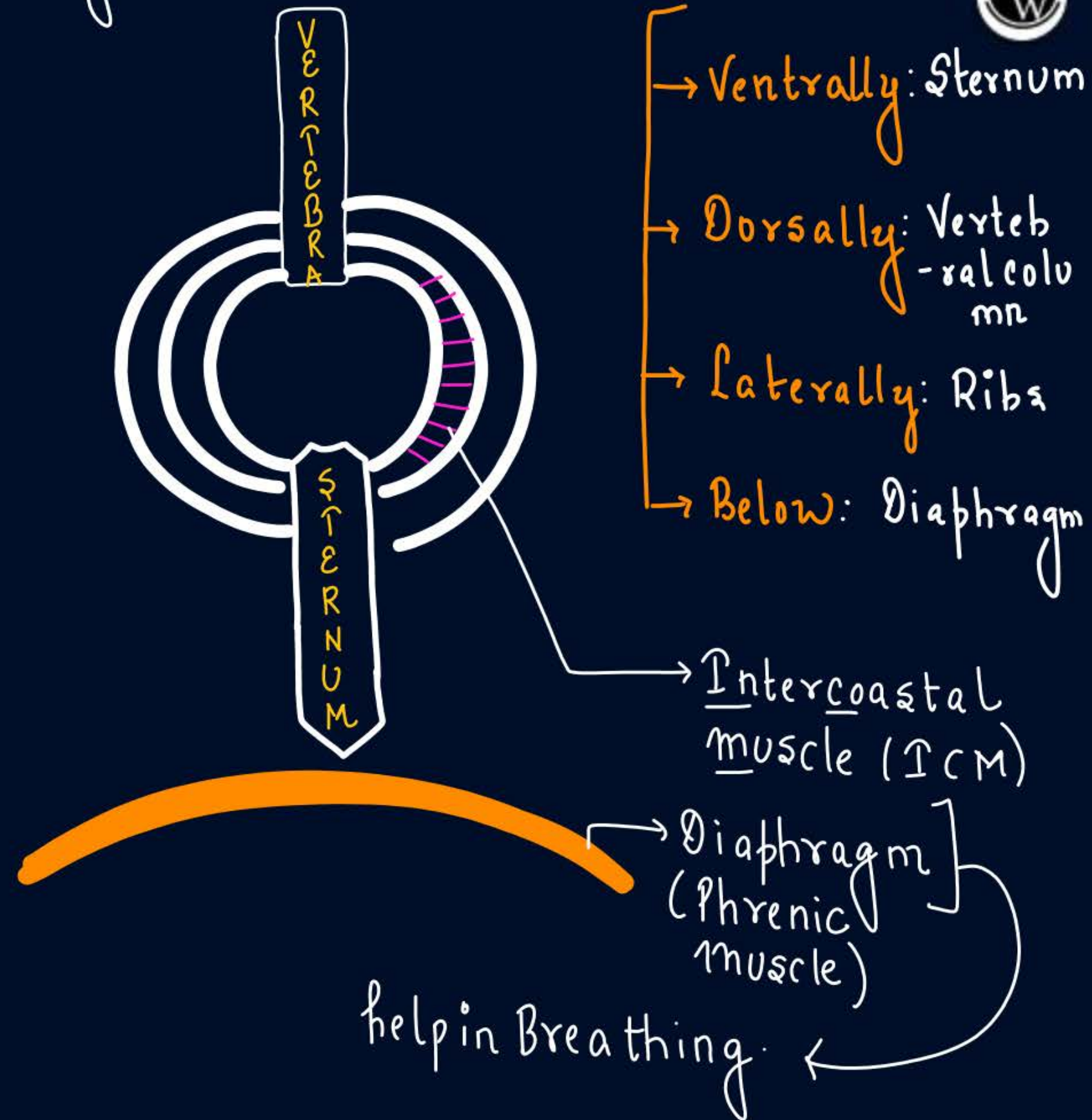
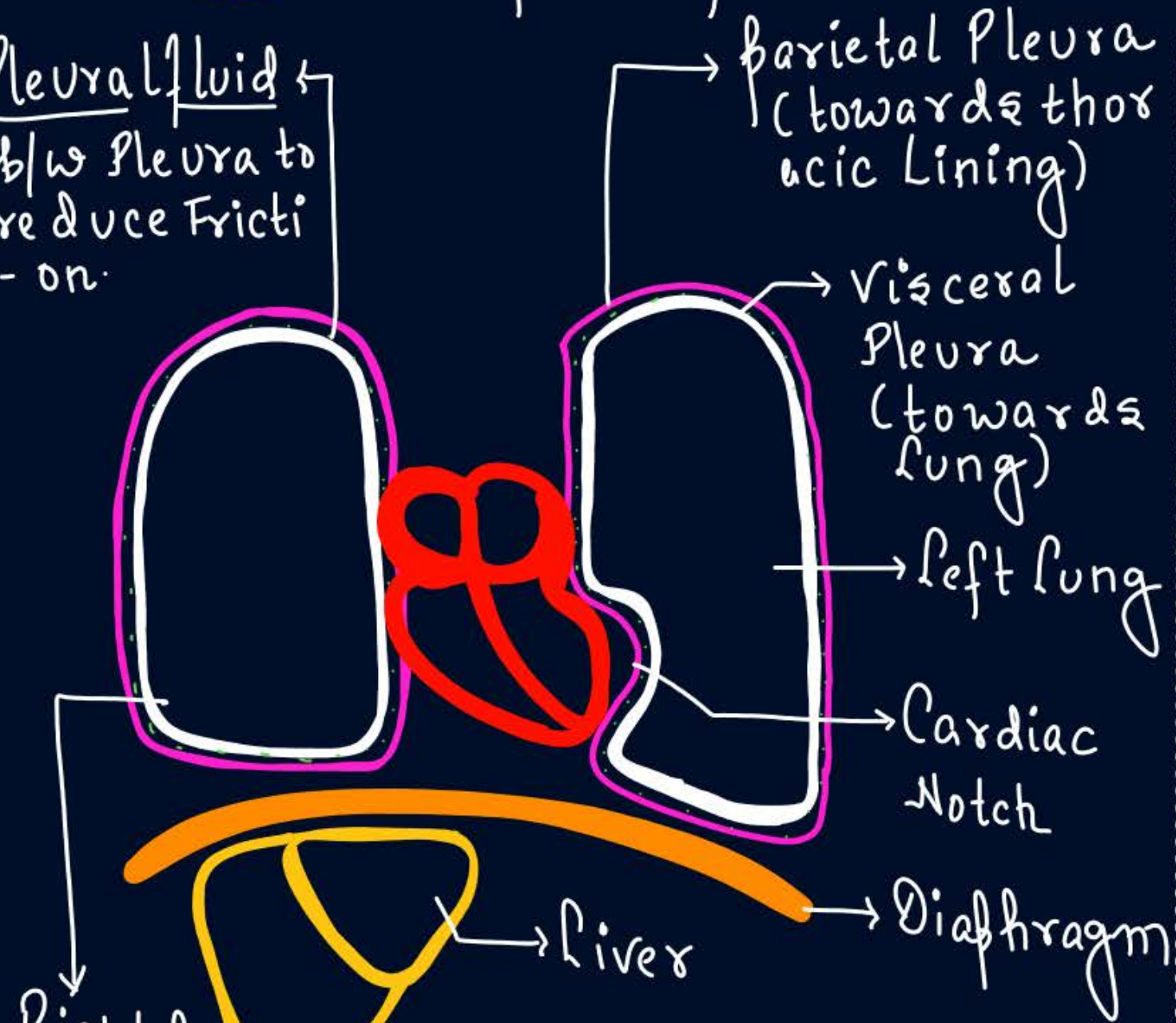
- Respiratory Bronchiole upto Alveoli
- Exchange / Diffusion of gases

