Oxygen dissociation curve:

The effect of carbon dioxide and acidity favour the formation of Oxyhaemoglobin at low concentration of CO_2 and H^+ ion and causes the dissociation of Oxyhaemoglobin releasing O_2 at high concentration of CO_2 and H^+ ion.

This shift in curve of oxyhaemoglobin due to concentration of carbondioxide at given partial pressure of oxygen, is known as Bohr effect.

The amount of Oxygen take up by Haemoglobin at particular time to from Oxyhaemoglobin is called percentage saturation.

The graph of percentage of O_2 saturation of haemoglobin plotted against partial pressure of Oxygen (PO_2) is called Oxygen dissociation curve.

The Oxygen dissociation curve is S-shaped (sigmoidal shape).

The curve indicates that haemoglobin has high affinity to Oxygen.

In human arterial blood have PO_2 of about 95-100 mmHg, at this level percentage of O_2 saturation of Hb is about 97 %. This indicates the formation of Oxyhaemoglobin is favoured.

Similarly, the venous blood have PO2 of 40mmHg,at this level percentage of O2 saturation of Hb is about 70%.

Effect of Carbon-dioxide on Oxygen dissociation curve:

The effect of CO2 on Oxygen dissociation curve is known as Bohr effect.

It has been found that increase in concentration of CO2 decreases the amount of oxyhaemoglobin formation.

According to Bohr effect, for any particular partial pressure of Oxygen, the affinity of Haemoglobin toward Oxygen decreases and favors dissociation of oxyhaemoglobin when the partial pressure of carbondioxide increases.

It means, higher CO2 concentration causes the dissociation of HbO2 releasing free O2.

Increase in PCO2 shifts the O2 dissociation curve downwards. Higher PCO2 lowers the affinity of haemoglobin for O2.

PpO2…23…40%; PPO2…26..50%; PPO2..30..60%; PPO2.40…75%;PPO2

45..80%;PPO2..61..90%;PPO2..80..95%...PPO2..100..97 %

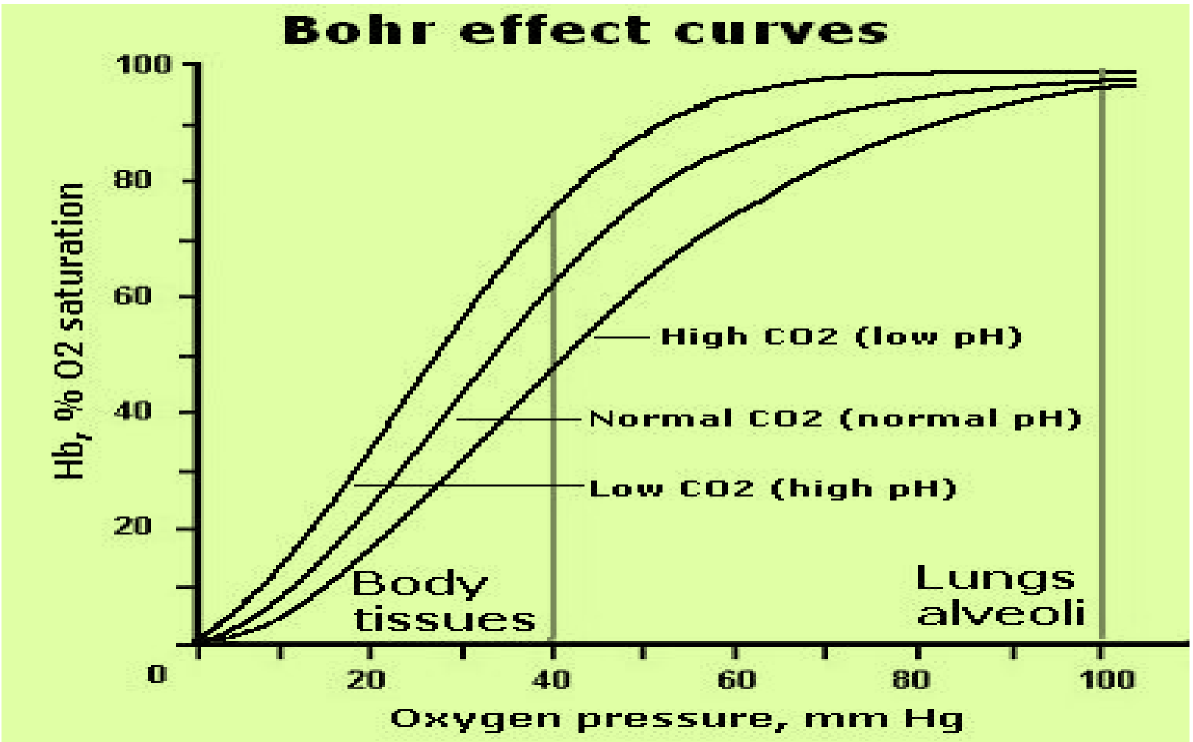

Fig. Oxygen dissociation curve of haemoglobin at different partial pressure of CO_2

Bohr effect is very important physiological phenomenon, because uptake of oxygen in lungs and its releases in the tissue is regulated by the concentration of CO_2 and H^+ ion as well as the partial pressure of O_2. So, this phenomenon made possible the cellular transport and release of O_2.

PCO_2 is lower in lungs than tissue, so Hb has higher affinity for O_2, therefore it favors HbO_2 formation and transport of O2 from lungs to tissue. similarly PCO2 is higher in tissue, so it favors dissociation of HbO2 releasing free O2 and transport of CO2 from tissue to lungs.

Factors affecting Dissociation of Oxy-hemoglobin:

a. Temperature:

(i) A rise in temperature decreases hemoglobin saturation.

(ii) At 25°C, hemoglobin is 88% saturated but at 37°C, it is only 56% saturated. Therefore, hemoglobin gives up oxygen more readily while passing from high to low oxygen tension (as from lungs to tissues) in warm-blooded animals than in coldblooded animals.

b. Electrolytes:

At low oxygen tensions, oxy-hemoglobin gives up oxygen more readily in the presence of electrolytes.

c. Effect of CO_2:

(i) The influence of CO_2 on the shape of the dissociation curve is actually the effect of carbonic acid formation with the lowering of the pH of the environment.

(ii) The increase in acidity facilitates the dissociation of oxy-hemoglobin.

(iii) The ability of CO_2 to shift the slope of the oxy-hemoglobin dissociation curve to the right is known as the Bohr effect. This effect is often described as causing a shift of the P-50 to the right. P-50 is the partial pressure (mm Hg) at which hemoglobin is 50% saturated. 1, 3-biphosphoglycerate, a compound formed during glycolysis in the red cell, also causes a significant shift of the P-50 to the right.