TRINITY COLLEGE FOR WOMEN NAMAKKAL

DEPARTMENT OF NUTRITION AND DIETETICS

HUMAN PHYSIOLOGY

19UND01-ODD SEMESTER

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Human Respiratory System

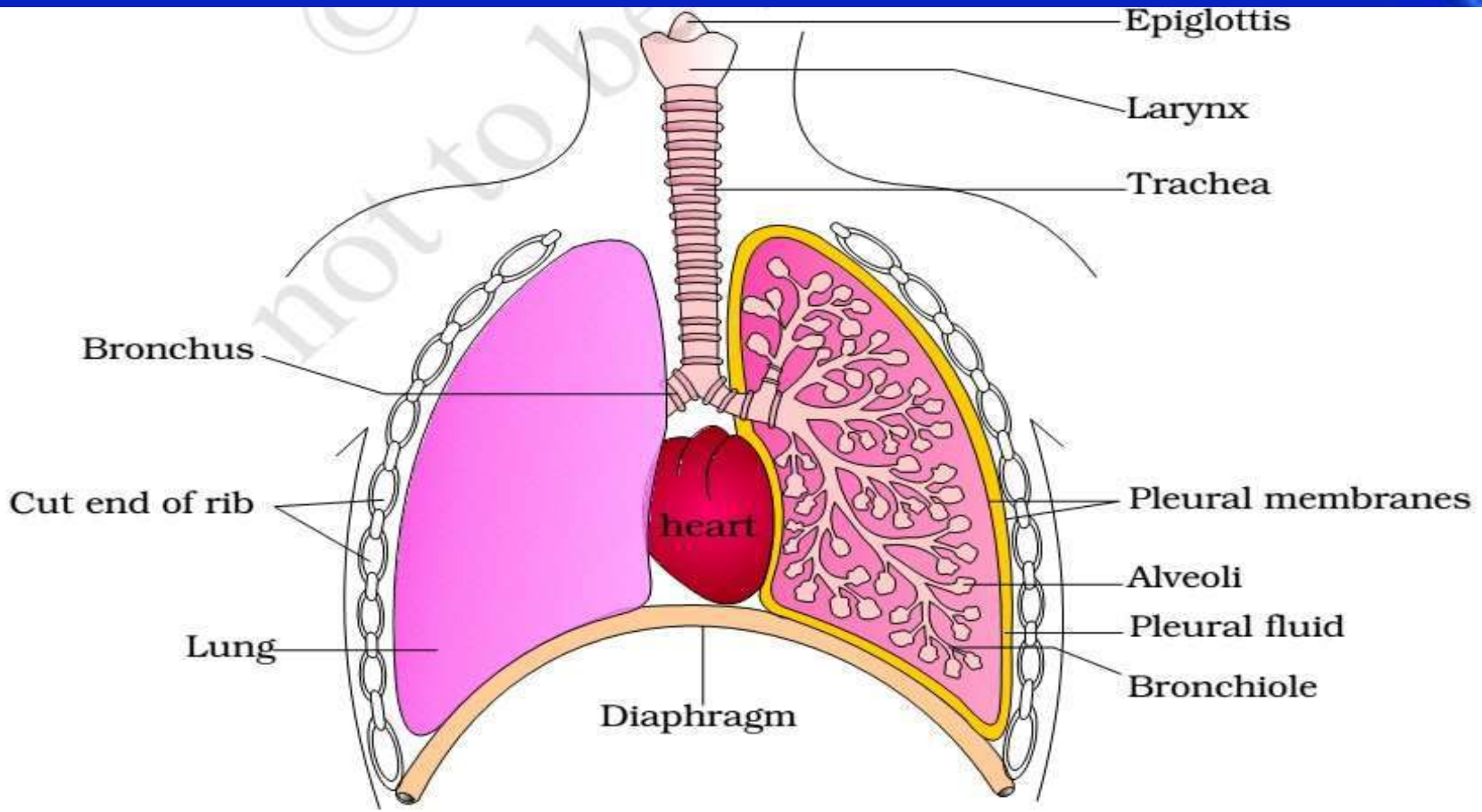


Figure 17.1 Diagrammatic view of human respiratory system (Sectional view of the left lung is also shown)

The 4 stages of Respiration:

1) Breathing- inspiration/inhalation and expiration/exhalation

2) External Respiration- exchange of gases between lungs and blood

3) Internal Respiration- exchange of gases between blood and cells

4) Cellular Respiration- energy-releasing reactions inside the cells

Steps in Respiration

(i) Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.

(ii) Diffusion of gases (O_2 and CO_2) across alveolar membrane.

(iii) Transport of gases by the blood.

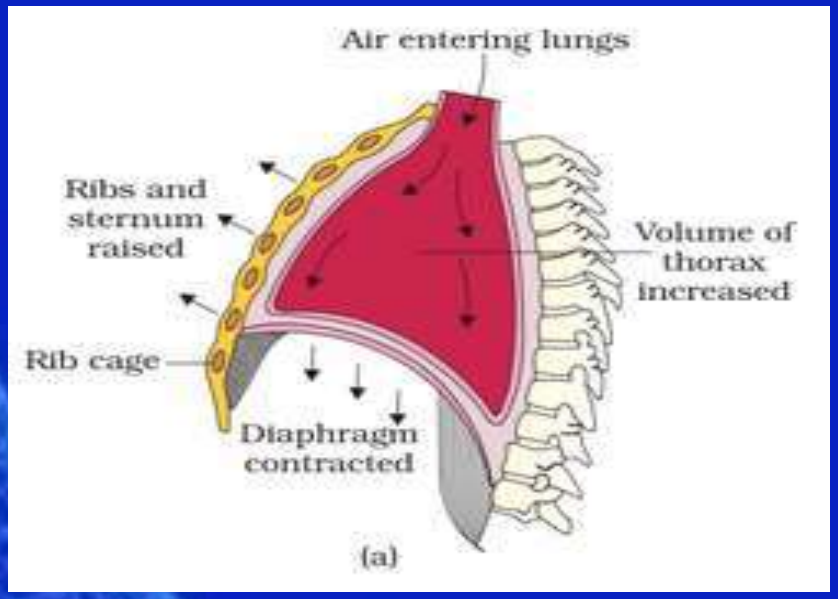
(iv) Diffusion of O_2 and CO_2 between blood and tissues.