Note Bronchi, Bronchioles & Alveoli makes our lung

LUNGS: 1 pair, present inside an airtight chamber c/a 'Thoracic Chamber'



Pleural fluid
b/w Pleura to
reduce Friction.



14.1.1 Human Respiratory System

We have a pair of external nostrils opening out above the upper lips. It leads to a nasal chamber through the nasal passage. The nasal chamber opens into the **pharynx**, a portion of which is the common passage for food and air. The pharynx opens through the larynx region into the **trachea**. Larynx is a cartilaginous box which helps in sound production and hence called the **sound box**. During swallowing glottis can be covered by a thin elastic cartilaginous flap called epiglottis to prevent the entry of food into the larynx. Trachea is a straight tube extending up to the mid-thoracic cavity, which divides at the level of 5th thoracic vertebra into a right and left primary **bronchi**. Each bronchi undergoes repeated divisions to form the secondary and tertiary bronchi and bronchioles ending up in very thin terminal **bronchioles**. The tracheae, primary, secondary and tertiary bronchi, and initial bronchioles are supported by incomplete cartilaginous rings. Each terminal bronchiole gives rise to a number of very thin, irregular-walled and vascularised bag-like structures called **alveoli**. The branching network of bronchi, bronchioles and alveoli comprise the lungs (Figure 14.1). We have two lungs which are covered by a double layered pleura, with pleural fluid between them. It reduces friction on the lung-surface. The outer pleural membrane is in close contact with the thoracic

→ which portion
Nasopharynx
oropharynx
Laryngopharynx

lining whereas the inner pleural membrane is in contact with the lung surface. The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature. Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air.

The lungs are situated in the thoracic chamber which is anatomically an air-tight chamber. The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs and on the lower side by the dome-shaped diaphragm. The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung (pulmonary) cavity. Such an arrangement is essential for breathing, as we cannot directly alter the pulmonary volume.

