Breathing and the Blood

🏆 Let's Take Attendance 🏆

http://sciovirtual.org/attendance

Attendance code: skin57

Icebreaker

- Which country do you want to visit/live in the most?

K

Class Updates and Winners!

- Homework #3(covering lessons 5 + 6) and course challenge 2 was due last night
- It included a challenge problem set, so be proud that you completed it
- Without further ado, here are the top scorers from the homework and winners of the course challenge

R

Homework Top Scorers!

- Sarah W.
- Shivika S.
- Ridhi S.
- Manasvi G.
- Caitlyn K.
- Note: This is not ranked but rather just arbitrary order

K

Course Challenge Winners!

- Joshua
- Shivika
- Ritisha
- Pranusha
- Sanya
- Note: This is not ranked but rather just arbitrary order

R

Course Updates!

- Homework #4 will be released tomorrow and will cover lessons 7 and 8
  - This homework will be due by the end of Thursday so top scorers can be announced during the last class(Friday)
- Course Challenge 3 will be released today
  - The challenge will be an escape room(thru google forms) that you must escape in the allotted time
    - Google forms will have a timer and specific time limits will be allotted based on group member count

K

Course Updates!

- Course Challenge 3 escape room allotted time
  - Solo(individual): 60 minutes(1 hour)
  - Group of 2: 45 minutes
  - Group of 3: 40 minutes
  - Group of 4: 35 minutes
- The escape room questions will be the same regardless of your group size, but there will be different forms for the different group sizes which will have different time limits(run through timer feature on google forms)
- If you work together in a group, only 1 person should submit, but that person should list out the names of all people in the group
  - If you do not list all group members, you may risk disqualification as we may not be able to trace down who was in a particular group

R

Pairing Form for Course Challenge!

- There will be a group pairing form up today after class
  - Please fill out the pairing form by the end of tomorrow
    - The pairing form will not accept responses after the end of tomorrow(Tuesday night) so if you want to be paired, fill it out by then

K

Review From Last Time!

- Respiratory functions:
  - Provide oxygen to blood
  - Eliminate CO_2 from blood
  - Regulate blood pH (with the kidney!)
  - Forms speech sounds
- Different animals can perform functions in different ways
  - Insects?
  - Tapeworms, Earthworms, Leeches
  - Fishies?
  - Amphibians, Mammals, Reptiles?

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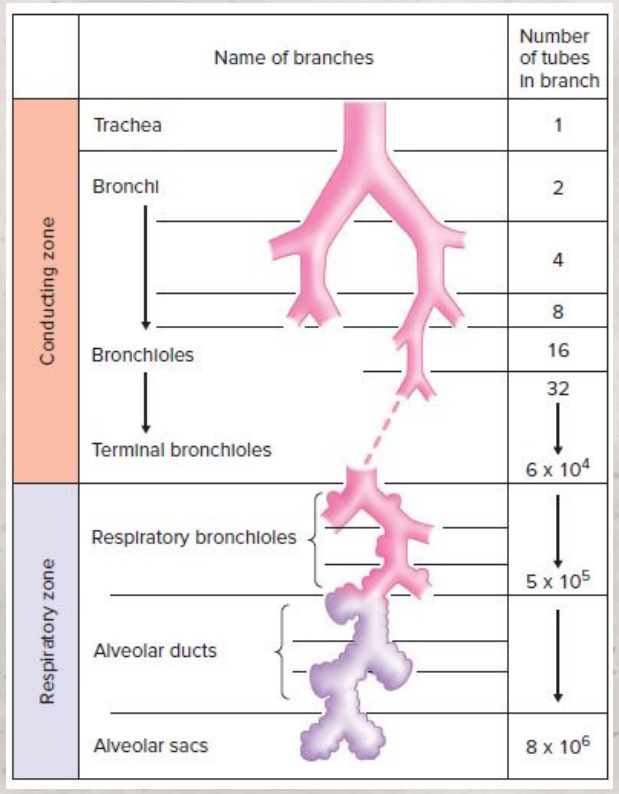
Review From Last Time!

