TRANSPORT OF GASES

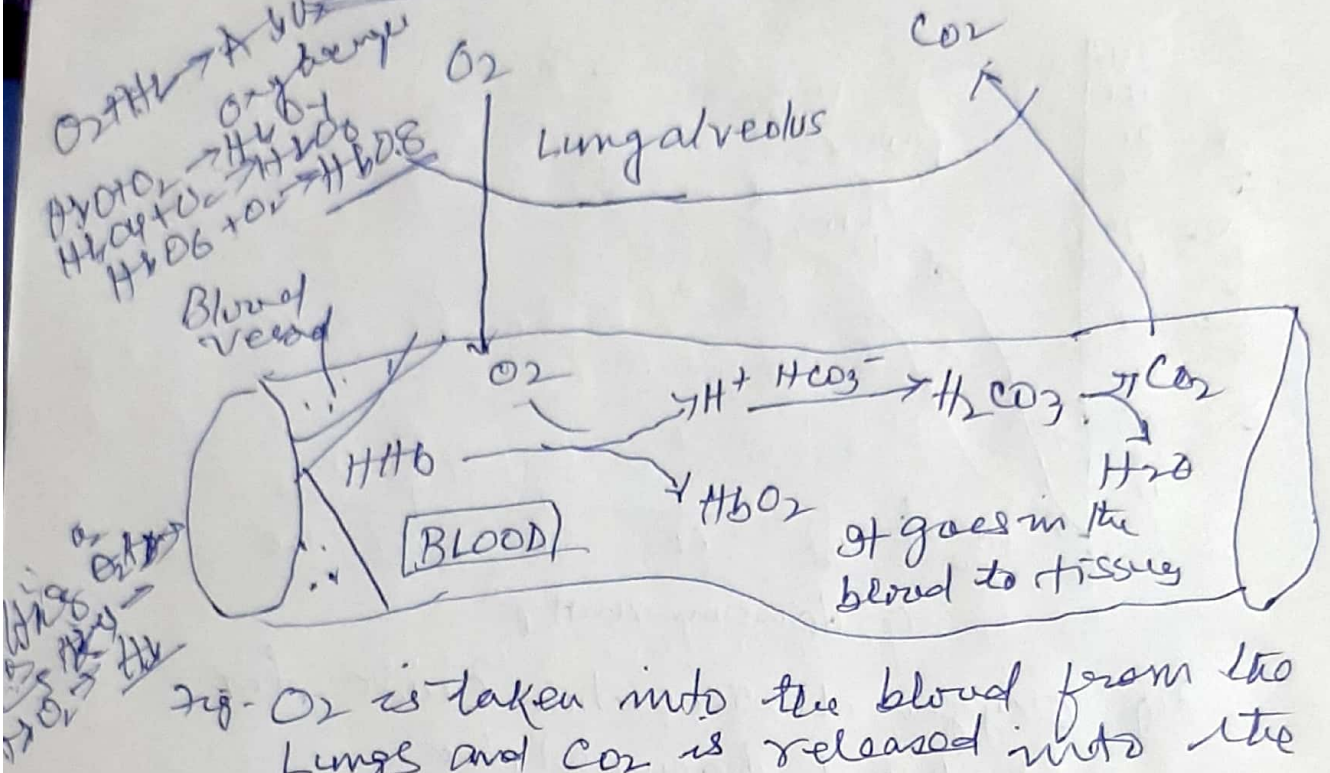


Fig - O_2 is taken into the blood from the Lungs and CO_2 is released into the lungs from the blood.

