

Topic 5: Homeostasis

Materials Exchange

BIO110

Objectives

- Describe problems associated with materials exchange.
- Briefly describe
 - Circulation
 - Respiration
 - Digestion

Homeostasis

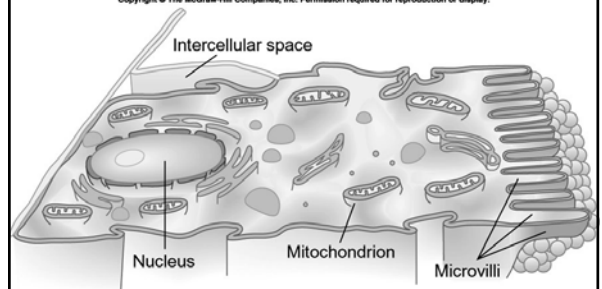
- Maintaining a stable internal environment
 - Materials exchange → Getting stuff in and out
 - Integration and control → rapid responses

Materials Exchange

- Cells require energy
 - They need the requirements for metabolism
 - Plants → Carbon Dioxide, Sunlight, Water
 - Plants & Animals → Oxygen, Sugars, Building blocks

Materials Exchange

- Diffusion is only effective at the membrane
 - Limits the size of a cell
 - This also means, if you have cells deep inside an organism, you need to be able to get the materials there!



Cells try to have as much surface area as possible.

Materials Exchange

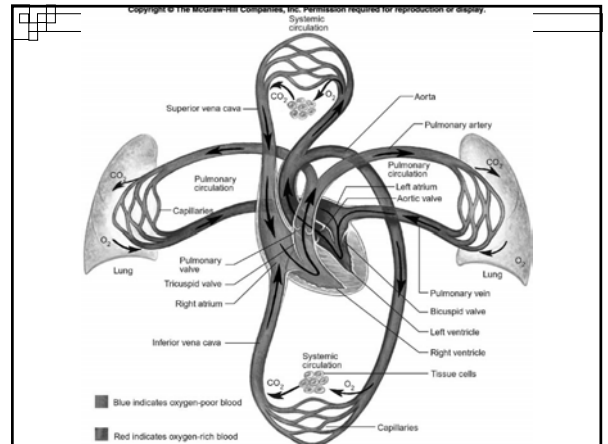
- Complex organisms have developed methods for transporting different nutrients
 - Gases → Respiratory System & Circulatory System
 - Food → Digestive System & Circulatory Systems

Circulatory System

- Goal → Use fluid (blood) to transport materials to target in the organism

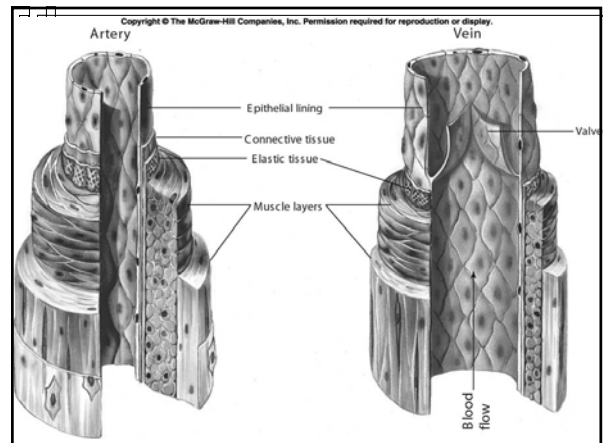
Composition of blood

- Blood is
 - 55% Plasma
 - Water
 - Proteins → Maintain osmotic levels
 - 45% Blood Cells
 - RBC
 - WBC
 - Platelets



