

Animal Systems

I. Digestive System

a. Process

i. Mouth

1. Salivary Amylase

- a. Digests starch

ii. Esophagus

iii. Stomach

1. Hydrochloric Acid (HCl)

- a. Digests proteins
- b. Creates a low pH environment for Pepsin

2. Pepsin

- a. Digests proteins

3. Food leaves stomach through **Pyloric Sphincter** (valve) as "Chyme"

iv. Small Intestine

1. More digestion

v. Pancreas

1. Secretes various substances into the Small Intestine

a. Pancreatic Amylase

- i. Digests carbohydrates

b. Pancreatic Lipase

- i. Digests lipids

c. Trypsin

- i. Digests proteins

d. Chymo-trypsin

- i. Digests proteins

vi. Liver

1. Produces **Bile**

2. Sends **Bile** to the Gall Bladder

vii. Gall Bladder

1. Stores **Bile**

2. Secretes **Bile** into the Small Intestine

viii. Small Intestine

1. **Bile**

- a. Emulsifies (breaks into smaller pieces) fats

2. **Microvilli (villi)**

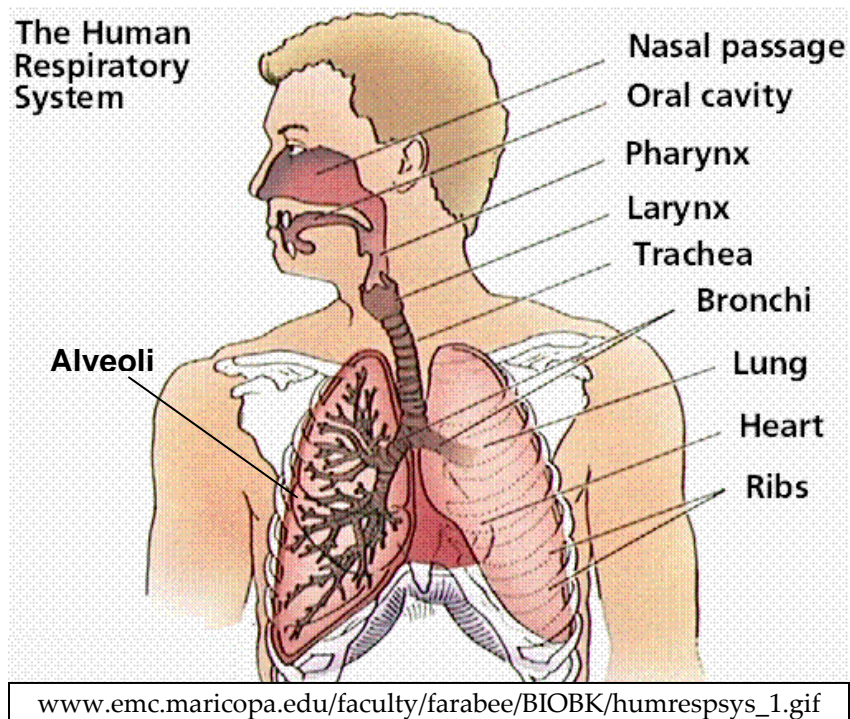
- a. Small hair like projections in the small intestine

- b. Provide surface area to absorb nutrients from the small intestine
 - ix. Large Intestine (colon)
 - 1. **Symbiotic Bacteria**
 - a. Mutualism
 - b. Bacteria get food
 - c. Bacteria produce Vitamin K
 - 2. Water re-absorption
 - b. Ruminants: Cattle, Sheep, etc.
 - i. 4-chambered stomach
 - 1. **Anaerobic Bacteria**
 - a. Digest cellulose and break it down into usable form for the ruminants
 - i. CO₂ + Methane
 - b. 1 cow → 400 Liters of Methane in 1 day
- c. Insulin-Glucagon
 - i. Pancreas
 - 1. **Insulin:** Helps sugar enter cells from the blood
 - a. Used when there is high blood sugar
 - 2. **Glucagon:** Helps break down Glycogen in the Liver and releases sugar into the blood
 - a. Used when there is low blood sugar