- Alveoli
  - Type 1 Alveolar Cells
  - Type 2 Alveolar Cells
- Surfactant
  - Increase Compliance
  - Prevents collapse of Alveoli (especially the smaller ones)



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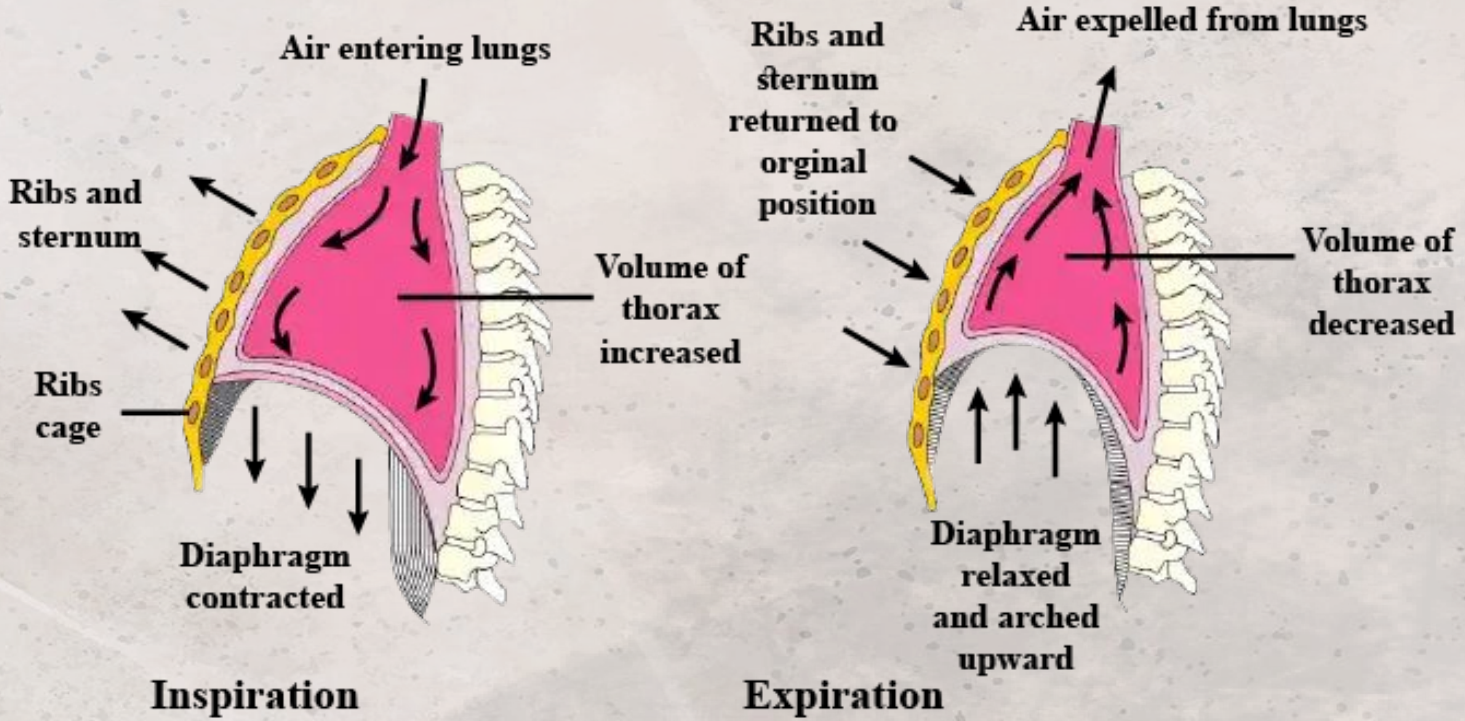
Review From Last Time!



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A little bit of physics (blegh)

Dalton's Law: In a mixture of gases, the pressure each gas exerts is independent of the others. The total pressure of the mixture is simply the sum of the individual pressures.