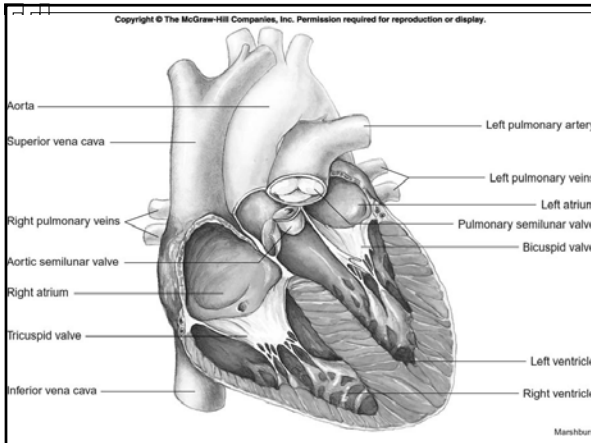
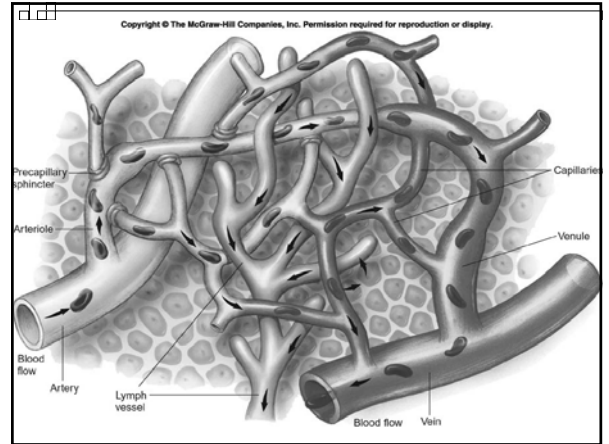
Flow of Blood

- Pulmonary Circuit
 - Heart → Lungs → Heart
 - Oxygenates Blood
- Systemic Circuit
 - Heart → Body → Heart
 - Delivers nutrients to tissues



Blood Vessels

- Arteries
 - Carry Blood away from the heart
 - Blood pressure
 - Very muscular
- Veins
 - Towards heart
 - Valves → No pressure



Heart

- 4 Chambers
 - Atria on Top
 - Ventricles on bottom

How does blood move?

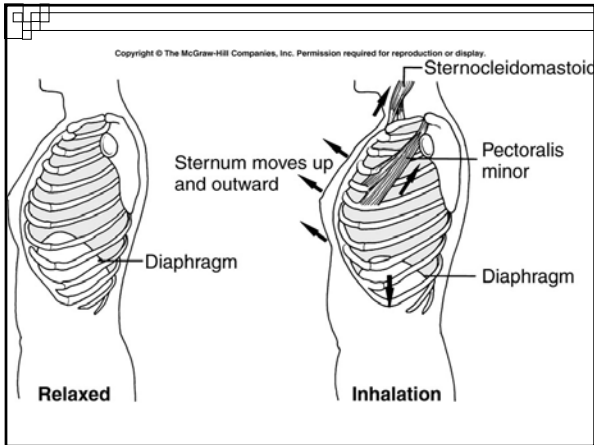
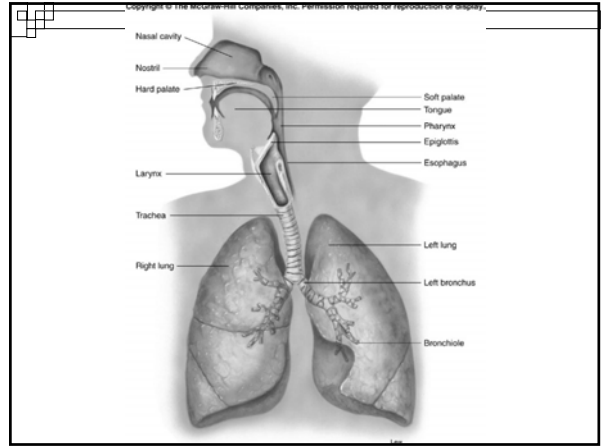
- Pressure differences (Diffusion)
- As ventricles contract
 - Heart has a much higher pressure than the rest of the body

Blood Pressure

- When ventricle contracts → Systolic Pressure
- During artery recoil → Diastolic

