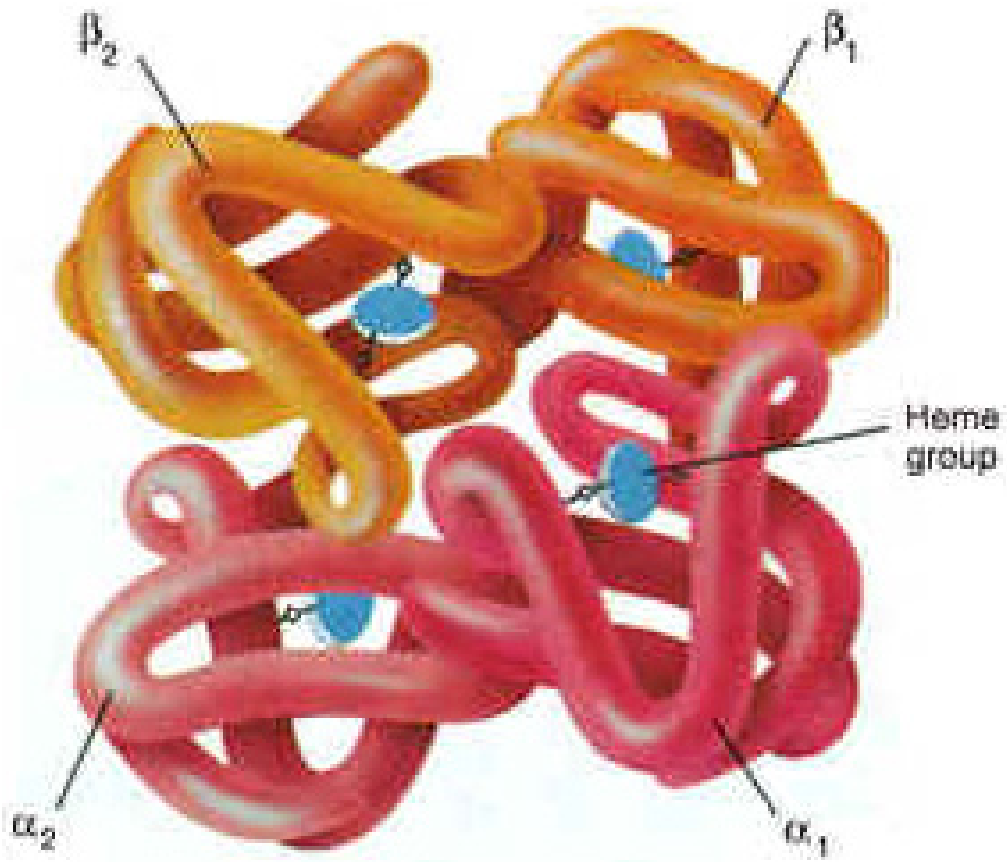
Transport of Gases


Aromarizers Only
"Budget Package"


