2/17 Biology Notes

Fig 33-2

The human respiratory system can be divided into 2 parts:

- The conducting portion, a series of passageways that carry air into and out of the gas-exchange portion of the respiratory system
- The gas-exchange portion, where gases are exchanged with the blood in tiny space within the lungs

- Conducting portion:
  - air is inhaled actively and exhaled passively
  - occurs in 2 stages:
    - Inhalation, when air is drawn into the lungs
      - negative- pressure system
      - Inhalation occurs when the chest cavity is enlarges:
        - The lower boundary of the chest cavity is formed by the diaphragm, which domes upward when relaxed
        - During inhalation, the diaphragm is contracted, which pulls it downward, and the rib muscles contract, lifting the ribs up and outward.
      - Inhaled air travels past the larynx into the trachea, reinforced with semicircular bands os stiff cartilage.
        - The trachea splits into two bronchi (one going to each lung)
        - inside the lung, each bronchus branches repeatedly into small tubes, bronchioles (thick walls)
        - Bronchioles lead to microscopic alveoli, where gas exchange occurs (membrane is thin)
    - Exhalation, when air is expelled from the lungs
    - Fig 33-11

- Gas Exchange portion:
  - Gas exchange occurs in the alveoli
    - Alveoli cluster around the end of each bronchiole like a bunch of grapes, providing a large surface area (1500 sq feet)
      - A network of capillaries covers most of the alveolar surface
      - The walls of the alveoli consist of a single thin layer of epithelial cells

- How does the blood carry oxygen and carbon dioxide:
    - Oxygen and carbon dioxide are transported in blood using different mechanisms

- Q: Which location would be expected to have the highest level of Oxygen?
    A: Lungs; starts with breathing in; sets gradients
    - based on amount of material we have

- Oxygen Transport
    - Nearly all (about 90%) of the Oxygen carried by the blood is bound to hemoglobin
    - A large protein that gives red blood cells their color
    - Each hemoglobin molecule can carry up to 4 oxygen molecules
    - As oxygen binds hemoglobin, the protein changes its shape, which alters its:
        - affinity for oxygen
        - its color

    Q: What color is oxygen poor blood?
        A: blue/maroon
    Q: What color is oxygen rich blood?
        A: red

- How do the following impact Oxygen transport?
    - Anemia
        - small amount of red blood cells by lack of iron in diet
    - Sickle cell Anemia
        - change in structure hemoglobin; molecules clump together (causes shape)
        - doesn't bind oxygen the same

- Q: What location would be expected to have the highest levels of carbon dioxide?
    A: muscle capillaries

- Carbon dioxide transport:
    - Carbon dioxide is transported in the blood in 3 ways:
        - As bicarbonate ions (70%)
        - Bound to hemoglobin (20%)
        - Dissolved in plasma as carbon dioxide (10%)

- Plasma has about 80% of CO_2 because bicarbonate ions are in there

- Bicarbonate ions (HCO_3^-) are formed in red blood cells when carbon dioxide combines with water

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

- These reactions are always reversible