Henry's Law: the amount of gas dissolved in a liquid is proportional to the partial pressure of the gas (the value of the proportionality constant doesn't really matter right now)

For our purposes, partial pressure roughly means how much of the gas there is

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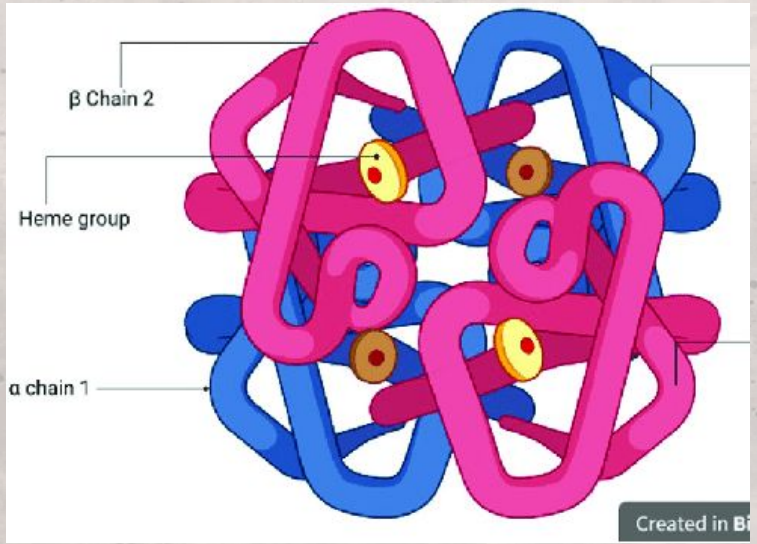
Respiratory Pigments

- Hemoglobin
  - 4 heme groups with 1 iron atom each
  - Each iron atom binds one O_2 molecule
- Pathogenic hemoglobin
  - Carboxyhemoglobin
  - Methemoglobin



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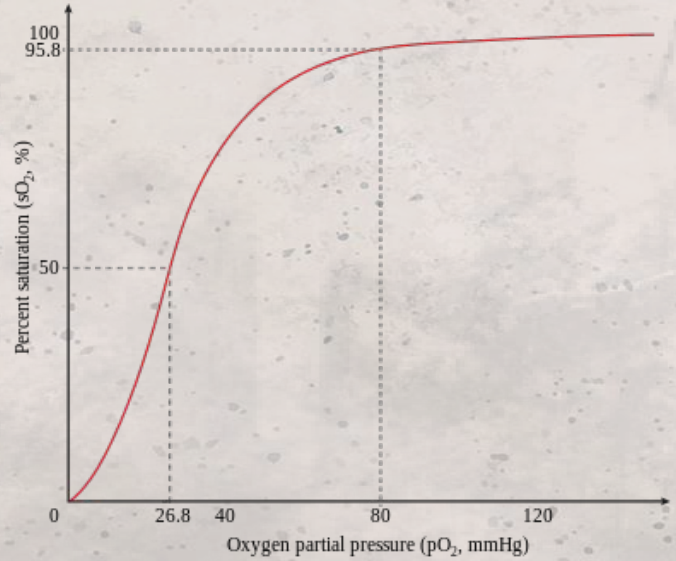
Cooperative Binding and Carbon Dioxide

- Oxygen binding to Hb changes the shape of the protein in a favorable way for the next oxygen

- Bohr Effect:

Carbon Dioxide allosterically binds to Hb to **decrease** oxygen affinity. H+ (acids) also binds to Hb to decrease oxygen affinity.



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A Closer Look CO2 Transport

Carbon dioxide can either be:

- dissolved in water
- bound to amino acids on hemoglobin
- (60-65%) converted to carbonic acid by carbonic anhydrase