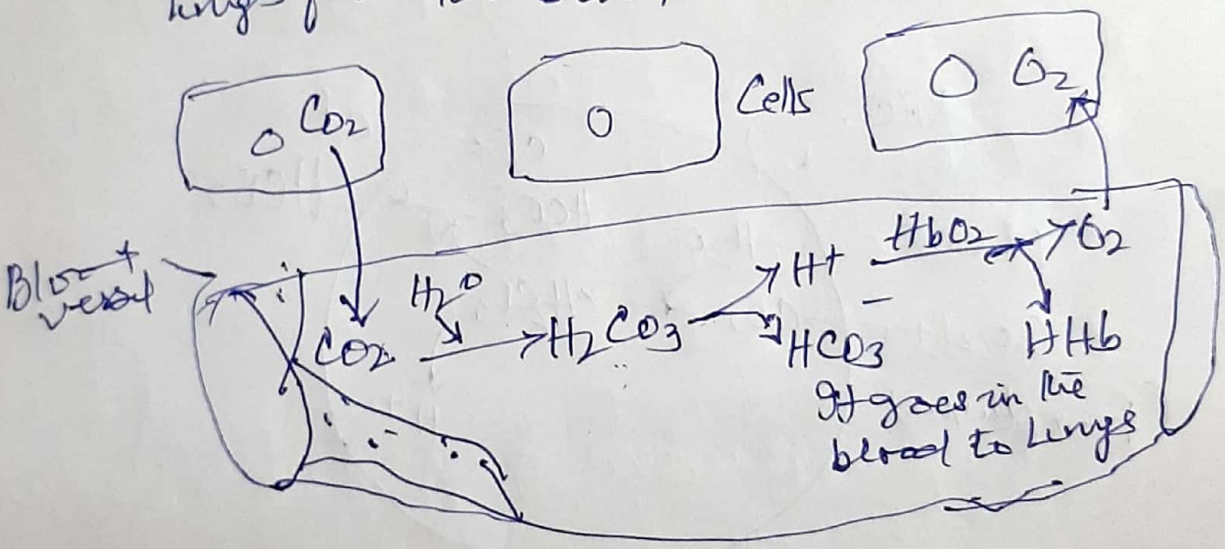


Fig - CO_2 is taken into the blood from the tissue and O_2 is released into the tissues from the blood.

Functional residual Capacity (FRC) : It is the sum of ERV and RV.

Lungs Volume and Capacities :-

① Tida volume (TV) : It is the volume of air expired with each normal breath. This is about 500 ml.

② Inspiratory Reserve volume (IRV) : Extra amount of air inspired forcibly after normal inspiration. It is 2000 to 3000 ml.

③ Expiratory Reserve volume (ERV) : Extra amount of air that can be expired forcibly after normal expiration. It is about 1000 to 1500 ml.

④ Residual volume (RV) :- Volume of air which remains still in the lung after the forceful expiration 1000-1500 ml.

⑤ Vital Capacity (VC) : It is the amount of air which can be maximum inspired and also maximum expired. It varies from 3.5 - 4.5 litres (VC = TV + IRV + ERV).

⑥ Total lung capacity : (TLC) - Total amount of air, present in the lungs and respiratory passage after a maximum inspiration. It varies from 5-6 litres.

⑦ Inspiratory capacity (IC) : It is the total volume of air that can be inhaled after a normal exhaling. It includes TV + IRV.

Respiratory Quotient : (RQ) :-

Ratio of volume of CO_2 produced to the volume of O_2 consumed over a period of time in respiration.

$$RQ = \frac{\text{Vol. of } CO_2 \text{ evolved}}{\text{Vol of } O_2 \text{ absorbed}}$$

[RQ of glucose is 1 - $\epsilon CO_2/\epsilon O_2 = 1$
for fat about 0.7
for Protein about 0.85]

PHYSIOLOGY OF RESPIRATION :-

(Gas exchang in Lungs and in Tissue) :-

Respiratory Pigments :-

① **Haemoglobin (Hb)** : 1 gm Hb. combines with 3-4 ml of ~~blood~~ O_2. It 1 molecule combines with 4 mol. of O_2. It combines in 0.01 Sec.

② **Myoglobin** :- It is found in skeletal muscles and myocardi... It has single atom of ferrous ion. It combine with 1 mol. of...

③ **Haemocyanin** :- It is copper pigment and blue in colour. It remain dissolved in plasma. It is present in Molluses.

④ **Chlorocruorin** :- It is green pigment present in Polychaetes.

⑤ **Haemoerythrin** :- It is red or violet pigment found in annelids.

Ⓐ Transport of O_2 :-

(i) About 3% of O_2 in the blood is dissolved in plasma which carries O_2 to blood cells.

(ii) About 97% of O_2 is carried in combination with haemoglobin of the erythrocytes to form oxyhaemoglobin

$$Hb + O_2 \underset{\text{In tissues}}{\overset{\text{In Lungs}}{\rightleftharpoons}} HbO_2$$ oxyhaemoglobin.

(iii) one mol. of Hb. can combine with 4 mols. of O_2 as there are four Fe^{2+} ions in mone mol. of haemoglobin.

(iv) High tension of O_2 favour the formation of oxyhaemoglob... While low tension of O_2 favour its dissociation.

