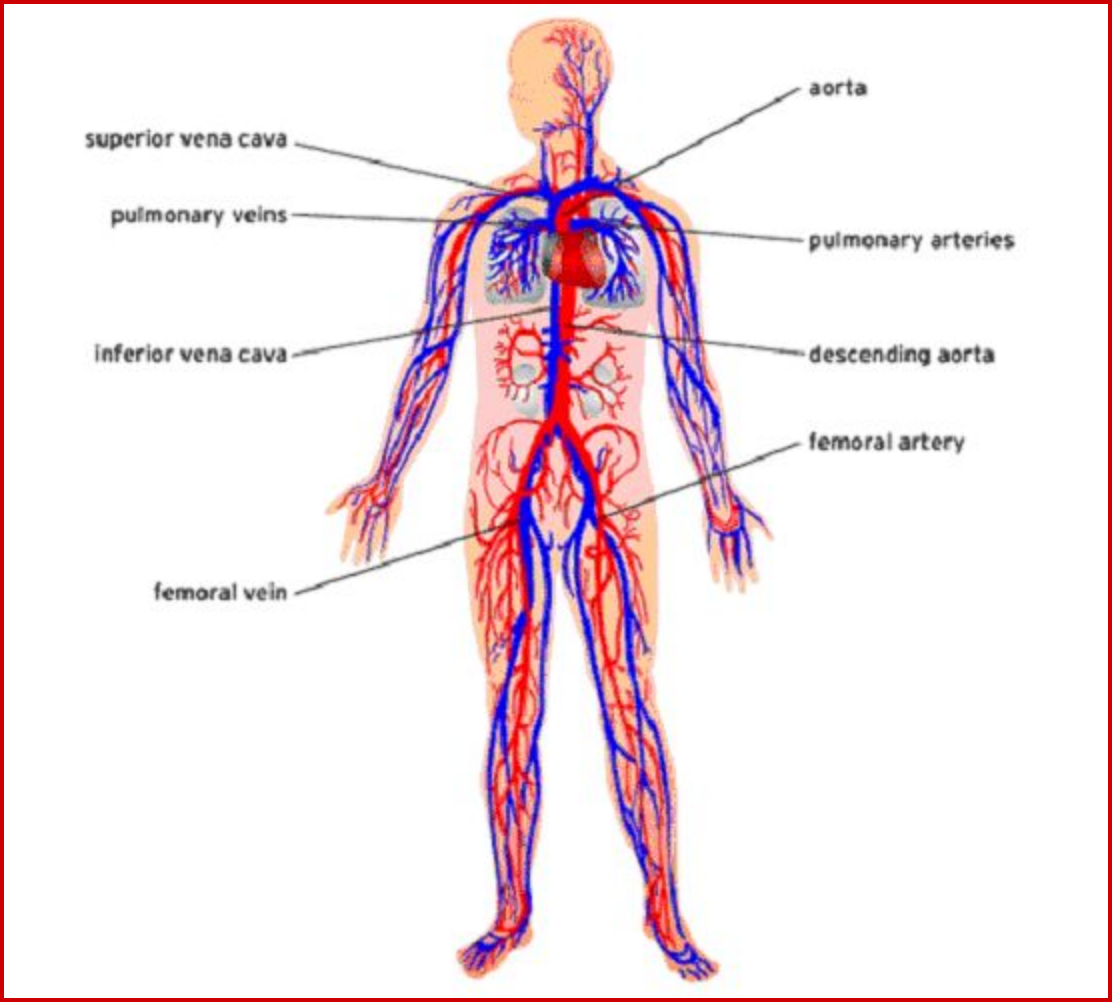
Circulatory System

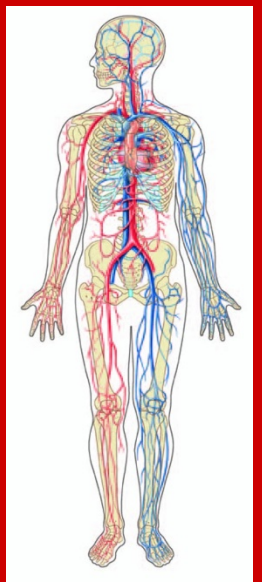


Function of circulatory system

- To carry **nutrients** to all body cells
  - E.g. glucose, amino acids, oxygen
- To carry **wastes** away from all body cells
  - E.g. ammonia, carbon dioxide
- Circulating fluid called blood flows through flexible pipe-like structures called vessels and organ(s) to move the blood

