

### Questions!

- Vascular cambium
- Phloem
- Xylem
- Bundle sheath
- Vascular bundle

---

---

---

---

---

---

---

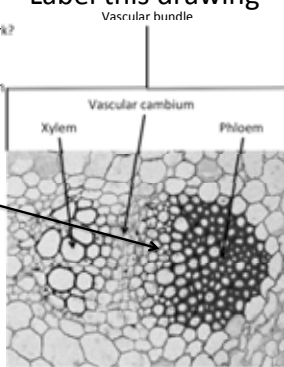
### Label this drawing

Which way to the bark?  
Left or right?

Where is translocation  
happening?

Phloem

Can you point out the  
Functional phloem?



[http://www.bio.txstate.edu/~stemke/botany/1410/lab/lab\\_exercises/lab4/stems/dicotstem.html](http://www.bio.txstate.edu/~stemke/botany/1410/lab/lab_exercises/lab4/stems/dicotstem.html)

---

---

---

---

---

---

---

### Ideas to know

- Understand the relationship between the surface area to volume ratio and diffusion
- The difference between and open and closed circulatory system.
- Why a bird's circulatory system has a higher blood pressure than a fish's.

---

---

---

---

---

---

---

## Animal Circulation

Oxygen and Carbon Dioxide binding

---

---

---

---

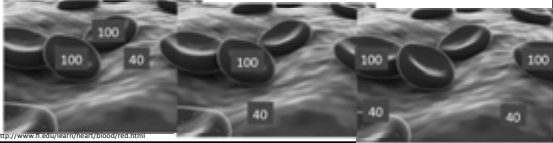
---

---

---

### Gas Exchange in RBCs

- Oxygen moves to cells via diffusion  
...with the concentration gradient
  - partial pressure
  - 100 mm Hg in RBC
  - 30 – 40 mm Hg in tissues



<http://www.biology.com/ncsc/c0000101.html>

---

---

---

---


---

---

---

### Cooperative Binding

- Gaining or losing an oxygen molecule changes the shape of hemoglobin
- Binding of one oxygen makes it more likely for another oxygen to bind
  - Makes gaining oxygen in the lungs easier
- Losing one oxygen makes it more likely for another oxygen to be lost
  - Makes donating oxygen to tissues easier



[http://en.wikipedia.org/wiki/File:Heme\\_b.png](http://en.wikipedia.org/wiki/File:Heme_b.png)

---

---

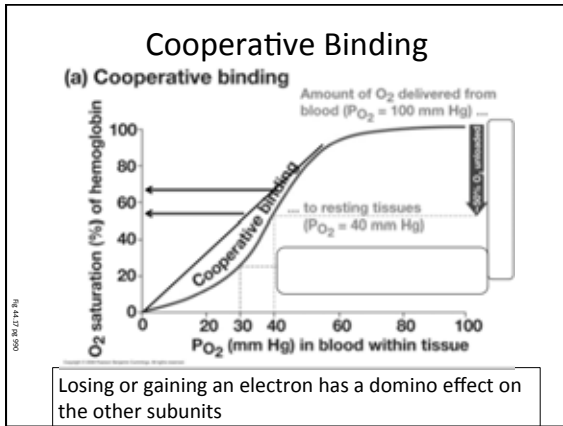
---

---

---

---

---




---

---

---

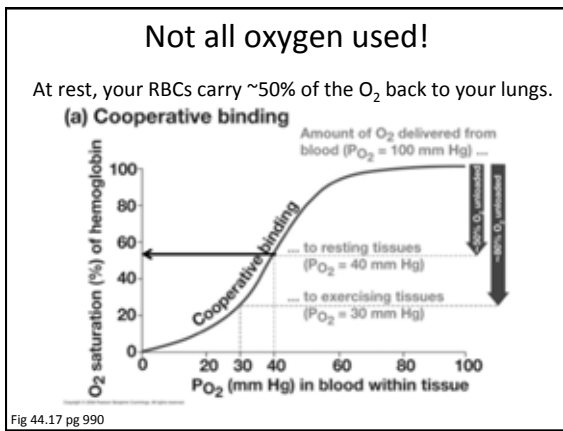
---

---

---

---

---




---

---

---

---

---

---

---

---

### Exercising and Oxygen loss

- In exercising muscles, partial pressure of oxygen is reduced, so the “extra” oxygen is pulled from hemoglobin
- But more CO<sub>2</sub> is also produced through respiration

(a) Cooperative binding

Fig 44.17 pg 990

---

---

---

---

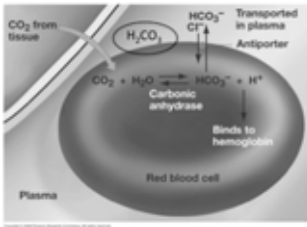
---

---

---

---

### How does the circulatory system get rid of the CO<sub>2</sub> ?



CO<sub>2</sub> exits tissues  
 Combined with water it forms carbonic acid  
 This lowers the blood pH, which:  
 increases the breathing rate  
 increases oxygen binding  
 keeps the CO<sub>2</sub> gradient high

