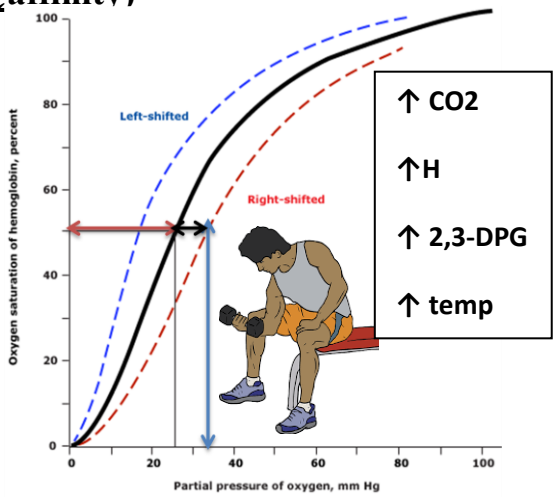
Shifting of O2-Hb dissociation curve to the right :(↓affinity)



1) ↑CO_2 concentration
   At tissue level ,Hb starts releasing O2 (deoxy Hb) → CO2 binds reversibly to the amino group of globin → form Carbaminohemoglobin → stabilize deoxy Hb →↓Hb affinity to O2→ shift the oxygen-hemoglobin dissociation curve to the right and ↑P50 (O2 release) .

2) ↑H concentration (↓PH):
   Bohr effect : is the decrease of Hb affinity to the O2 by the effect of increase acidity (↓PH) : HbO2 + H ↔ HbH +O2
   when the blood passes through the tissues→↑CO2 which react with H2O to form carbonic acid in presence of carbonic anhydrase enzyme →↑hydrogen ion concentration (H binds to several amino acid residue in deoxy Hb →stablizes deoxy Hb →↓Hb affinity to O2→ shift the O2-Hb dissociation curve to the right and ↑P50 (O2 release) .

3) ↑ temperature .ex : during exercise: ↑temp →↓Hb affinity to O2→shift to the right →O2 release .

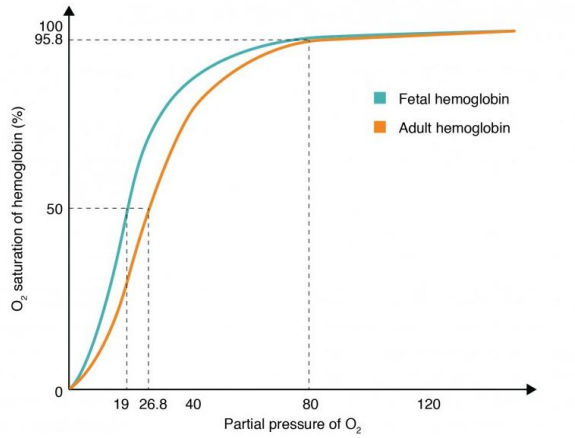
4) ↑2,3 DPG (**2,3- Diphosphoglycerate):**
   HbO2 +2,3DPg↔Hb-2,3DPG +O2
   - It is an intermediate compound in the glycolytic pathway which is synthesized from 1,3 diphosphoglycerate . It is abundant in RBC.
   - It binds to **β chain** of deoxy Hb and stabilizes it→reduce O2 affinity
   - Factors affecting 2,3DPG :
     i. high altitude (adaptation) : ↑2,3 DPG
     ii. chronic hypoxemia caused by pathological lung disease and anemia →↑2,3 DPG
     iii. Exercise: ↑ within 60 min .
     iv. Hormones : growth hormone , thyroid hormone and androgen →↑2,3 DPG
     v. Acidosis : ↓pH →↓red blood cell glycolysis →↓2,3DPG

vi. blood store : 2,3 DPG ↓ in stored blood in a week →difficult O2 release to critically hypoxic patients after blood transfusion.

shifting of O2-Hb curve to the left :(↑affinity):

O2 affinity of Hb ↑ when ↓H , CO_2 , 2,3-DPG level and temperature (decreases metabolic rate and the need for O2 is less) . Another Two conditions →Lt shift and ↓ P50:

a) **Fetal hemoglobin** : HbF (contains **ɣ globin** chain instead of β globin chain) the affinity of fetal hemoglobin(Hb F) for O2 is greater than that for adult Hb(Hb A) , The cause of this greater affinity is the poor binding of 2,3DPG by the ɣ peptide chain that replace β chain in HbF →shift the curve to the Lt . This greater affinity facilitates the movement of the of O2 from the mother to the fetus even at low PO2 .

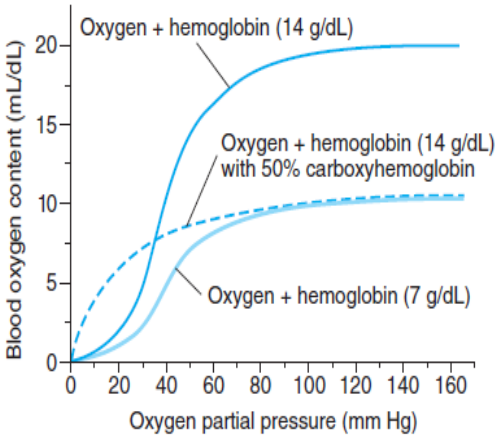


b) Carbon monoxide :

- It is an extremely deadly gas .Co is a colorless, tasteless and odorless gas . CO competitively binds Hb with very high affinity(>240 times of O2) to produce carboxy hemoglobin.
- CO ↓ the Hb carrying capacity for O2 (↓saturation of Hb)
- dissolved O_2 does not affected by CO. it affects only O_2 binding sites of Hb →PaO2 normal →no stimulation of respiratory center which depends on PO2 level that stimulate the peripheral chemoreceptors

- Why patient with 50 %carboxy Hb is seriously affected than anemic patient with 50 % Hb (7gm/dl) ?

  - In CO poisoning the ODC curve shift to the Lt ,↑ oxygen affinity of Hb and ↓ the release of O2 to the tissue



<u>myoglobin</u> : is an iron-containing pigment found in skeletal muscle.

- It contains only one heme group→ It binds one rather four O_2 molecules.
- The myoglobin dissociation curve is rectangular hyperbola rather than the sigmoid curve observed for hemoglobin
- It has higher affinity for O_2 (P50 is low) →favors picking up of O2 from hemoglobin in the blood.
- O2 is released only at low PO_2 values (eg, during exercise).
- When muscle blood supply is compressed during contractions, →myoglobin can continue to provide O_2 under reduced blood flow or reduced PO_2 in the blood.