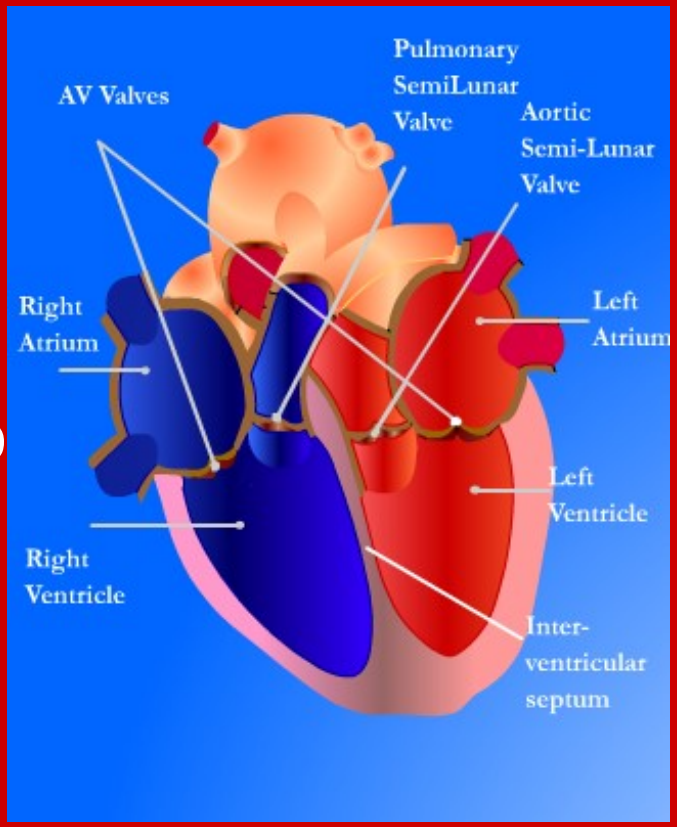
Human Circulatory System

- Consists of
  - **Heart-**Pumps the blood
  - **Blood vessel-** conduits through which blood flows
  - **Blood**-substance which carries the materials being transported.



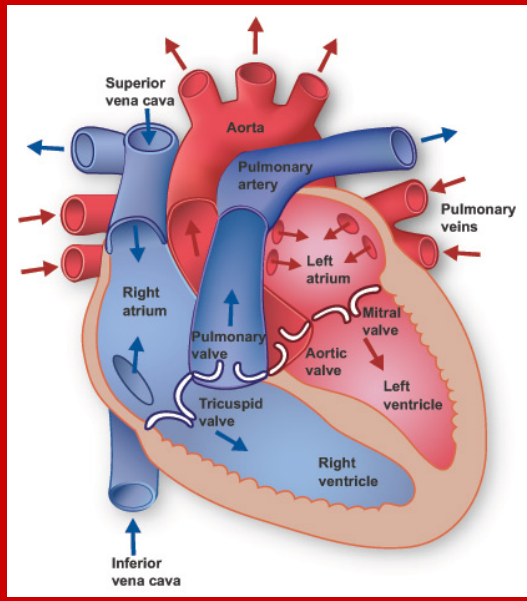
Heart

- Located near center of your chest
- Hollow organ approximately the size of your clenched fist
- 4 chambers
  - **Atrium**: upper chambers of the heart
    - Receives blood
  - **Ventricle**: lower chambers o the heart
    - Pumps blood