Fig 44.20 pg 992

---

---

---

---

---

---

---

---

### The Bohr shift makes hemoglobin more likely to release oxygen to tissues with low pH

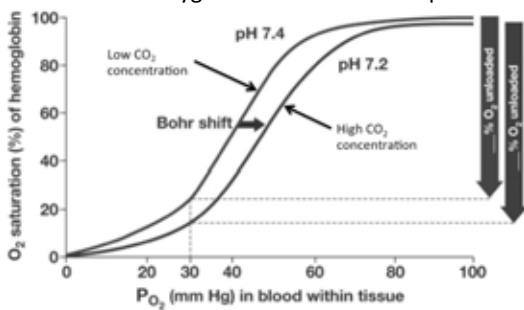


Fig 44.18 pg 991

---

---

---

---

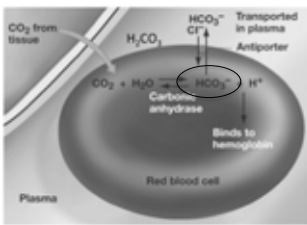
---

---

---

---

### How does the circulatory system get rid of the CO<sub>2</sub> ?



Most of the CO<sub>2</sub> is taken up by the RBC and converted to bicarbonate  
 The hemoglobin binds the excess H<sup>+</sup>, acting as a pH buffer

Fig 44.20 pg 992

---

---

---

---

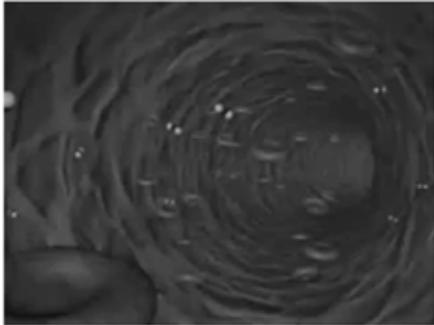
---

---

---

---

### CO<sub>2</sub> Transport




---

---

---

---

---

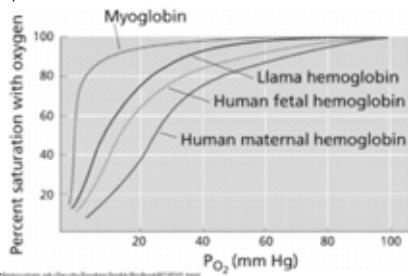
---

---

---

### Other oxygen-binding molecules

Myoglobin is a single polypeptide chain that has one heme molecule. It is found in the muscle tissue.  
Does the myoglobin bind more or less tightly to oxygen than hemoglobin and why is that important?



[http://www2.estrellamountain.edu/file\\_upload/estrellamountain/2005/Health/02/020105.html](http://www2.estrellamountain.edu/file_upload/estrellamountain/2005/Health/02/020105.html)

---

---

---

---

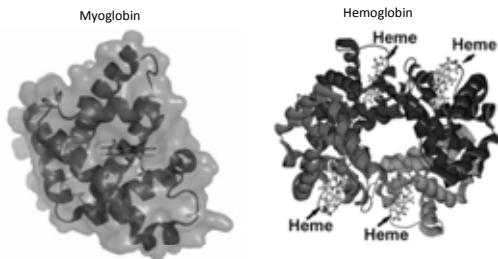
---

---

---

---

### Myoglobin vs. Hemoglobin



<http://themedicalbiochemistrypage.org/hemoglobin-myoglobin.html>

[http://en.wikipedia.org/wiki/File:Heme\\_3.svg](http://en.wikipedia.org/wiki/File:Heme_3.svg)

---

---

---

---

---

---

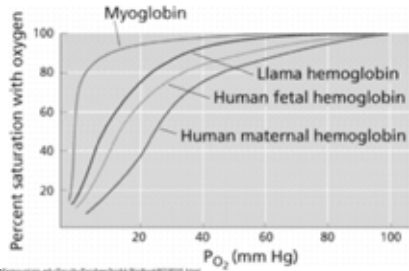
---

---

### Other oxygen-binding molecules

Does human fetal hemoglobin have a higher or lower oxygen affinity than maternal hemoglobin?

Explain why.



<http://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookRESP05.html>

---

---

---

---

---

---

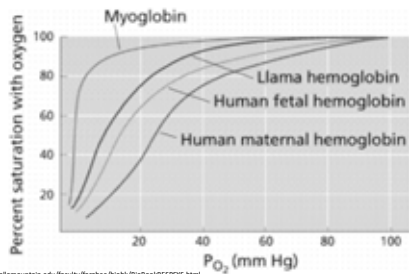
---

---

### Other oxygen-binding molecules

What would explain the fact that Llama hemoglobin has a higher oxygen affinity?

Where would you expect to find this adaptation?



<http://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookRESP05.html>

---

---

---

---

---

---

---

---