OXY BAR

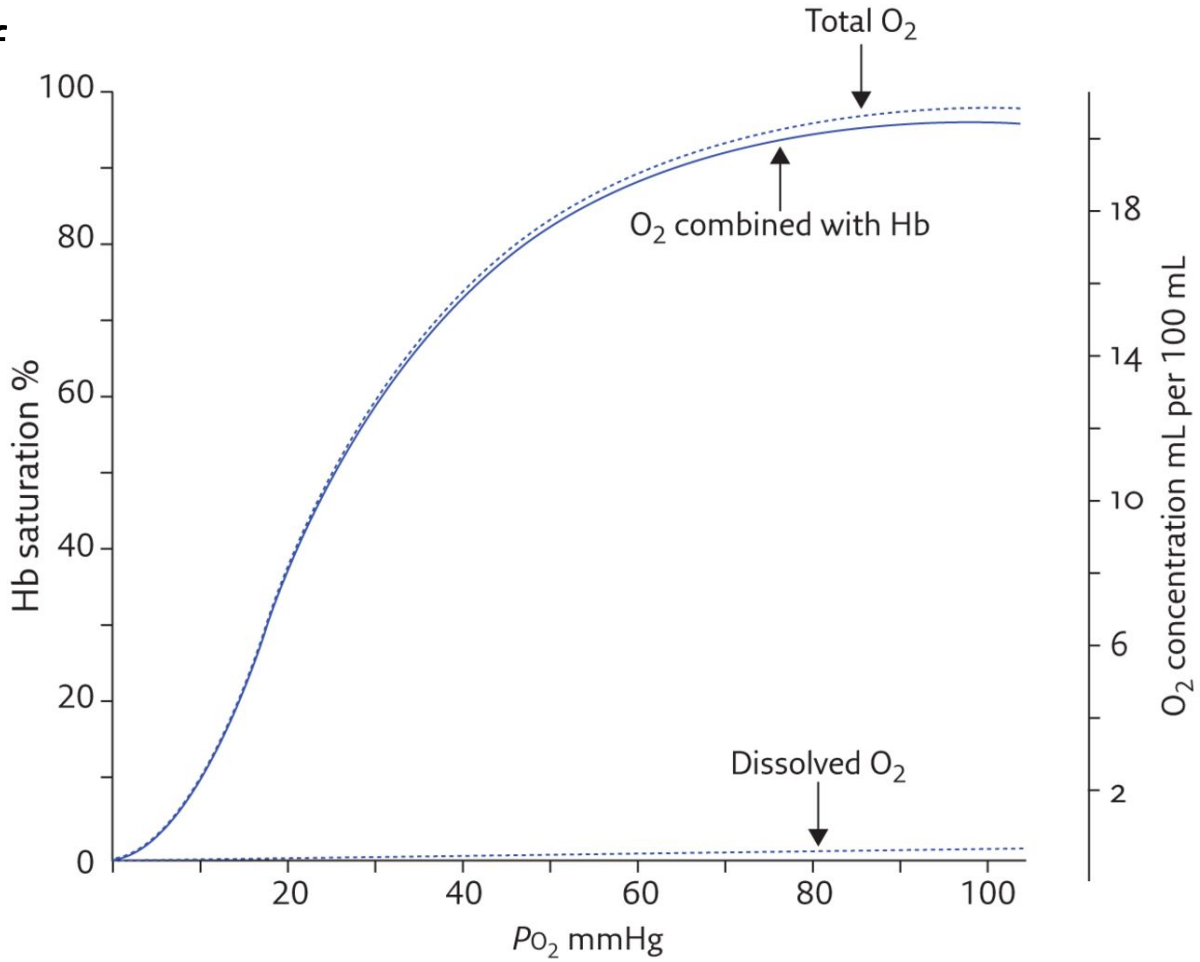
Oxygen Transport



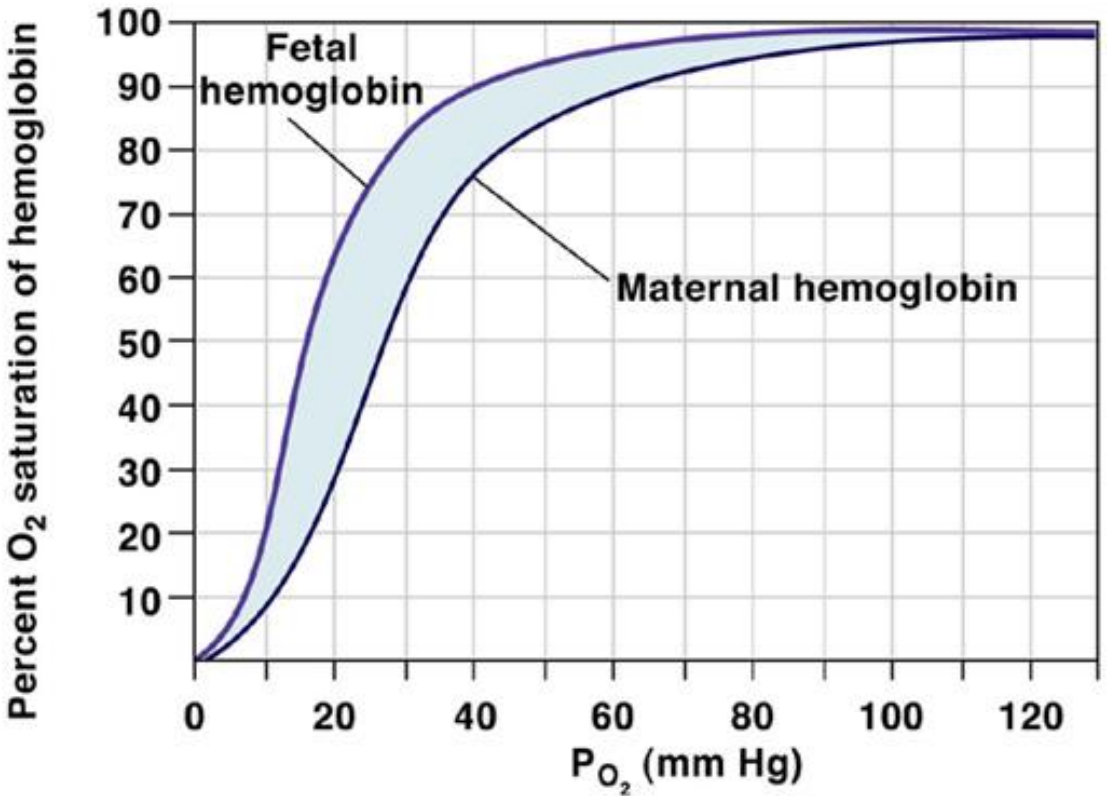
- hemoglobin (Hb)
- contains heme- an iron molecule that makes blood red
- picks up to 4 molecules of oxygen at lungs
- releases oxygen in presence of high carbonic acid (CO2 at tissues)
- some carbon dioxide will bind to Hb.

Partial Pressure Curve

- pO2 or partial pressure of oxygen determines how oxygen binds the Hb
- when partial pressure is high Hb gets saturated
- when partial pressure is low, oxygen leaves hemoglobin
- as Hb moves through tissues its saturation drops because of lower pO2