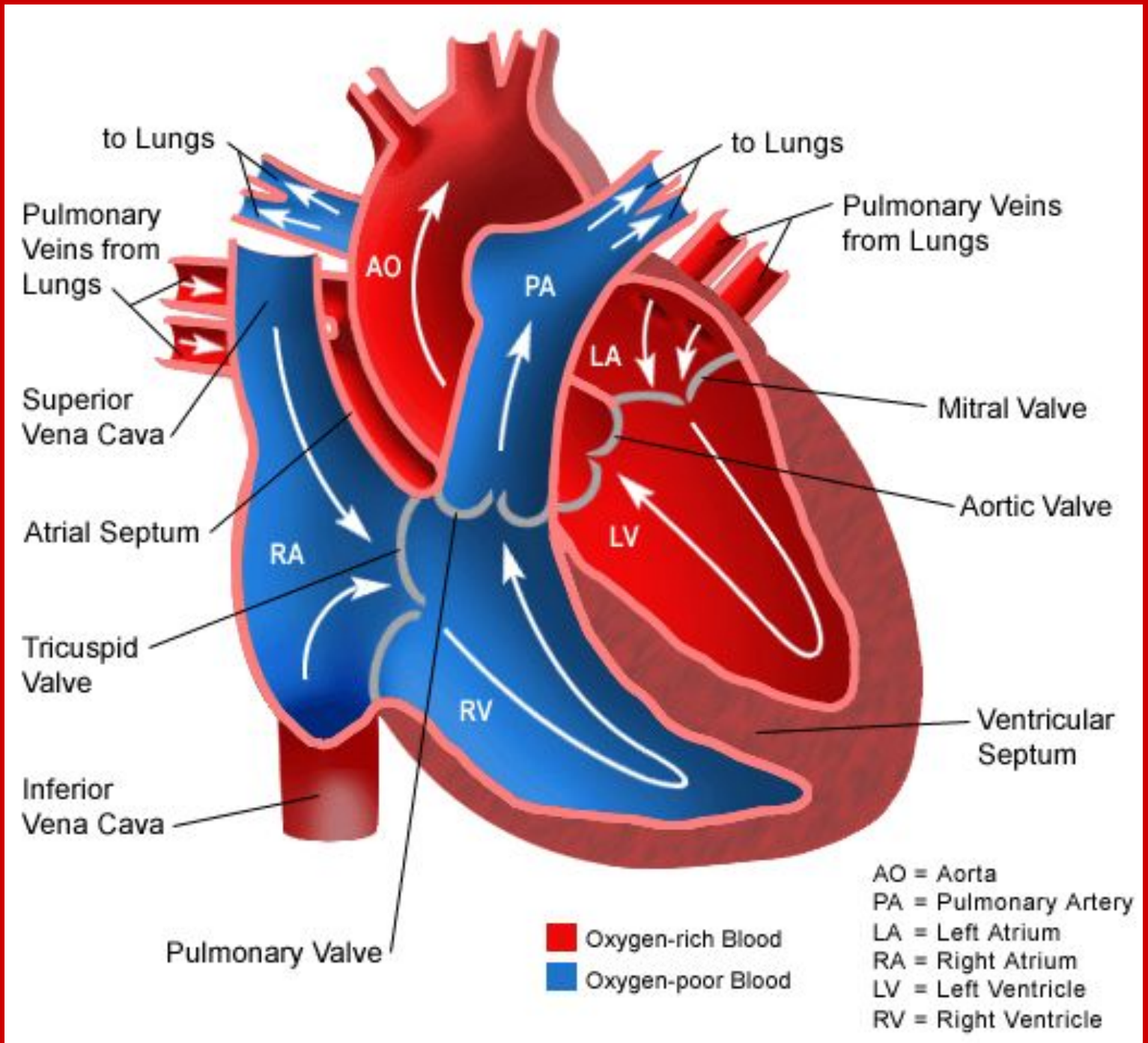
Cardiac Circulation

- Heart functions as two separate pumps



- Right side pumps blood from the heart to the lungs (**pulmonary circulation**)
  - In lungs CO_2 leaves blood and O_2 is absorbed

- Left side pumps blood from the heart to the rest of the body (**systemic circulation**)


to Lungs
to Lungs
Pulmonary Veins from Lungs
Pulmonary Veins from Lungs
AO
PA
LA
Superior Vena Cava
Mitral Valve
Aortic Valve
Atrial Septum
RA
LV
Tricuspid Valve
RV
Ventricular Septum
Inferior Vena Cava
Pulmonary Valve
Oxygen-rich Blood
Oxygen-poor Blood
AO = Aorta
PA = Pulmonary Artery
LA = Left Atrium
RA = Right Atrium
LV = Left Ventricle
RV = Right Ventricle

Blood Vessels

- 3 types of blood vessels
  - **Arteries**
  - **Veins**
  - **Capillaries**

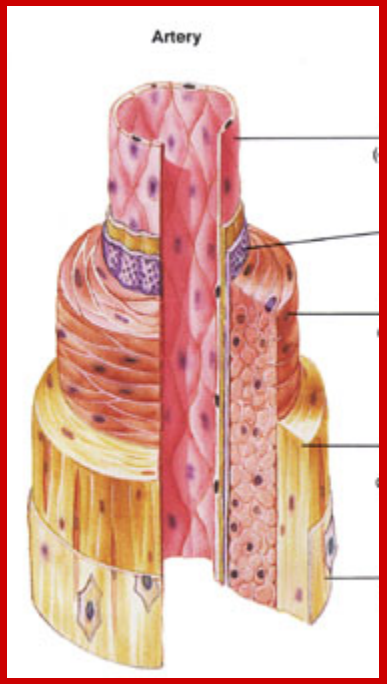
Arteries

Carry blood **away** from the heart

-except for the pulmonary arteries all arteries carry **oxygen rich blood**

-thick walls that help withstand pressure produced when heart contracts and pushes blood