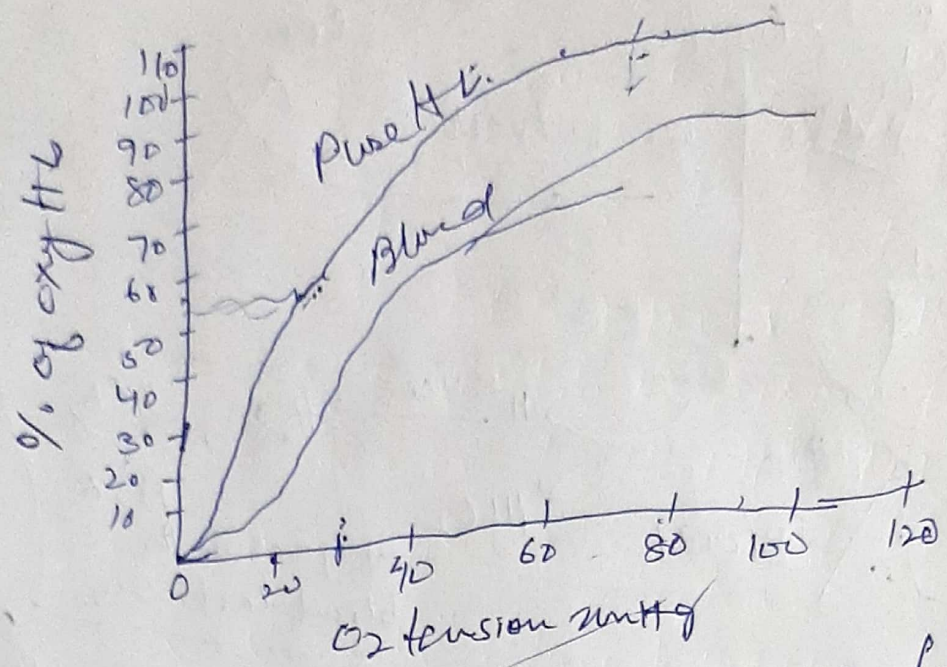
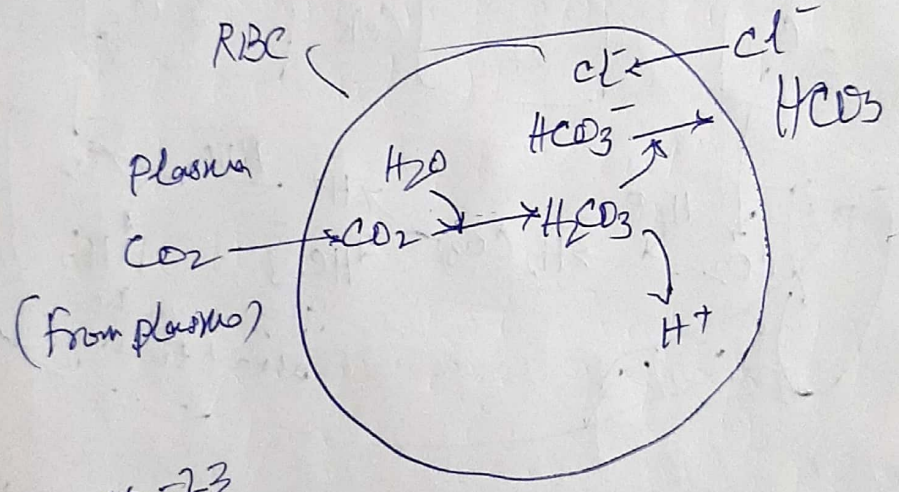


Fig - Oxygen dissociation curve for blood and haemoglobin



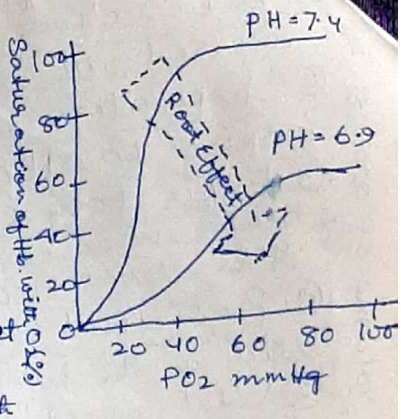
Plasma = 23
RBC = 07

Fig - Chloride Shift

- Transport of CO_2 → 5%
  1) Carbonic acid — 10%
  2) Carbaminocompounds
  3) Bicarbonate — 85%

Oxygen dissociation Curve:-

The oxygenation of haemoglobin increases with increase in Partial pressure of CO_2. But after 100 mm Hg it does not increase. So when rate of oxygenation is plotted against Partial pressure, a Sigmoid curve is appear which is called Oxygen dissociation curve.



Bohr Effect:- When P_{CO_2} and acidity (decrease in PH) increases, Oxyhaemoglobin dissociates into O_2 and Hb. (Sigmoid curve shift to right). Bohr effect facilitates delivery of O_2 during need.

ROOt Effect:- It is found in fishes with Swim bladder where Hb. is not saturated at any Partial pressure of O_2 due to low PH.

Transport of CO_2:-

(i) About 7% of CO_2 gets dissolved in blood plasma and is carried in solution to the lungs.

(ii) About 70% of CO_2 enters the erythrocytes where it reacts with H_2O to form Carbonic acid in the presence of Carbonic anhydrase. In RBC most of the carbonic acid rapidly dissociate to form bicarbonate and hydrogen ions.

$$CO_2 + H_2O \underset{}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}} \underset{\text{carbonic acid}}{H_2CO_3} \rightleftharpoons \underset{\text{Hydrogen ion.}}{H^+} + \underset{\text{Bicarbonate}}{HCO_3^-}$$

(iii) Bicarbonate ions pass out from the RBC into the plasma. This cause a significant difference in the ionic balance between ions in the plasma and those inside the RBC.

(iv) To compensate the balance, Chloride ions diffuses from plasma to RBC. The movement of Chloride ion is called Chloride Shift (Hamberg phenomenon).

(v) Some of the HCO_3^- is carried in RBC while most of the HCO_3^- release into plasma to be carried by it (plasma)

(vi) About 23% of CO_2 entering in RBC combine with $-NH_2$ group of globin (Protein) of haemoglobin to form Carbaminohaemoglobin which is transported to the lungs.