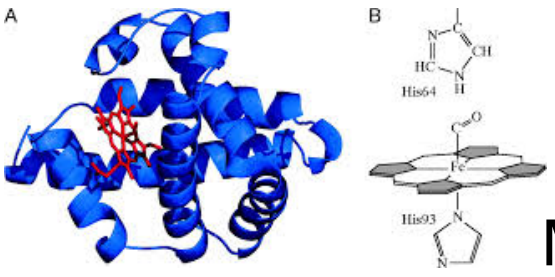
Partial Pressure Curve



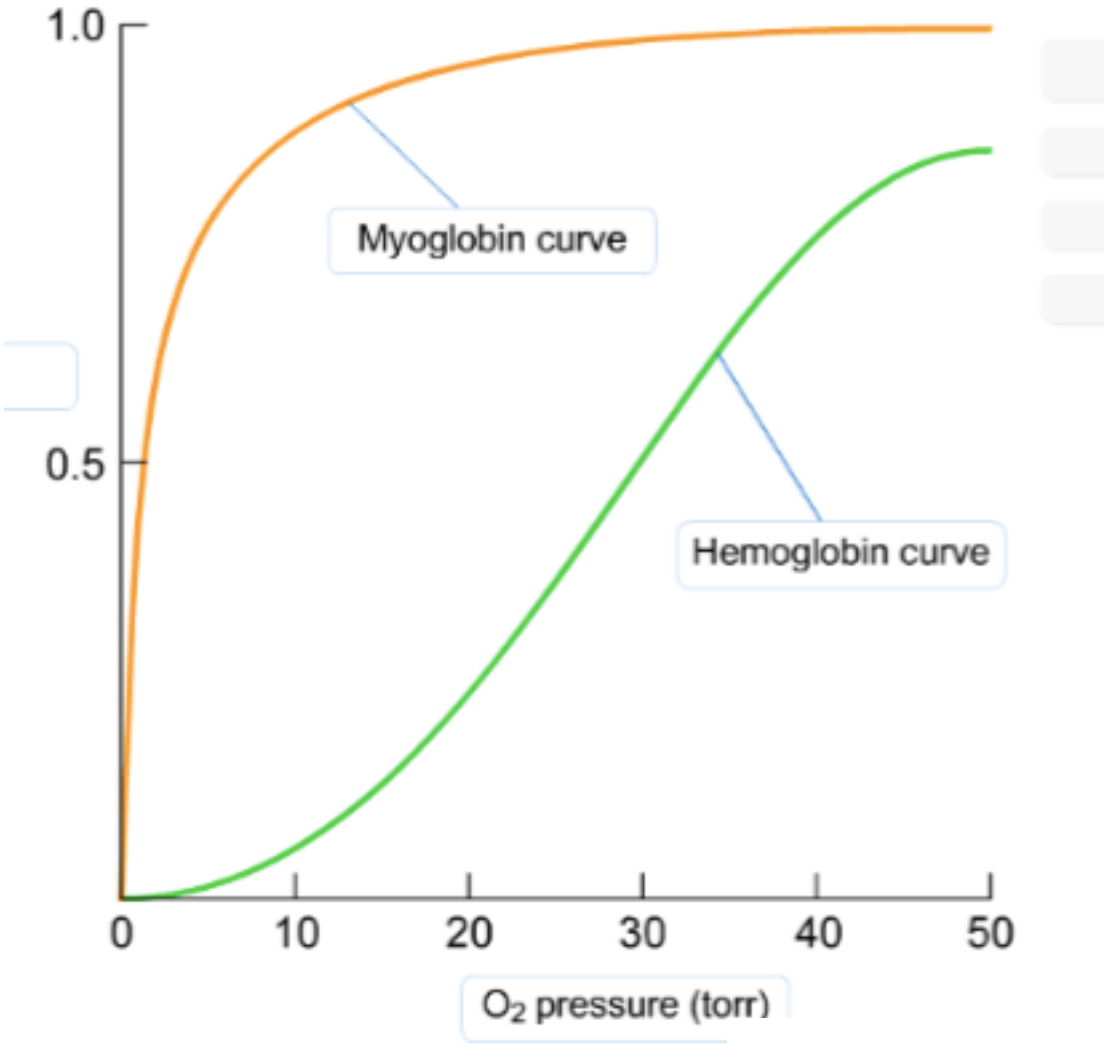
- Fetal Hb tends to have a higher affinity to Oxygen at lower partial pressures
- This ensures that the fetus will transport O2 by facilitating transfer from mother Hb to child Hb

Partial Pressure Curve and Myoglobin in muscles

- one heme and one protein subunit
- stores O2 in muscles
- has high affinity to O2 at a very low partial pressure
- in muscles where O2 is low, it still can bind and store
- releases during vigorous exercise when O2 is very low