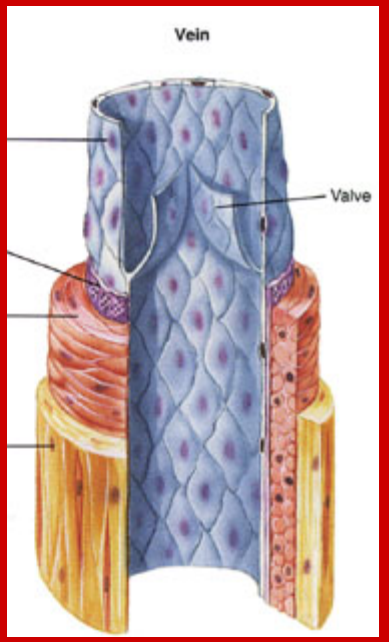
-artery walls contain connective tissue, smooth muscle and endothelium



Veins

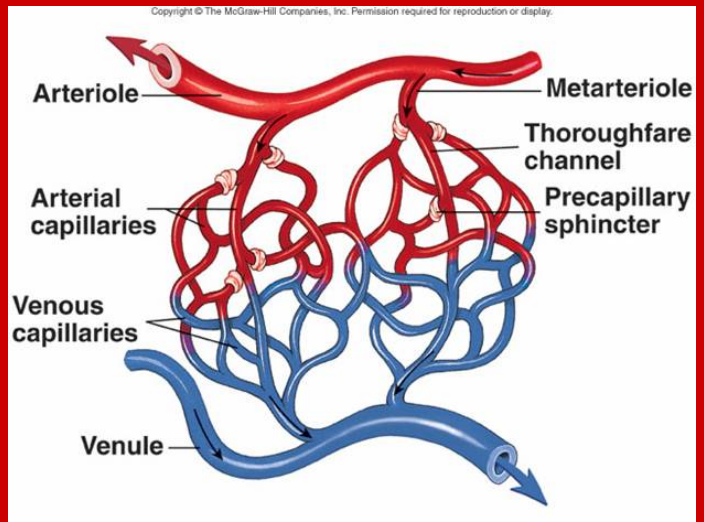
- Carry blood **<u>toward</u>** heart
- Carry **oxygen-poor blood**
- Walls contain connective tissue and smooth muscle
- Valves in vein to keep blood moving toward heart
  - Many veins located near skeletal muscles

  (contractions help push blood thru veins)



Capillaries

- **<u>Connect</u>** arteries and veins
- Smallest of blood vessels
- Walls only one cell thick
- **Very narrow** □ blood cells must pass thru single file
- Where gases are passed to/from tissues



Blood Pressure

- Typical blood pressure **120/80**

- Blood pressure **regulated** 2 ways:
  1. Neurotransmitters cause smooth muscles in blood vessels to contract or relax
  2. Kidneys remove water from blood when blood pressure is too high

     (this reduces blood volume and lowers blood pressure)

Diseases of the Circulatory System

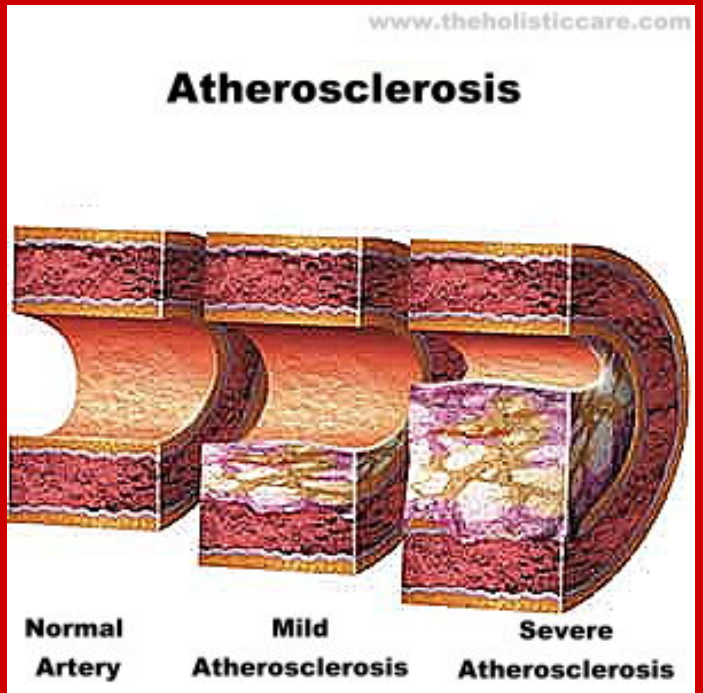
- Called **cardiovascular diseases**
- Heart disease and stroke are leading causes of death and disability in US
- Main causes of heart disease