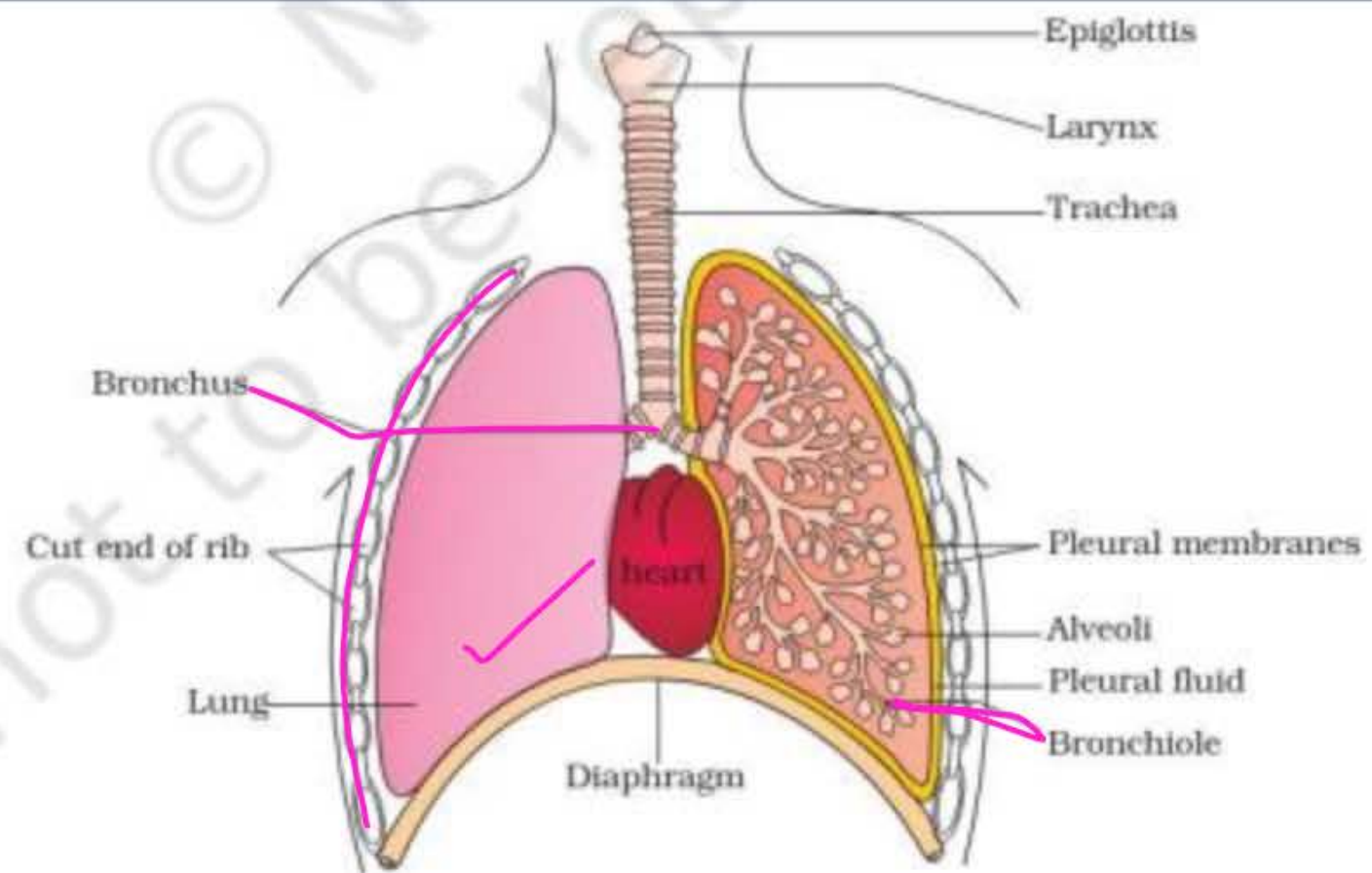


Figure 14.1 Diagrammatic view of human respiratory system (sectional view of the left lung is also shown)

Mechanism of Breathing:

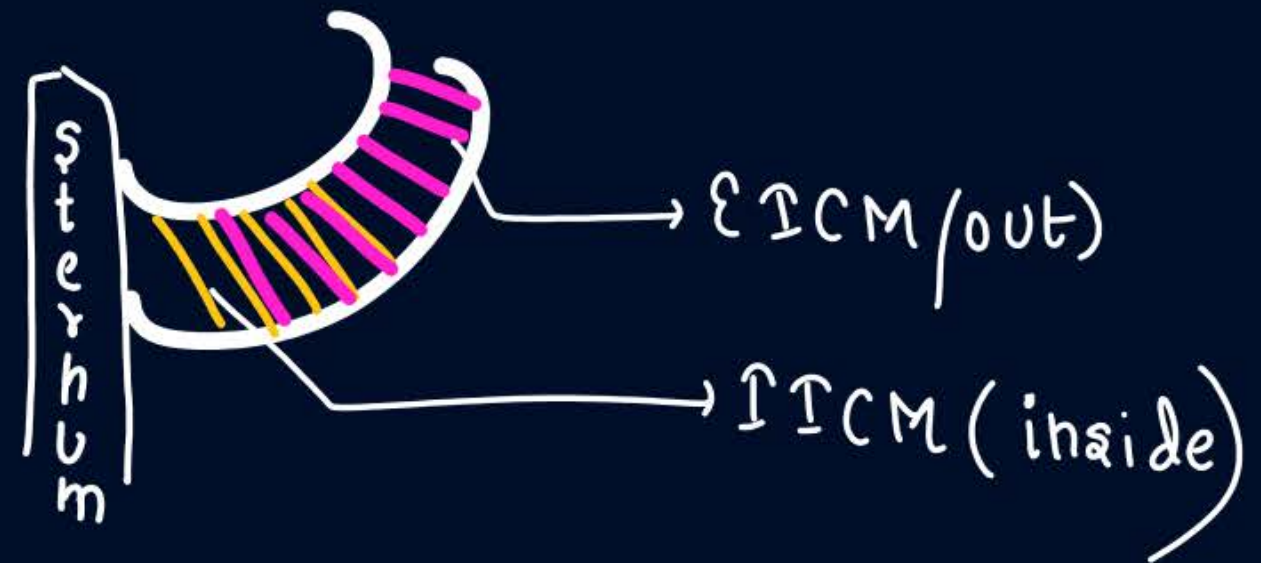


- Presence of Lungs in thoracic chamber/cavity is in such a way that any change in volume of thoracic chamber will be directly reflected in Pulmonary volume.

