Anatomy of The Respiratory System & Partial Pressures
(Text Pg 120 – 124)

The respiratory system is composed of structures that allow the passage of air from outside the body to the lungs as well as structures that allow for gas exchange to occur.

3 Main Functions of the Respiratory System
1. Supply O₂
2. Remove CO₂
3. Regulate blood pH

The structures of the respiratory system are divided into two main zones:

A) Conductive Zone:
The combination of all the structures that convey air from the outside of the body to the lungs

Purpose:
- Transport air to the respiratory zone
  - Filter incoming air
  - Humidify incoming air
  - Warm the inspired air

Structures include:
- Mouth & Nose
- Pharynx
- Larynx
- Trachea
- Bronchi
- Bronchioles

B) Respiratory Zone
The structures that are involved with the exchange of gases between inspired air and the blood

- Terminal Bronchiole
- Respiratory Bronchioles
- Alveolar ducts
- Alveoli

Purpose:
- Rapid Gas exchange (O₂ & CO₂) via diffusion
  - Alveoli = functional unit (1 cell thick membrane)
  - 300 million = ~ 2800 square feet of surface area
  - Alveoli are covered with capillaries (1 cell thick membrane)
DEMO: Holding Your Breath

- Lets Hold Our Breath for as long as we can!
  - How were you feeling when you had to stop? What makes us want to take our next breath?

Physiology of Respiration (Respiratory Control Centres)

- The main stimulus to breathe is the level of CO₂ in the blood. As CO₂ levels rise, the Medulla Oblongata (respiratory control center in the brain) triggers:
  - An increase in the breathing Frequency (F)
  - An increase in the DEPTH of each breath know as the Tidal Volume (VT)
    - Both remain elevated until the level of CO₂ returns to acceptable levels.
- The Pons fine tunes our breathing rate (smoothes out the transition between inhalation and exhalation)

Atmospheric air is a mixture of three key gases

- Oxygen (O₂) = 20.93% pO₂ = 159.1 mmHg
- Carbon Dioxide (CO₂) = 0.03% pCO₂ = 0.23 mmHg
- Nitrogen (N₂) = 79.04% pN₂ = 600.7 mmHg

Three Rules That Determine Gas Movements For Breathing

1. Gasses move from high to low pressure (Law of partial pressures).
2. Gasses move from high concentration to low concentration.
3. Gasses move within the body by means of diffusion. (as the concentration gradient increases, greater rates of diffusion are observed)

Henry’s Law

- The amount of gas that will dissolve/diffuse into a liquid is proportional to the partial pressure of the gas and the solubility of the gas.
- A gas will continue to dissolve into solution until equilibrium is reached.

The Partial Pressure of a Gas Determines Its Movement Between:

- The atmosphere and our lungs
- Our lungs and our blood
- Our blood and our cells
- As PO₂ ↓’s or PCO₂ ↑’s, it becomes harder to breath

What Happens When Altitude Changes?

- % of gas remains constant.
- The Partial pressures change.
  - Up a mountain: Partial Pressure drops which limits O₂ delivery to the blood (e.g. PO₂ = 104 mmHg)
  - Below sea level: Partial Pressure rises which increases O₂ delivery to the blood (e.g. PO₂ = 180 mmHg)