TRANSPORT OF CARBON DIOXIDE

During respiration CO_2 is produced in the tissue as a result of different metabolic activities. Due to high PCO_2 in the tissue cells, they diffuse into the blood. This CO_2 must be transported to lungs, so that it can be eliminated through alveolar surface. The CO_2 transported to lung through two main ways-

A. **In physical solution**- CO_2 enter to the blood, combine with the water of plasma and form carbonic acid (H_2CO_3). Approximately 5% of the total CO_2 produced in the tissue is transported to lung in this way.

$$H_2O + Co_2 \rightleftharpoons \underset{\text{Carbonic acid}}{H_2Co_3}$$

B. As chemical compound-

i) **As carbamino compound**- about 15-20 % CO_2 is transported as carbamino compound. CO_2 directly combined with the amino group (-NH2) of haemoglobin to form carbohaemoglobin

$$Co_2 + Hb,NH_2 \rightleftharpoons \underset{\text{Carbohaemoglobin}}{HB.NH.COOH}$$

ii) **As bicarbonate**- 80-85% CO_2 transported by this way. When CO_2 enter RBC it combine with water and form carbonic acid, as happened in the plasma, but the reaction is very much faster due to the presence of the enzyme carbonic anhydrase inside RBC. Carbonic acid then readily breaks down to HCO_3^- and H^+.

$$H_2O + Co_2 \xrightarrow{\text{Carbonic anhydrase}} \underset{\text{Carbonic acid}}{H_2Co_3} \rightleftharpoons HCo_3^- + H^+$$

HCO_3^- ion diffuse out to cytoplasm and in conbination with Na^+ and K^+ ion forms sodium and potassium bicarbonate and transported to lung.

$$Na^+ + HCo_3^- \longrightarrow \underset{\text{Sodium bicarbonate}}{NaHCo_3}$$

$$K^+ + HCo_3^- \longrightarrow \underset{\text{Potassium bicarbonate}}{KHCo_3}$$

When the blood reach the lung, then due to low partial pressure of CO_2 and also for the high PO_2 they releases the CO_2 to the alveoli.

In order to balance the exit of HCO_3^- ions from the RBC, Cl^- enter RBC from plasma. This entry of Cl^- ion ensure the continuity of exit of HCO_3^- ion and so the formation of Bicarbonates. This shifting of Cl- ion from plasma is therefore, an important phenomenon, called **Chloride shift or Hamburgers phemenon.**

Release of Co2 at the respiratory surface-

The carbonic acid, bicarbonates and carbohaemoglobin are carried to the lung with blood, where they breakdown under the influence of different factors and liberate free CO_2

i) $H_2CO_3 \xrightarrow{\text{Carbonic anhydrase}} H_2O + CO_2\uparrow$

ii) $2KHCO_3 \xrightarrow{\text{Acidity of oxyhaemoglobin}} K_2CO_3 + H_2O + CO_2\uparrow$

iii) $2NaHCO_3 \xrightarrow{\text{Acidity of oxyhaemoglobin}} Na_2CO_3 + H_2O + CO_2\uparrow$

iv) $Hb.NH.COOH \xrightarrow{\text{Reduction due to higher } PO_2} Hb.\ NH_2 + CO_2\uparrow$

The oxygenation of blood in the lungs enhances the release of additional amount of CO_2 from blood, a phenomenon called **Haldane effect**, opposite to Bohr's effect.