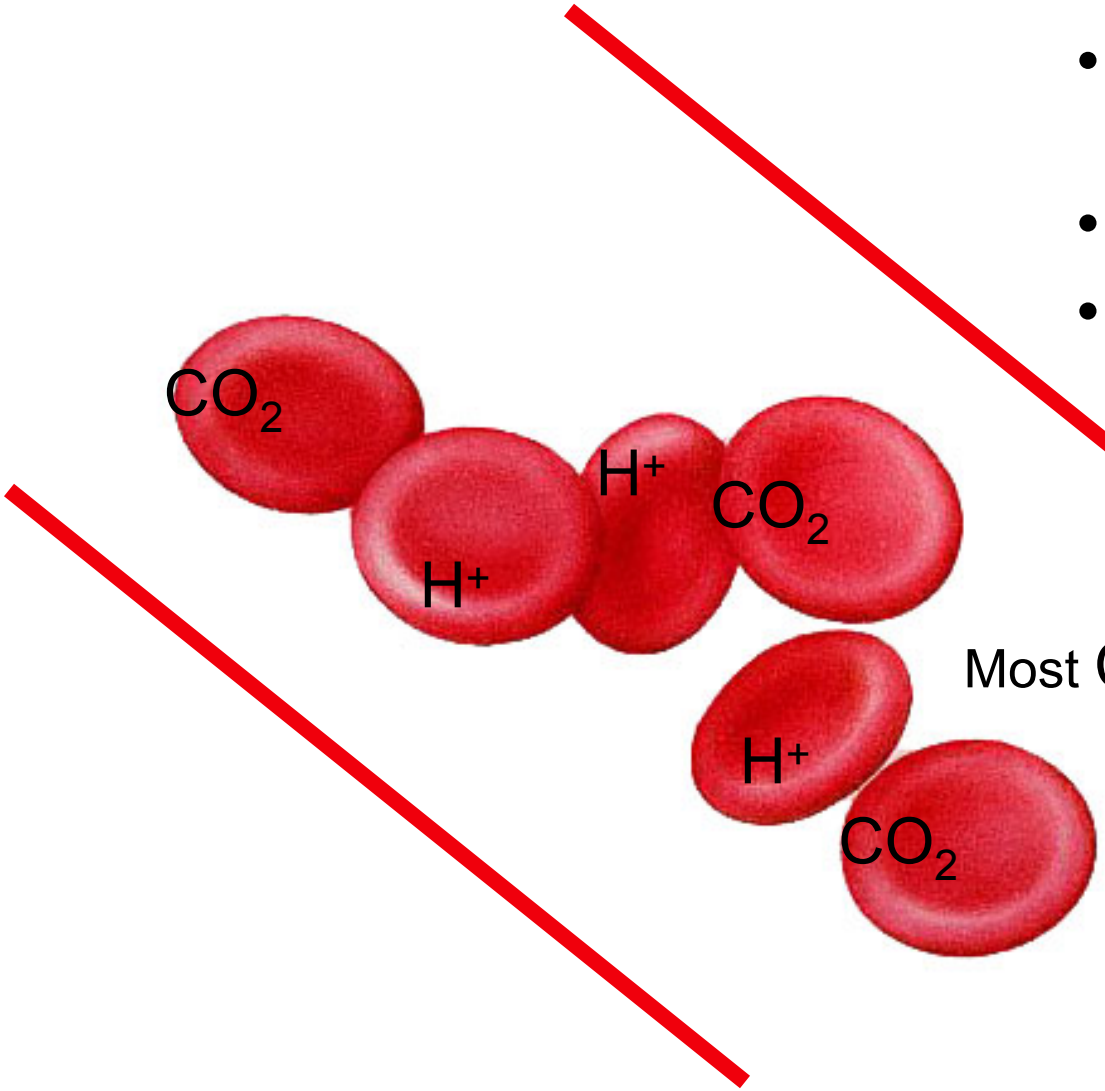


Myoglobin



Carbon Dioxide Transport

- some dissolves in blood
- some binds to hb
- most reacts with water to form carbonic acid