$$CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow HCO_3^- + H^+$$

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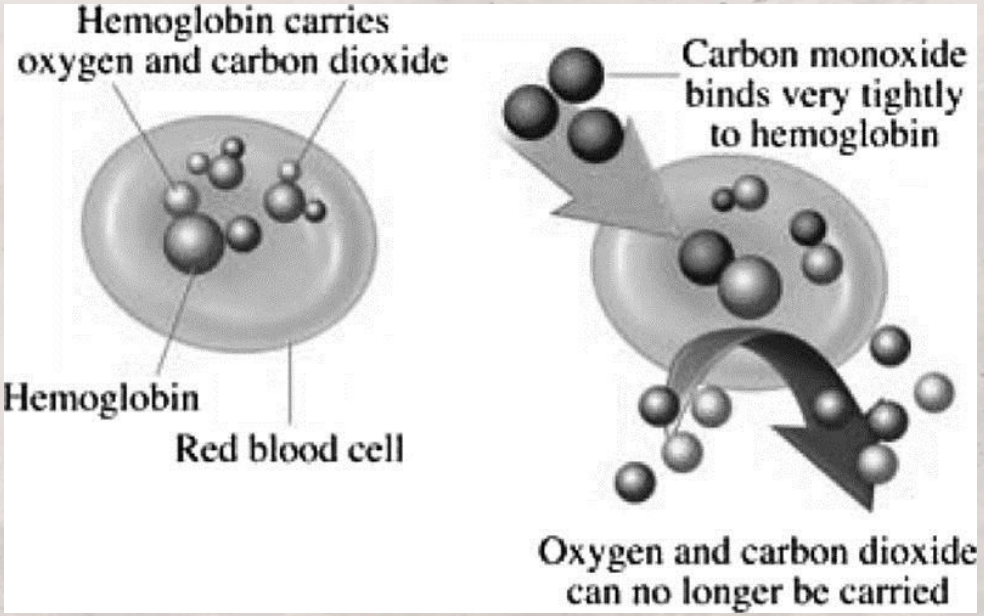
Carbon Monoxide

Hemoglobin binds to carbon monoxide (CO) 200-300 times stronger than to oxygen

- No odor
- No way to tell when you're breathing in CO



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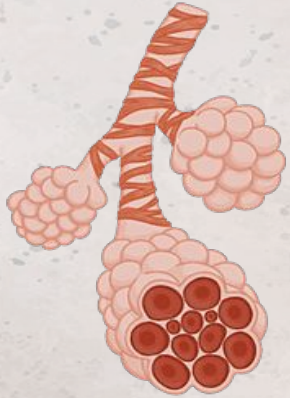
Let’s make some sense of this...



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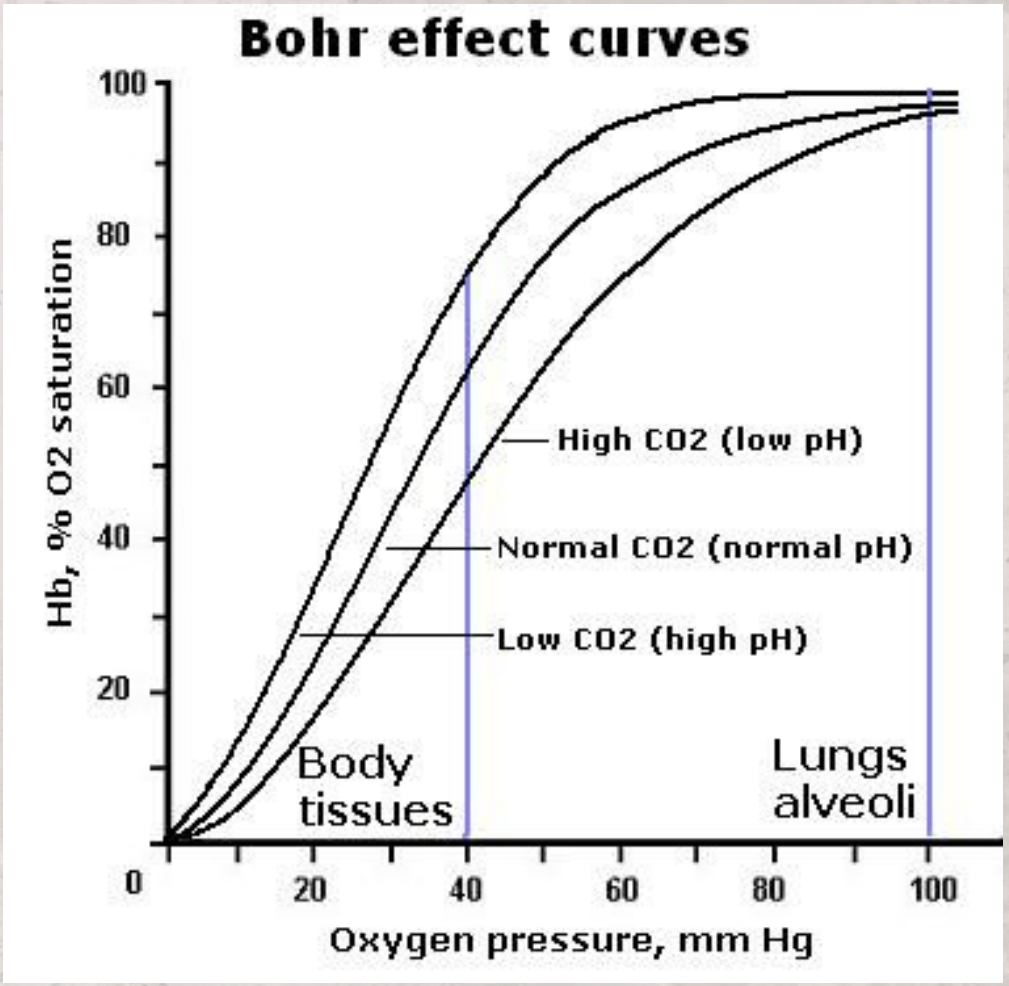
Bohr effect curves
Hb, % O2 saturation
100
80
60
40
20
0
20
40
60
80
100
Oxygen pressure, mm Hg
High CO2 (low pH)
Normal CO2 (normal pH)
Low CO2 (high pH)
Body tissues
Lungs alveoli