II. Body Temperature Regulation

- a. Homeotherms: Keep a constant body temperature
- b. Poikilotherms: Varying body temperatures depending on the environment
- c. Heterotherms: Sometimes change temperature and sometimes do not
- d. Ectotherm: Use environment to regulate body temperature
- e. Endotherm: Heat from body metabolism
- f. Counter-current Exchange: Blood that goes down is near the blood that is coming up → heat stays in the blood → conservation of heat

III. Respiratory System (Animals)

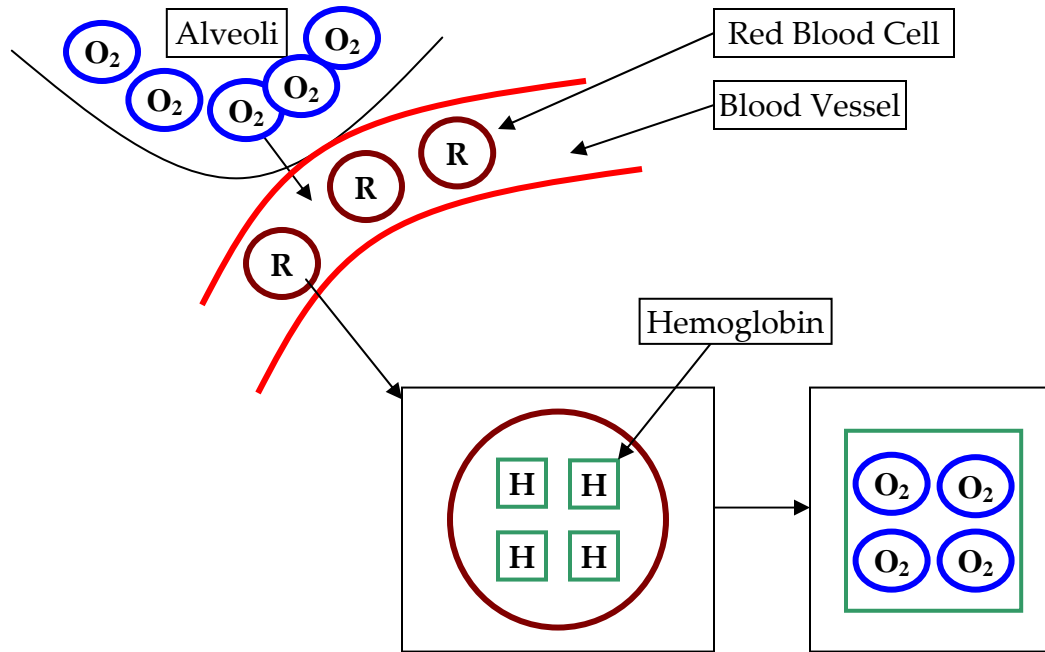


a. Diaphragm:

- i. Contracts → pulls down → expands cavity → air comes in

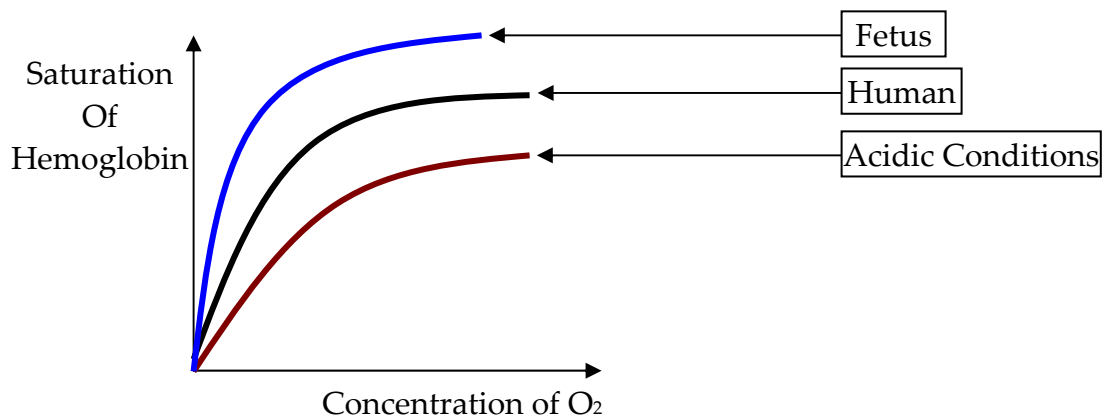
b. Alveoli:

- i. Large surface area
- ii. Increases surface area
- iii. Allows gas exchange



iv. Oxygen transport

- 1. O_2 diffuses into Blood Vessel from the Alveoli
- 2. O_2 enters Red Blood Cell
- 3. 4 O_2 attach onto each Hemoglobin in the Red Blood Cells
- 4. Binding Curve



- c. Recycle
 - i. Cells receive O₂
 - ii. Cells use O₂
 - iii. Cells produce CO₂
 - 1. → enters Capillaries
 - iv. CO₂ enters a Red Blood Cell
 - 1. **Carbonic Anhydrase** converts CO₂ to HCO₃⁻
 - v. HCO₃⁻ is sent out into the blood stream
 - vi. A Small amount of HCO₃⁻ remains in the Red Blood Cell
 - vii. ***
 - viii. HCO₃⁻ will re-enter a Red Blood Cell
 - ix. HCO₃⁻ will be re-converted into CO₂
 - x. CO₂ will enter the Alveoli in the Lungs
 - xi. The Alveoli will convert the CO₂ into O₂

IV. Respiratory System (Insects)

- a. Spiracles: Holes in the body surface
- b. Trachea: Tubes in the body connected to the spiracles
 - i. O₂ diffuses
 - 1. from the atmosphere
 - 2. into the spiracles
 - 3. through the trachea
 - 4. to the cell

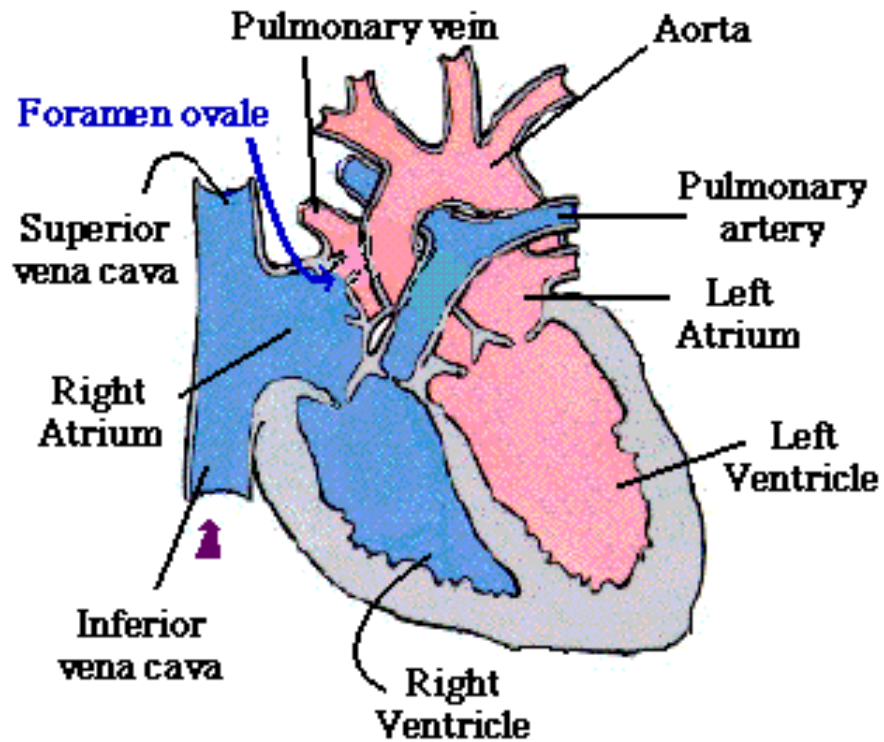
V. Respiratory System (Annelids and Cnidarians)