Most $CO_2 + H_2O \rightarrow H_2CO_3$

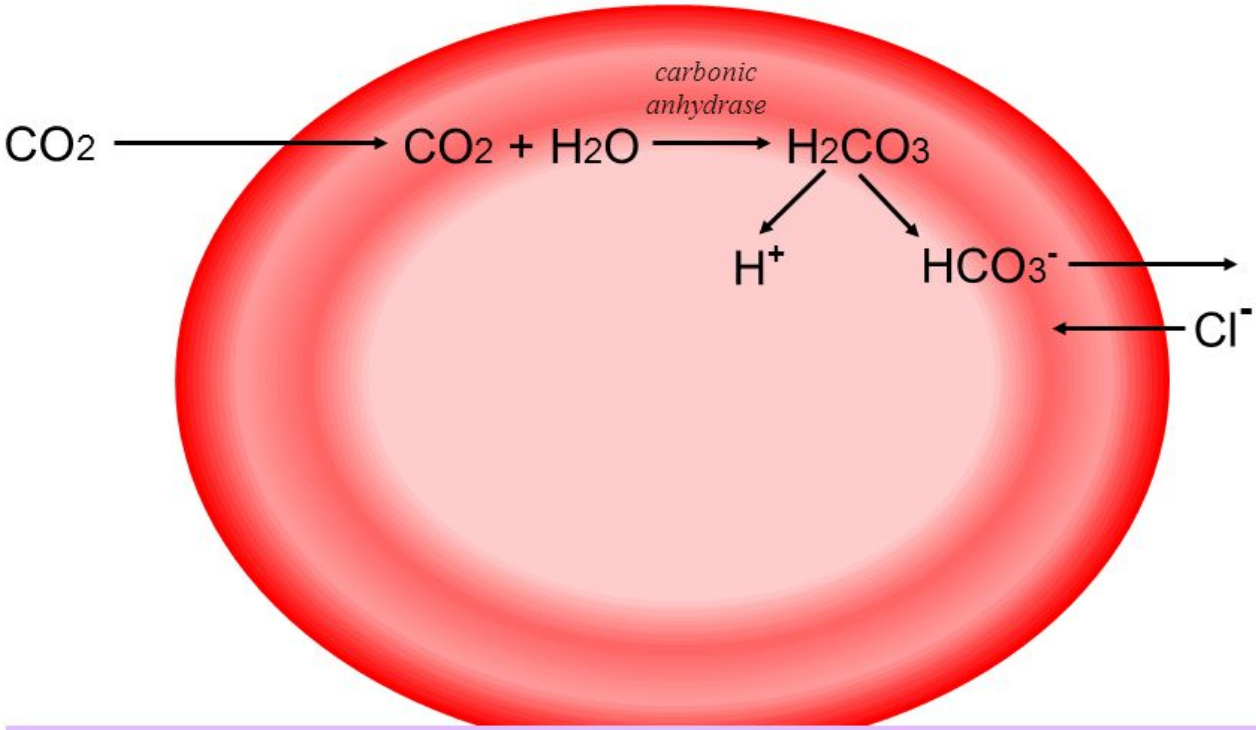
$H_2CO_3 \rightarrow HCO_3^-$

CO_2 in Blood

Form of Transport	A Vein at Rest	A Vein during Exercise
dissolved in blood as CO_2	0.78	1.32
bicarbonate ions $HCO_3^- + H^+$	14.52	14.56
CO_2 Bound to Hb	0.3	0.24
Total CO_2	15.59	16.22
Blood pH	7.37	7.14

- Carbon Dioxide is converted to bicarbonate HCO_3^- (which makes it less toxic)
- Caused by the enzyme *carbonic anhydrase in RBC*

Dissociation of Carbonic acid:

