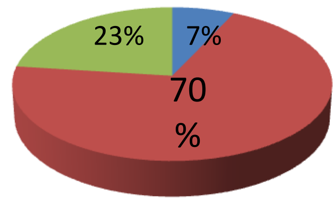


Transport of CO2 in blood

by 3 forms :

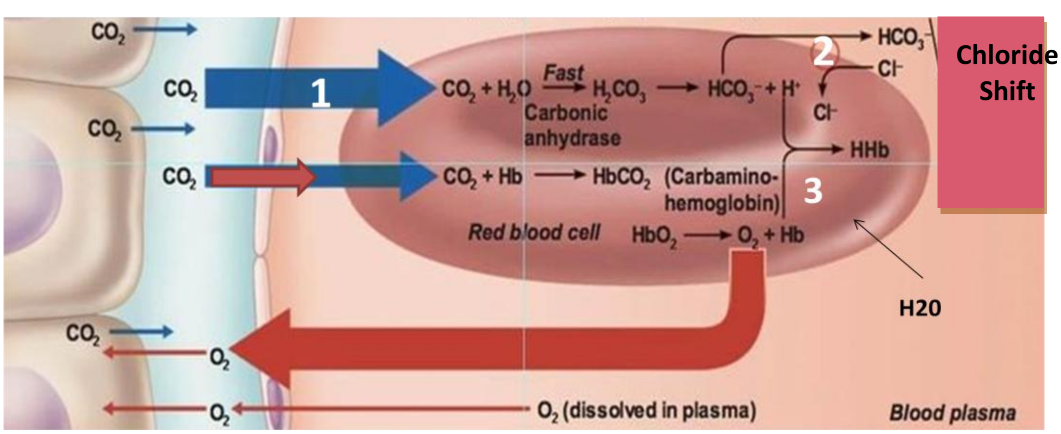
1. **Dissolved form (7%)**
2. **Bicarbonate ion (70 %) :**
   1) When CO_2 diffuses from the tissue to the blood it combines with water to form H_2CO_3 , In RBC this reaction occurs very rapid by the effect of carbonic anhydrase enzyme :

   $$\mathbf{CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-}$$

   2) **Chloride shift** : the bicarbonate ions diffuse from the red cells into the plasma in exchange with Cl ion by an anion exchanger called **bicarbonate-chloride carrier protein** which present in the RBC membrane .
   3) the hydrogen ions then combines with the hemoglobin in the red blood cells because the hemoglobin protein is a powerful acid-base buffer

   $$\mathbf{Hb + H \leftrightarrow HbH}$$

- For each CO2 added to the blood at tissue level the following changes occur :
  - the chloride content of venous red blood cells is greater than that of arterial red cells.
  - increase of one osmotically active substance to the RBC → movement of H_2O by osmosis to inside the RBC →swelling of RBC in venous side →hematocrite in venous side > 3% than arterial

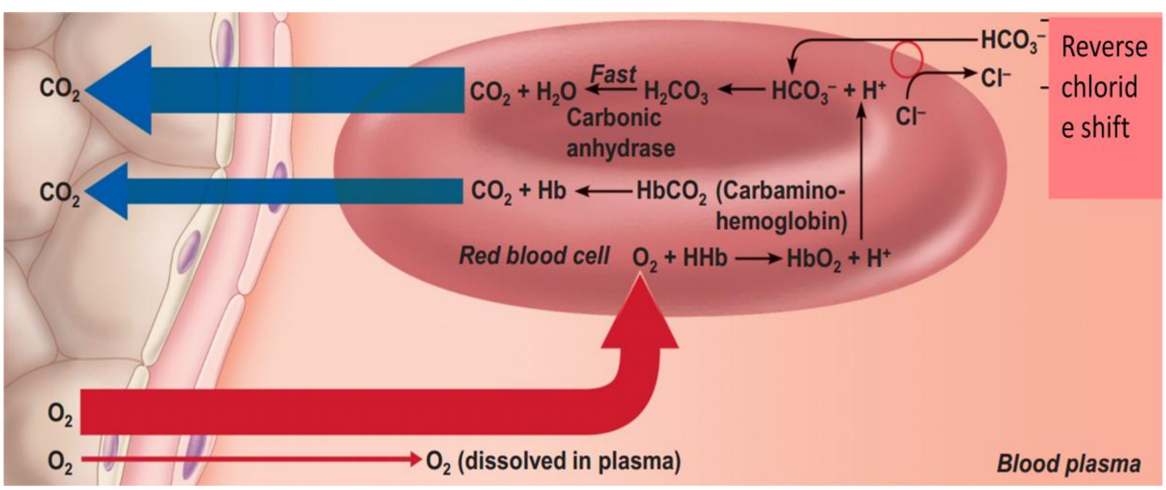


At tissue level

3. **Carbaminohemoglobin. (23%)**
    - CO_2 reacts directly in a reversible reaction with amino group of the globin molecule to form the compound **carbaminohemoglobin** (CO_2Hb) .
      Hb + CO2 ↔HbCO2
    - CO2 binds to amino groups of polypeptide chains of other plasma proteins

<u>CO_2 dissociation curve :</u>

- It describes the relation between the PCO_2 level and CO2 content in all form in the blood.
- the normal content of CO2 in blood 48 ml/dl in arterial side and 52 ml in venous side → only 4 ml /dl is removed .
  <u>Haldane effect:</u>
- **Is the decrease of Hb affinity to CO2 and H ion by the effect of O2**
- It is important for CO2 transport. How?
- binding of oxygen with hemoglobin in the lungs causes the Hb to become a stronger acid→ CO2 release by two ways :
  1. The highly acidic hemoglobin has less tendency to combine with CO2 to form carbaminohemoglobin → release of CO2 from the blood
     O2 + HbCO2 →HbO2 +CO2
  2. The increased acidity of the Hb → release an excess of hydrogen ions , **O2 + HbH →HbO + H** . the released H ion will bind with HCO3 ion that reinters inside the RBC by the **reverse chloride shift process**
     H + HCO_3 ↔H_2CO_3 ↔ CO_2 + H_2O



At lung level

- The Haldane effect doubles the amount of CO_2 released at the lungs.
- At high PO2 (Lung) →shift the CO2 dissociation curve to a lower level (decrease Hb affinity for CO_2) →the Hb releases 4ml /dl instead of only 2ml . the reason is that in the new downward curve with low affinity of CO2 , the content of CO_2 at the lung ↓to 48 ml/dl instead of 50 ml /dl at PCO_2 = 40 mmHg →52-48 =4 ml /dl