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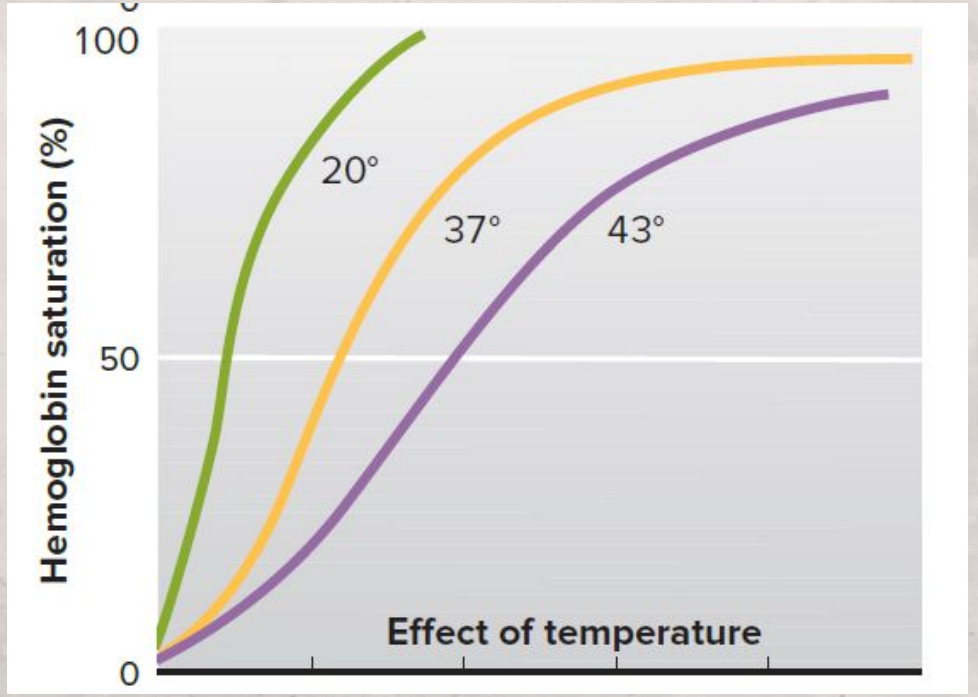
Temperature

Given that metabolically active issues release heat...

Should high temperature decrease or increase Hemoglobin's affinity to oxygen?



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oH nO!

Arvyn was filling out college apps when his house caught on fire!

This did not faze him and he remained focused until he felt as if he was suffocating, even though he was ventilating his lungs!

What disease has Arvyn brought upon himself?

How might you go about curing this?