Diseases

- High blood pressure
  - **Hypertension**
  - Forces the heart to work harder, may weaken or damage the heart muscle and blood vessels
  - More likely to develop coronary heart disease
  - Increases the risk of heart attack or stroke

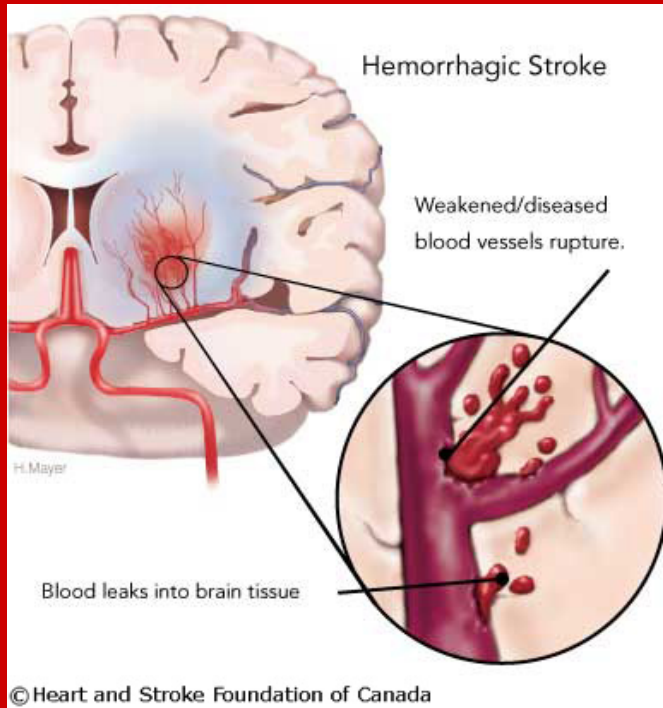
Diseases

- **Atherosclerosis**
  - Fatty deposits called plaque build up on inner walls of arteries
  - Blocked artery can die from lack of oxygen
  - If enough heart muscle is damaged = heart attack



Diseases

- **Heart Disease**
  - Narrowing of blood vessels around the heart, which can lead to:
- **Heart attack**
  - symptoms include nausea, shortness of breath, and severe crushing chest pain
- Blood clots can form as result of **atherosclerosis**, can travel to brain and cause stroke
  - Brain cells die from lack of oxygen and brain function in that region may be lost