↓
Such arrangement: ESSENTIAL for Breathing as we can't alter Pulmonary volume directly.

Muscles involved

- Diaphragm
- ICM
 - External ICM (EICM)
 - Internal ICM (IICM)
- Abdominal muscles

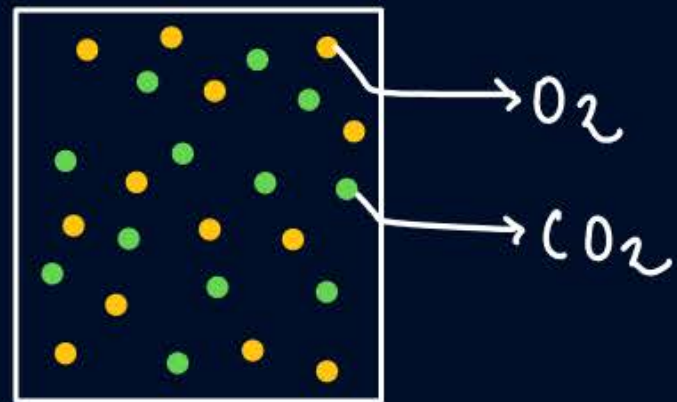


Basic Principle: Air moves from a region of high partial pressure to low partial pressure



$P_{\text{high}} \rightarrow P_{\text{low}}$

Partial Pressure: The pressure exerted by an individual gas (on the wall of this chamber) in mixture of gases.



Closed Chamber

p_{O_2}
 p_{CO_2} \rangle Partial Pressure

- Breathing is done by creating a pressure gradient b/w Lungs & atmosphere

① Normal Inhalation:

atmosphere
(760 mmHg)
↳ fixed
(HIGH)

air

Intrapulmonary pressure
(LOW)

Change intrapulmonary volume
(↑)
($P \propto \frac{1}{V}$: Boyle's Law)

Change (↑) the volume of Thoracic chamber

① By using Diaphragm
↳ Contraction

↳ Become FLAT from Dome

Vol. of thoracic chamber ↑
anterio-posteriorly

↳ Intra-pulmonary Vol ↑,
Intrapulmonary pressure ↓

② By using EICM
↳ Contract

↳ Ribs & sternum movement outward & slightly upward.

Vol. of thoracic chamber ↑ dorso-ventrally

↳ Intrapulmonary Vol. ↑, Intra-pulmonary pressure ↓

AIR
COMES
IN



14.2 MECHANISM OF BREATHING

Breathing involves two stages : **inspiration** during which atmospheric air is drawn in and **expiration** by which the alveolar air is released out. The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere. Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, i.e., there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure. The diaphragm and a specialised set of muscles – external and internal intercostals between the ribs, help in generation of such gradients. Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and the