Respiratory System

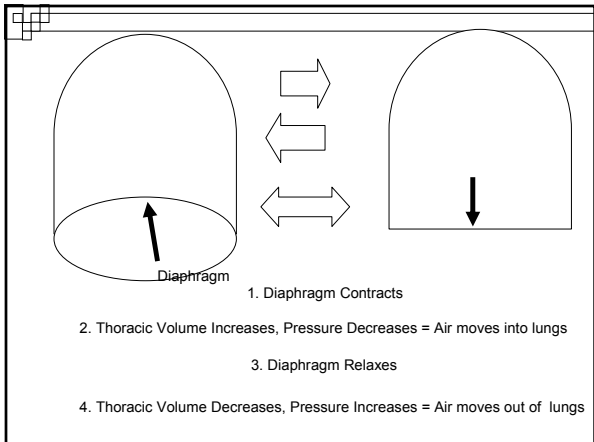
- Goal → Gas Exchange
 - Swap O₂ for CO₂
 - Where → Lungs



Gas Exchange

- Movement of air is based on creating pressure differences

$$\text{Pressure} \times \text{Volume} = \text{Constant}$$



Gas Exchange

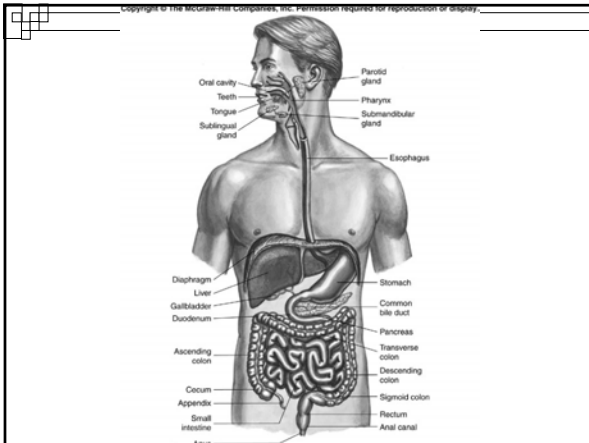
- What drives movement when gasses are in the lungs?

Nutrition

- Digestive System
- Goal → Uptake and processing of building blocks (Protein, Carbs, Fats, ...)

Digestive System

- Mechanical Processing
 - Physical Breakdown of food
- Chemical Processing
 - Use of enzymes or acids to break down food



Digestive System

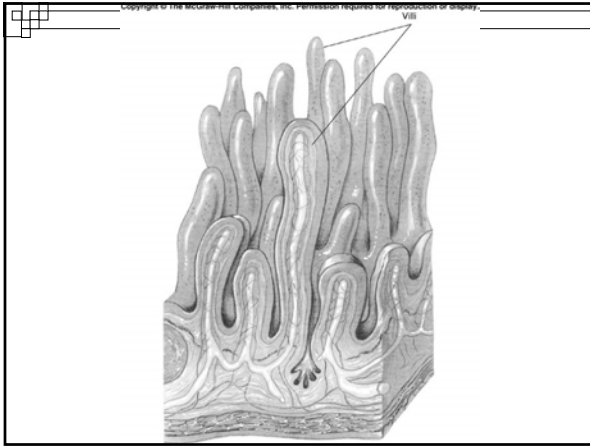
- Mouth
 - Mechanical Processing
 - Chemical Processing????

Digestive System

- Stomach
 - Chemical Processing
 - Physical Processing

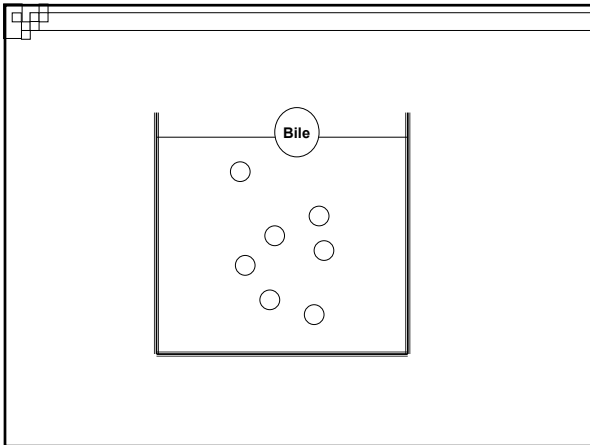
Digestive System

- Small Intestines
 - Chemical Processing
 - Absorption
- Large Intestines
 - Chemical Processing
 - Absorption



Digestive System

- Accessory Organs
 - Liver
 - Pancreas



Digestion

- Factors affecting absorption
 - SURFACE AREA
 - What is being absorbed?
 - Where is it being absorbed?