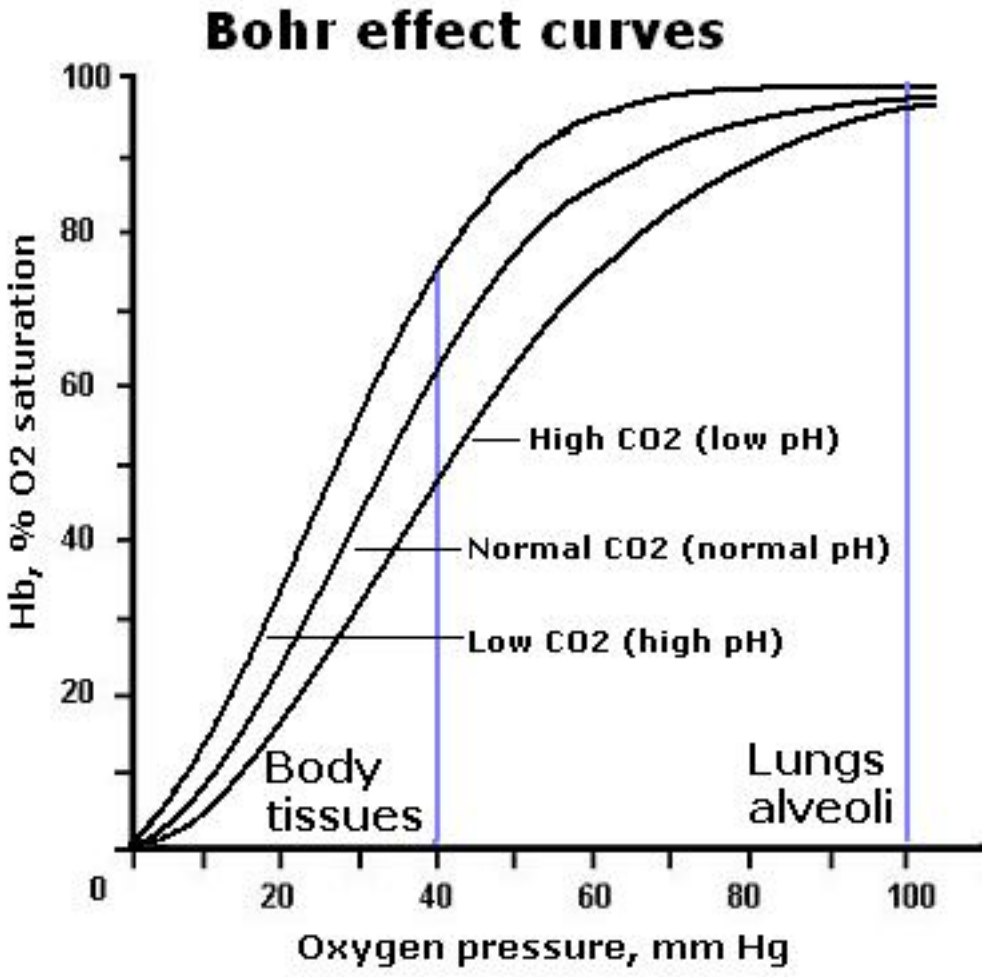


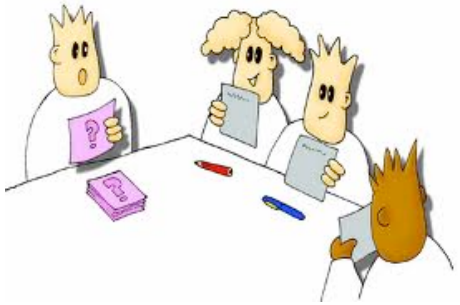
Carbonic acid dissociates and HCO_3^- is transported out of the RBC, in exchange for Cl^-. (This is the CHLORIDE SHIFT)

- $HCO3^-$ is transported out of RBC by facilitated diffusion
- Cl- moves in to balance charges in and out of the RBC

The Bohr Shift

- The release of oxygen is promoted by the Bohr shift
- Hb affinity to oxygen is highest when blood pH is high (ie high partial pressure of CO2)
- Hb affinity to oxygen drops with blood pH is low (ie low pCO2)





As a person climbs a mountain, the higher they climb the lower the partial pressure of oxygen. They develop Mountain Sickness

a. Predict what physically might happen to the a person with mountain sickness?