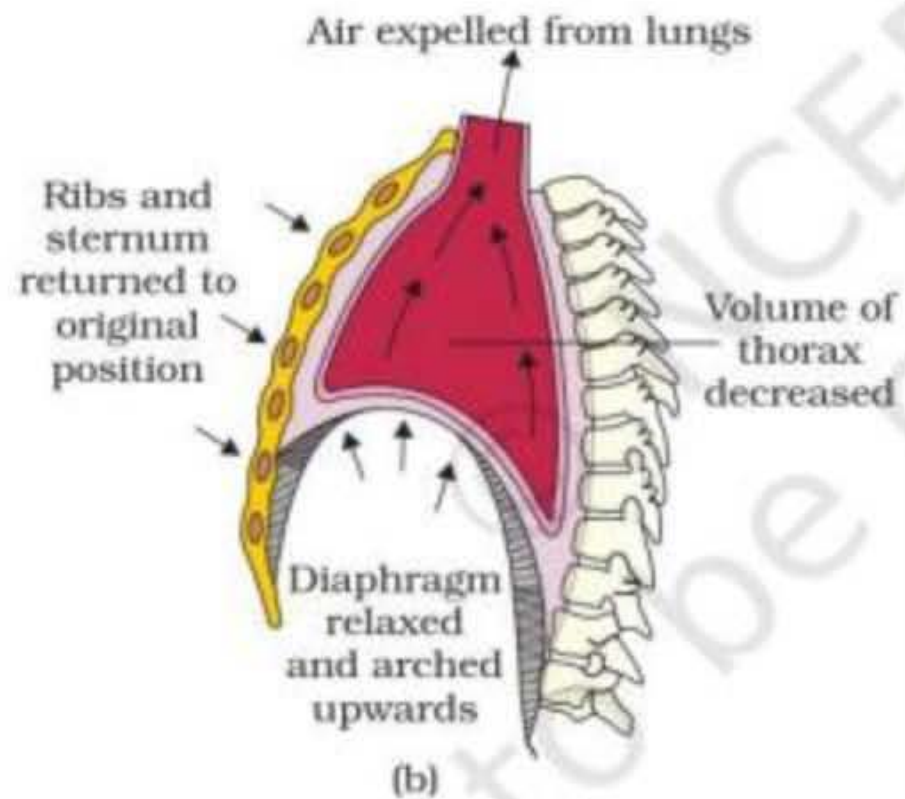
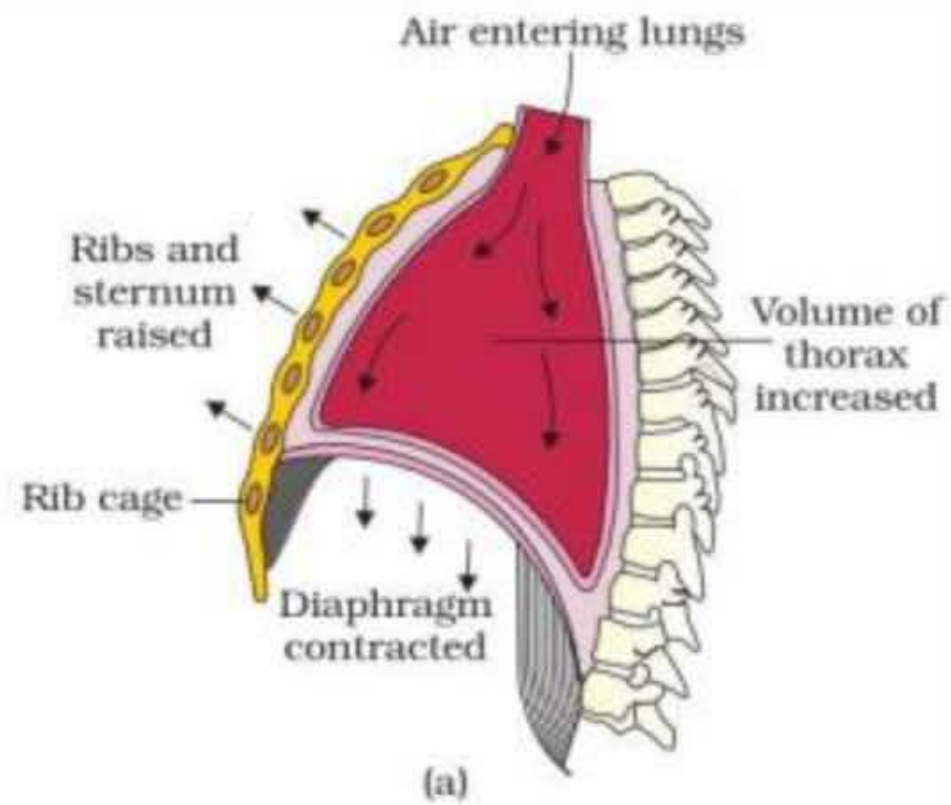


Figure 14.2 Mechanism of breathing showing :
(a) inspiration (b) expiration

sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure which forces the air from outside to move into the lungs, i.e., inspiration (Figure 14.2a). Relaxation of the diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume. This leads to an increase in intra-pulmonary pressure causing the expulsion of air from the lungs, i.e., expiration (Figure 14.2b). We have the ability to increase the strength of inspiration and expiration with the help of additional muscles in the abdomen. On an average, a healthy human breathes 12-16 times/minute. The volume of air involved in breathing movements can be estimated by using a spirometer which helps in clinical assessment of pulmonary functions.