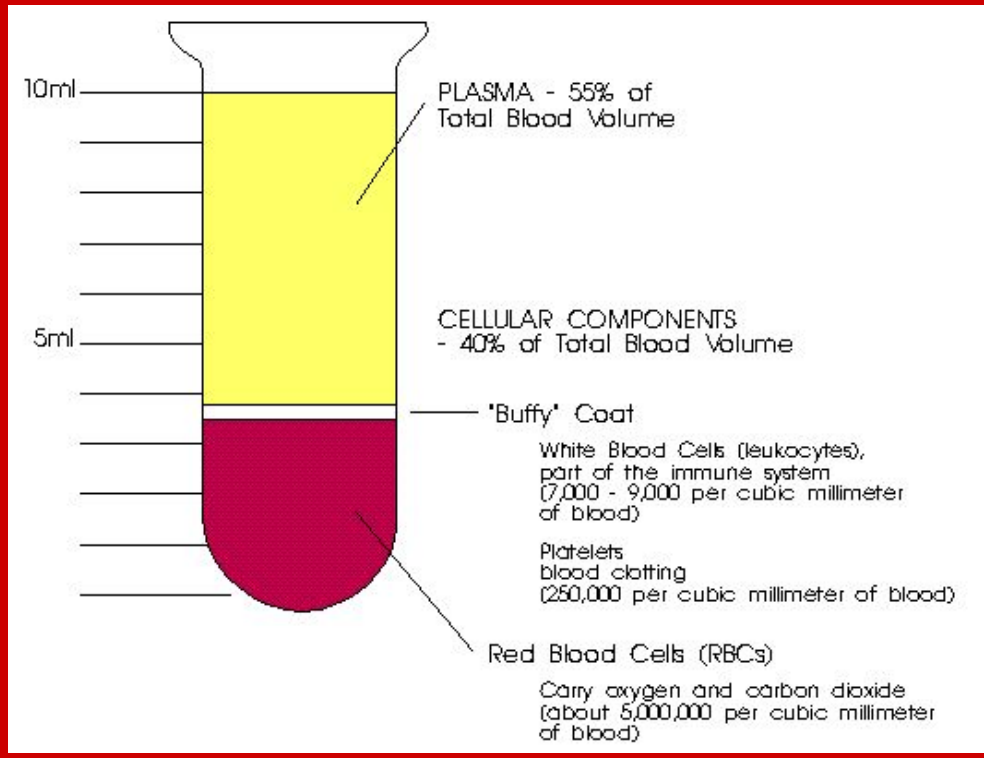


Preventing Disease

- Getting **regular exercise**
- Eating a balanced diet
- **Not smoking**

Blood

- Human body contains 4-6 liters of blood (8% of total mass of body)
- Consists of solids and liquids
  - **Red Blood Cells**
  - **White Blood Cells**
  - **Platelets**
  - 55% of volume of blood is straw-colored fluid called plasma



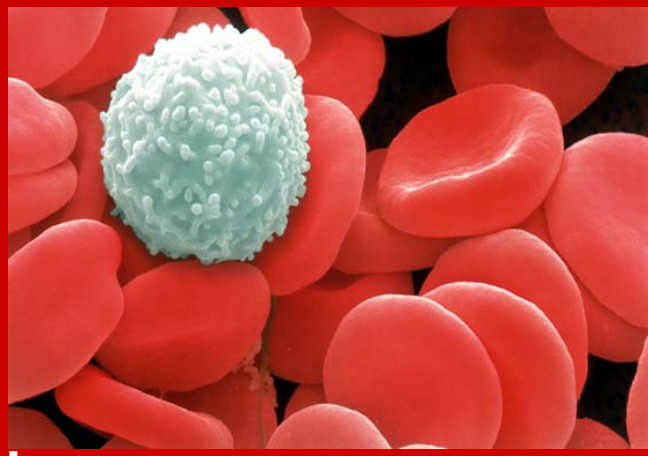
Plasma

- About 90% water
- 10% dissolved gases, salts, nutrients, enzymes, hormones, waste products and plasma proteins
- Plasma proteins divided into 3 groups
  1. **Albumins**
  2. **Globulins**
  3. **Fibrinogen**

Red Blood Cells

- AKA **erythrocytes**
- Most numerous cells in blood
- Transport oxygen
- Get their color from **hemoglobin**
  - Hemoglobin is iron-containing protein that binds with oxygen
- Shaped like round plates which are indented in center

White Blood Cells



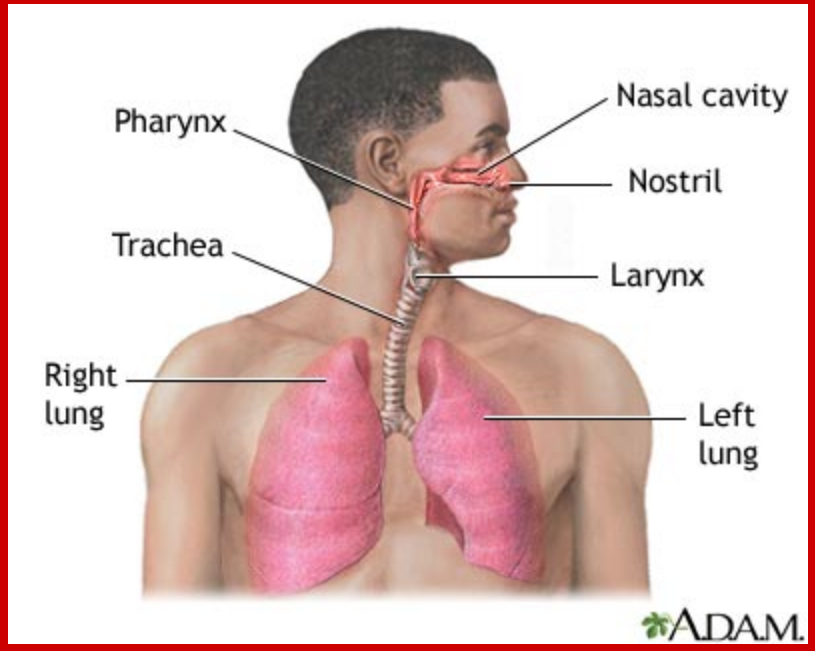
- AKA **leukocytes**
- Do not contain hemoglobin
- Much less number than RBC's (outnumbered 1000 to 1)
- Produced from cells in bone marrow
- Fight disease by finding pathogens
- May live for days, months, or even years