- a. Through Body Surface

VI. Circulatory System

- a. Open
 - i. Blood cells do not stay in blood vessels
 - ii. Slow circulatory system
 - iii. i.e. Insect
- b. Closed
 - i. Blood cells stay in blood vessels
 - ii. Faster circulatory system
 - iii. i.e. Mammals

iv. Closed Human Heart

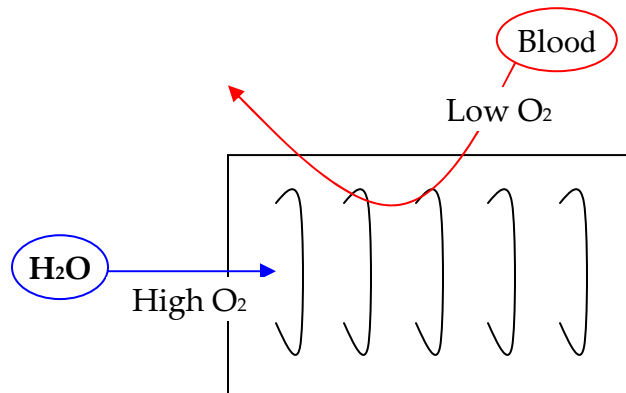


<http://www.wellesley.edu/Biology/Courses/111/ForOval.gif>

v. Cycle

1. Deoxygenated blood from the **Body** enters the heart through the **Vena Cavas**
2. Deoxygenated blood enters the **Right Atrium**
3. Deoxygenated blood enters the **Right Ventricle**
4. Deoxygenated blood enters the **Lungs** through the **Pulmonary Artery**
5. Blood is Oxygenated in the **Lungs**
6. Oxygenated blood leaves the **Lungs** through the **Pulmonary Vein** and enters the **Left Atrium**
7. Oxygenated blood enters the **Left Ventricle**
8. Oxygenated blood enters the **Body** through the **Aorta** from the **Left Ventricle**

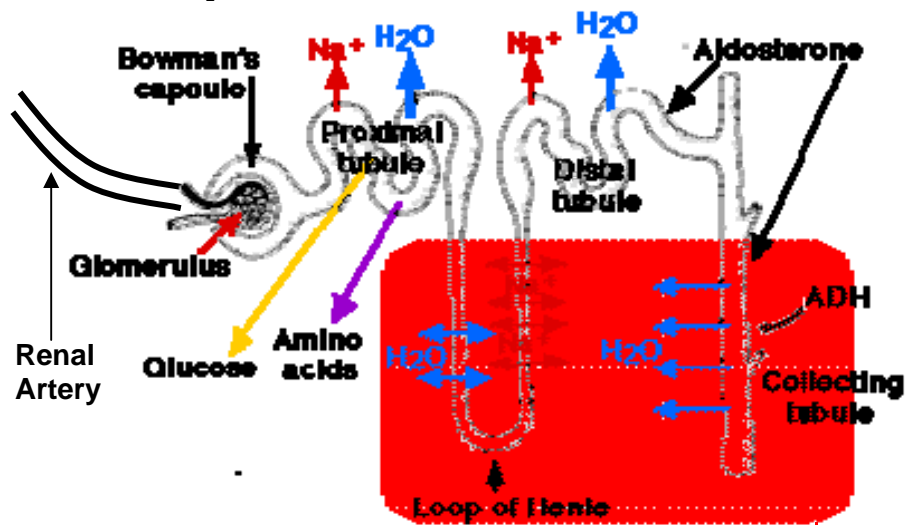
- c. Fish Circulation
 - i. Countercurrent Exchange
 1. O_2 diffuses from H_2O into Blood