Humans Adapt to High Altitude

» ↑ in RBC production

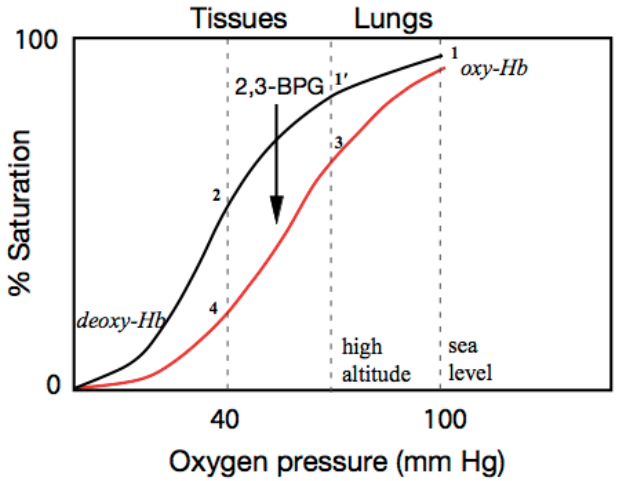
» ↑ ventilation

» ↑ myoglobin in muscles

Population at High altitude

» ↑ lung capacity and surface area

» O2 dissociation curve shift right



Control of Breathing Rate

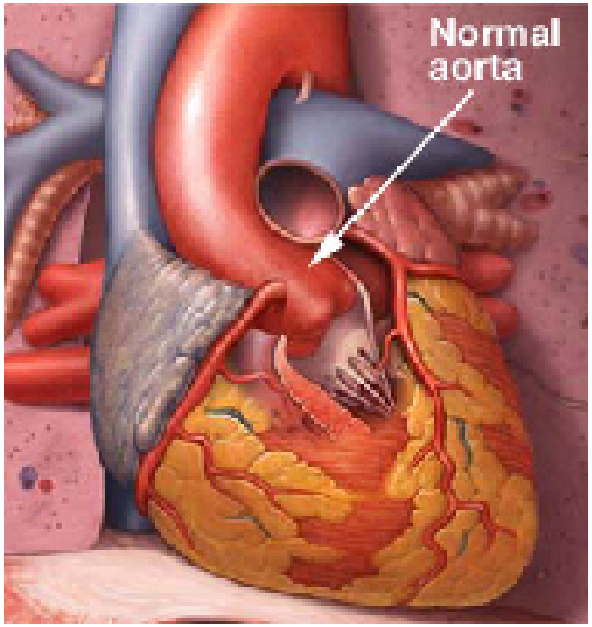
https://www.youtube.com/watch?v=F0OBkR00OZE

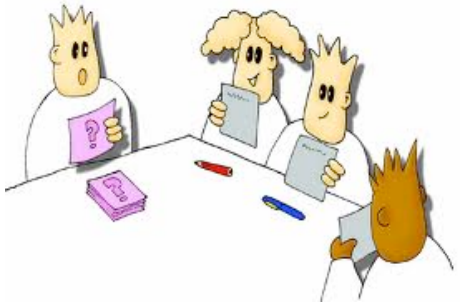
1. **Carbon dioxide & the Medulla oblongata**

- the part of the brain that controls our breathing (& heart rate)
- high levels of CO_2 in blood LOWERS pH
- Lower pH is detected by the M. O. in the brain
- ---> increase our breathing rate & depth of breathing
- (increases pH back to normal at CO_2 leaves)

2. Oxygen and **Chemoreceptors** in large blood vessels

- special cells in the aorta and other large arteries (carotid) detect low oxygen
- increase our breathing rate & depth of breathing





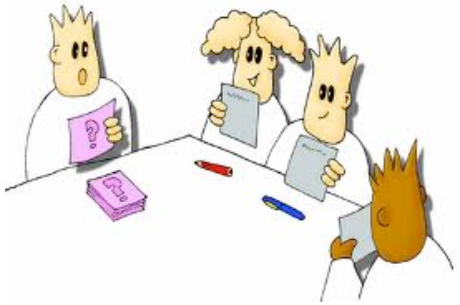
Carbon dioxide level (pH), oxygen level

(i) Where is each detected?

(ii) What level (high? low?) causes a reaction?

(iii) What happens when a level needs responding to?

What centre has ultimate control on our breathing?

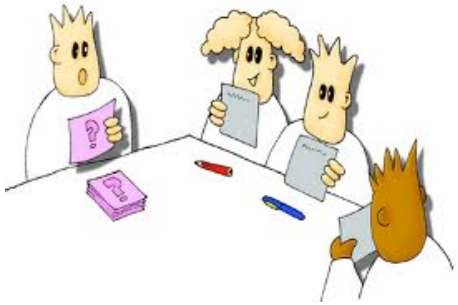


How will each of the following scenarios affect the breathing of an individual, and what mechanism is in operation?

a. You take a visit to Denver where the city is 1500 m higher in elevation than Windsor.

b. You take up smoking which produces carbon MONOXIDE gas that blocks the O2 molecules from entering the blood stream, but does not affect your carbon dioxide levels.

c. You add more plants to your room because your know that they release oxygen gas.



“Sick Building Syndrome” can occur when there is poor ventilation in a building. When this happens, carbon dioxide often builds up inside buildings.

Create a flow chart showing what happens in our body and the effect SBS can have on our breathing rate.

Methods & Observations:

1. Copy the following chart into your notebook:

Condition	Resting	Hyperventilate (1min)	Bag Breathing (1 min)	heavy exercise (1 min)
Hypothesis of # of breaths and the time change of the indicator				
Respiratory Rate				

2. Predict the results of each test before you start.
3. Record the number of breaths you take in 1 minutes.
4. Do your treatment for the time specified
5. Record your breathing for one minute afterward.
6. Blow normally into the indicator solution/ and time how long it takes until it change from pink to clear.

Record your results on the group data on the front door.