Platelets

- Blood has the ability to form a clot because of platelets
- **Blood Clotting**
  1. Break in capillary wall
  2. Clumping of platelets
  3. Clot forms to prevent further loss of blood

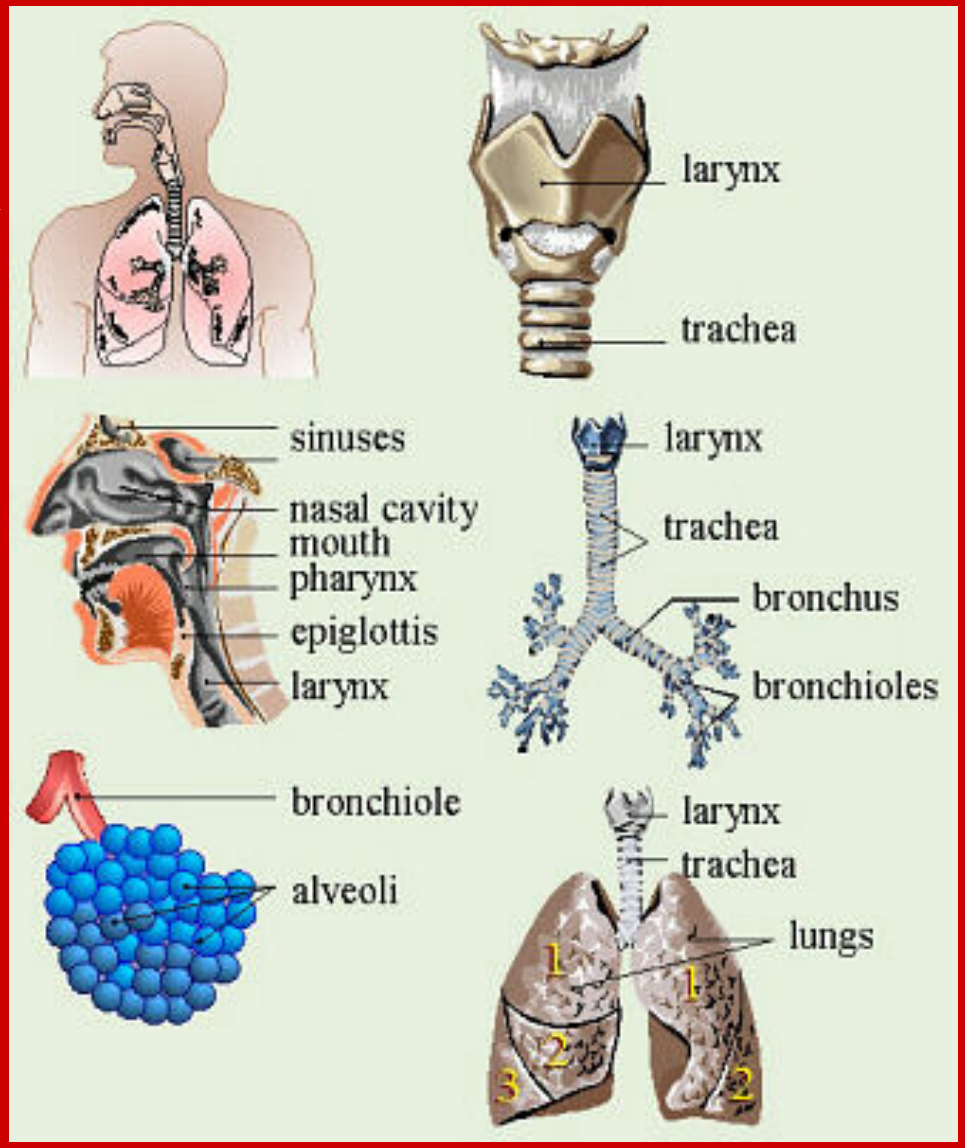
Respiratory System

Basic Function is to **exchange oxygen and carbon dioxide** between blood, air and tissue