Next category.

H.W

QUESTION

Given below are two statements.

Statement I: The lungs are situated in the thoracic chamber

Statement II: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs.

In the light of the above statements, choose the most appropriate answer from the options given below.

- 1 Statement I is correct but Statement II is incorrect.
- 2 Statement I is incorrect but Statement II is correct.
- 3 Both Statement I and Statement II are correct.
- 4 Both Statement I and Statement II are incorrect.

QUESTION

Given below are two statements.

Statement I: The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part

Statement II: The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

- 1 Statement I is correct but Statement II is incorrect.
- 2 Statement I is incorrect but Statement II is correct.
- 3 Both Statement I and Statement II are correct.
- 4 Both Statement I and Statement II are incorrect.

QUESTION

Statement-I: The first step in respiration is breathing.

Statement-II: Inspiration and expiration are carried out by creating pressure gradients between the atmosphere and the lungs.

- 1 Statement I and Statement II both are correct.
- 2 Statement I is correct, but Statement II is incorrect.
- 3 Statement I is incorrect, but Statement II is correct.
- 4 Statement I and Statement II both are incorrect.

QUESTION

Statement-I: Lungs are covered by a double layered pleura.

Statement-II: Alveoli are thin, irregular-walled, and vascularised , bag-like structures.

- 1 Statement I and Statement II both are correct.
- 2 Statement I is correct, but Statement II is incorrect.
- 3 Statement I is incorrect, but Statement II is correct.
- 4 Statement I and Statement II both are incorrect.

QUESTION

Statement-I: An increase in pulmonary volume increases the intra-pulmonary pressure more than the atmospheric pressure.

Statement-II: Relaxation of the diaphragm and the inter-costal muscles reduces the thoracic volume.

- 1 Statement I and Statement II both are correct.
- 2 Statement I is correct, but Statement II is incorrect.
- 3 Statement I is incorrect, but Statement II is correct.
- 4 Statement I and Statement II both are incorrect.

QUESTION

Statement-I: During normal exhalation diaphragm and EICM relaxes

Statement-II: Relaxation of diaphragm and EICM decreases the volume of thoracic chamber dorsoventrally and anterioposteriorly respectively

- 1 Statement I and Statement II both are correct.
- 2 Statement I is correct, but Statement II is incorrect.
- 3 Statement I is incorrect, but Statement II is correct.
- 4 Statement I and Statement II both are incorrect.

QUESTION

Respiration through skin is called as;

- 1 branchial respiration.
- 2 cutaneous respiration.
- 3 pulmonary respiration.
- 4 tracheal respiration.

QUESTION

Which of the following is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air?

- 1 Exchange part
- 2 Conducting part
- 3 External nostrils
- 4 Terminal bronchioles

QUESTION

Epiglottis helps to;

- 1 produce sound.
- 2 reduces friction on the lung-surface.
- 3 prevent the entry of food into the larynx.
- 4 All of these

QUESTION

Read the following statements and identify 'X'.

- I. 'X' humidifies the air to body temperature.
- II. 'X' clears it from foreign particles.

1 Conducting part

2 Alveoli

3 Alveolar ducts

4 Exchange part

QUESTION

Complete the analogy.

Outer pleural membrane: Thoracic lining :: Inner pleural membrane:

- 1 Lung surface
- 2 Sternum
- 3 Diaphragm
- 4 Vertebral column

QUESTION

Statement-I: The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung cavity

Statement-II: Such an arrangement is essential for breathing, as we can directly alter the pulmonary volume.

- 1 Statement I and Statement II both are correct.
- 2 Statement I is correct, but Statement II is incorrect.
- 3 Statement I is incorrect, but Statement II is correct.
- 4 Statement I and Statement II both are incorrect.



Homework

- REVISE CLAASNOTES / ZOOLOGY MED EASY

MODULE HW

Module -1

Prarambh exercise 1- 7-26

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