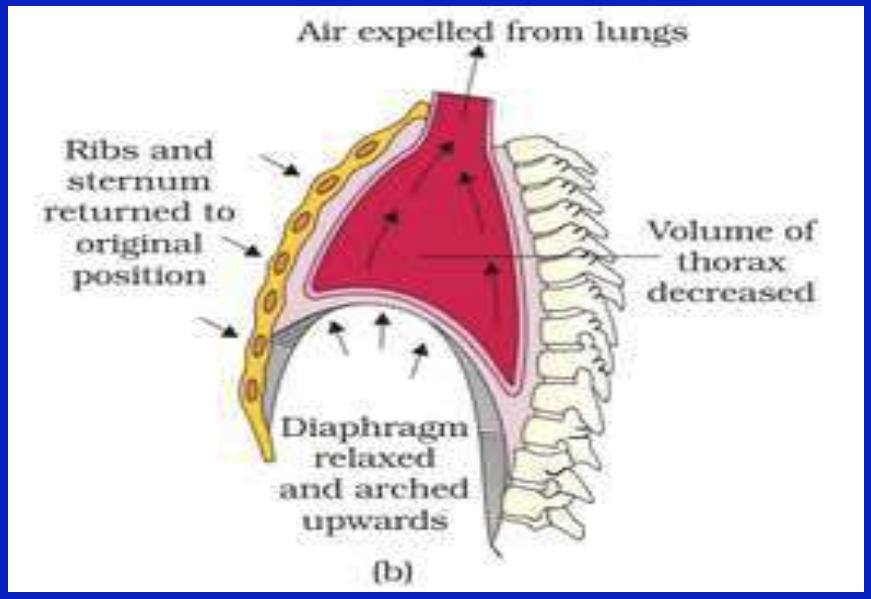
(v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2 (cellular respiration as dealt in the Chapter 14 – Respiration).

Breathing involves two stages:

Inspiration during which atmospheric air is drawn in and **expiration** by which the alveolar air is released out.

Mechanism of breathing





Exchange of Gases

- **Alveoli** are the primary sites of exchange of gases. Exchange of gases also occur between **blood and tissues**. O2 and CO2 are exchanged in these sites by simple **diffusion** mainly based on pressure/concentration gradient.

- **Partial pressure** of gasses, **Solubility** of the gases as well as the **thickness** of the membranes involved in diffusion are some important factors that can affect the rate of diffusion.

- Pressure contributed by an individual gas in a mixture of gases is called partial pressure.

TABLE 17.1 Partial Pressures (in mm Hg) of Oxygen and Carbon dioxide at Different Parts Involved in Diffusion in Comparison to those in Atmosphere

Respiratory Gas	Atmospheric Air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissues
O_2	159	104	40	95	40
CO_2	0.3	40	45	40	45

TRANSPORT OF GASES

✓**Blood** is the medium of transport for O2 and CO2.

✓About **97 per cent** of O2 is transported by **RBCs** in the blood. The remaining 3 per cent of O2 is carried in a **dissolved state** through the plasma.

✓Nearly 20-25 per cent of CO2 is transported by **RBCs** whereas 70 per cent of it is carried as **bicarbonate**. About 7 per cent of CO2 is carried in a **dissolved state** through plasma.

TRANSPORT OF OXYGEN

- **Haemoglobin** is a red coloured **iron** containing pigment present in the RBCs. O2 can bind with haemoglobin in a reversible manner to form **oxyhaemoglobin**.

- Each haemoglobin molecule can carry a maximum of **four** molecules of O2. Binding of oxygen with haemoglobin is primarily related to **partial pressure** of O2.

- Partial pressure of CO2, hydrogen ion concentration and temperature are the other factors which can interfere with this binding.

Transport of Carbon dioxide

- CO_2 is carried by haemoglobin as **carbamino-haemoglobin** (about 20-25 per cent). This binding is related to the partial pressure of CO_2. Partial pressure of O_2 is a major factor which could affect this binding. RBCs contain a very high concentration of the enzyme, **carbonic anhydrase** and minute quantities of the same is present in the plasma too. Nearly 70 per cent of carbon dioxide is transported as bicarbonate (HCO_3) with the help of the enzyme carbonic anhydrase.

- At the tissue site where partial pressure of CO_2 is high due to catabolism [the breakdown of complex molecules in living organisms to form simpler ones, together with the release of energy], CO_2 diffuses into blood (RBCs and plasma) and forms HCO_3 and H+-.

- Thus, CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2. Every 100 ml of deoxygenated blood delivers approximately 4 ml of CO_2 to the alveoli.
- At the alveolar site where pCO_2 is low, the reaction proceeds in the opposite direction leading to the formation of CO_2 and H_2O.

THANK YOU

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