Blood flows through the lamellae opposite to the direction that water does
- Counter current flow optimizes P oxygen gradient between blood and water

Hemoglobin:
- Many in one RBC
- One hemoglobin can bind 4 oxygen molecules
- Low P oxygen = only 1 oxygen binds
  - When 1 binds it changes the shape of the hemoglobin and makes it easier for more to bind
- High P oxygen = hemoglobin 100% saturated
- Only 1 oxygen molecule is released when hemoglobin circulates whole body
  - Saves oxygen for when and where it is really needed
- Carbon dioxide has a 240 fold higher binding affinity to hemoglobin
- Excess H+ binds to hemoglobin and lowers oxygen affinity
  - binding/dissociation curve shifts right
  - Hemoglobin will release more oxygen when pH in tissue is low
- 2,3 bisphosphoglyceric acid (metabolite of glycolysis)
  - Low P oxygen → increased glycolysis
  - BPG binds with deoxygenated hemoglobin and lowers oxygen affinity
  - Shifts curve right

Carbon dioxide is transported as bicarbonate ions in the blood but converted back to carbon dioxide in the lungs
Carbonic anhydrase speeds up carbon dioxide into carbonic acid which then dissociates into bicarbonate and water
Breathing is generated from the brain
- Can be voluntary or involuntary but involuntary dominates
  - Motor neurons in dorsal medulla increase firing rate just before inhalation
    - Leave the CNS to form phrenic nerve which innervates the diaphragm
  - Exhalation occurs when they stop firing
- Exhalation is a passive recoil of the lung tissues
- Motor neurons in the ventral medulla become active when breathing demand is high