VII. Excretory System

- a. Process of getting rid of Nitrogenous wastes
- b. Ammonia: Breakdown of amino acids and nucleic acids
 - i. Toxic at high concentrations
- c. Land Animals
 - i. Dilute Ammonia
 1. Urea
 2. Uric Acid
- d. Platyhelminthes (Flatworms)
 - i. Protonephridia
 - ii. Flame cells
 1. Cilia lead waste out of the body surface
- e. Annelids (Earthworms)
 - i. Metanephridia
- f. Insects
 - i. Malphigian Tubules
 1. Pump out salts and Uric Acid
 2. H_2O flows by Osmosis
 3. Salt moves back
 4. Uric Acid is left

- g. Humans
 - i. Kidney
 - 1. Nephron



users.rcn.com/jkimball.ma.ultranet/BiologyPages/K/Kidney.html

- a. H₂O enters and leaves **Loop of Henle** through Osmosis
- b. → Concentrated Urine
- c. **Distal Tubule**
 - i. **Aldosterone**
 - 1. Causes more salt re-absorption
 - 2. More H₂O follows the salt
- d. **Collecting Duct**
 - i. End of the tube
 - ii. **Anti-diuretic Hormone (ADH) (Vasopressin)**
 - 1. Causes H₂O to be reabsorbed out of the **Collecting Duct** and into the **Body**
 - iii. **Collecting Duct** leads urine to the bladder

VIII. Reproductive System

a. Female Anatomy

- i. Ovaries: Where eggs are produced
- ii. Fallopian Tube: Delivers egg to the uterus
- iii. Cervix: End of the vagina
- iv. Vagina: Site of sperm entrance and birth canal

b. Male Anatomy

- i. Testes: Where sperm and testosterone are produced
- ii. Vas Deferens: Delivers sperm to the urethra
- iii. Prostate Gland: Produce nutrients and alkaline solutions to help the sperm survive
- iv. Cowper's Gland: Produce nutrients and alkaline solutions to help the sperm survive

c. Menstrual Cycle

i. Day 1 – Day 4

- 1. Bleeding

ii. Anterior Pituitary Gland

1. Follicle Stimulating Hormone (FSH)

- a. Stimulates follicle (immature egg) growth
- b. Follicle starts producing **Estrogen**
- c. **Estrogen** goes to the Pituitary Gland
 - i. Causes **Lutenizing Hormone (LH)** to be produced

iii. Day 14

iv. Surge in LH causes **Ovulation**

- 1. Egg released from the ovary
- 2. Remainder of the Follicle: **Corpus Luteum**
 - a. Helper cells
 - b. Secretes **Estrogen** and **Progesterone**
 - i. Act on **Uterus** to build wall
- 3. Fertilized Egg
 - a. Secretes **Human Chorionic Gonadotropin (HCG)**
 - b. Signal to **Corpus Luteum** to produce more **Estrogen** and **Progesterone**
- 4. Unfertilized Egg
 - a. No **HCG**
 - b. Signal to **Corpus Luteum** to stop producing **Estrogen** and **Progesterone**
 - c. **Menstruation** occurs

d. Basic Development

- i. **Fertilization**
 - 1. Sperm and Egg come together to form a diploid cell (**Zygote**)
- ii. **Cleavage**
 - 1. Cells in the **Zygote** continue to divide
- iii. **Blastulation**
 - 1. Food filled cavity (**Blastocoel**) is formed in the **Zygote**
- iv. **Gastulation**
 - 1. Mouth and anus begin to form
 - 2. Layers form
 - a. **Ectoderm:** Skin, Nervous System, Eyes
 - b. **Mesoderm:** Bones, Muscles, Excretory System, Circulatory System
 - c. **Endoderm:** Pancreas, Gallbladder, Lining of the Gut
- v. **Neurulation**
 - 1. Cells divide in the **Neural Plate**
 - a. **Notochord:** Vertebrate Column, Skeletal System
 - b. **Neural Tube:** Spinal chord, Brain, Peripheral Nervous System