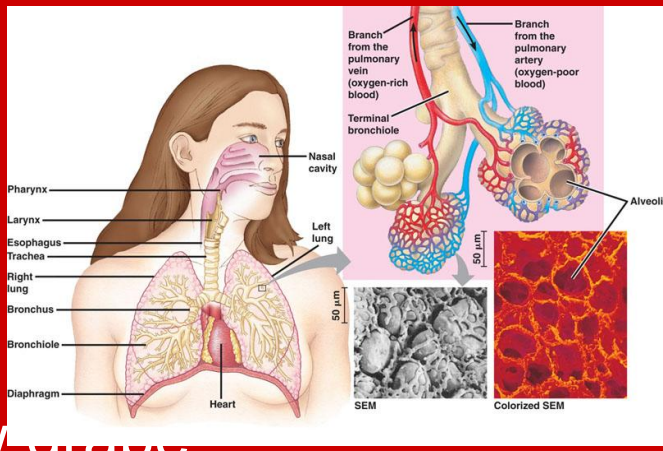
Respiratory System

- Consists of:
  - **Nose/Nasal Cavity**
  - Pharynx
  - **Larynx**
  - Trachea
  - Bronchi
  - **Lungs**



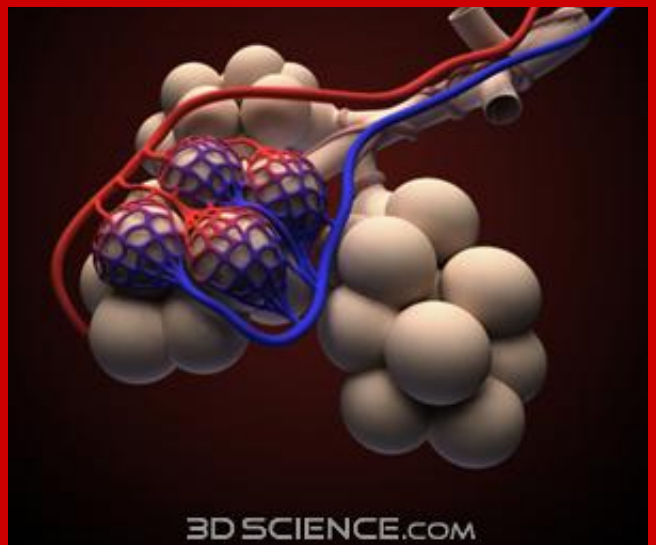
Pathway of Air into the Body

- From Nose/Nasal Cavity
  - Warms air and strains out dust and particles
- To the Pharynx
- To Larynx
  - Contains vocal cords and is opening of the:
- To Trachea
  - Windpipe that travels to the lungs
- To Bronchi
  - Branches in two, one for each:
- To Lung
  - Contains **alveoli**, which are like hollow grape clusters
    - Alveoli are moist, and this is where O_2 diffuses in, and CO_2 diffuses out



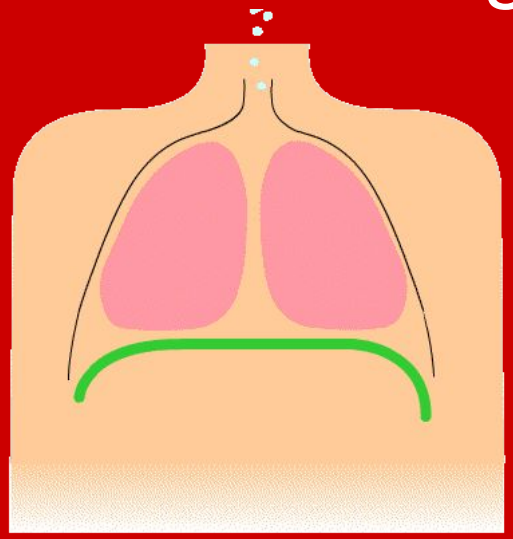
Alveoli

- 150 million in each lung
- Site of **gas exchange**
  - Oxygen in, carbon dioxide out
  - Carried out by diffusion
- Each is surrounded by capillaries



Breathing

- Takes ENERGY!
- Lungs are sealed in airtight sacs
- The **diaphragm**, a smooth muscle located beneath the lungs, expands and contracts
- This puts pressure on the lungs and forces air in and out



Tobacco and Respiratory System

- **Nicotine** is stimulant drug that increases the heart rate and blood pressure
- Carbon monoxide is poisonous gas that blocks the transport of oxygen by hemoglobin
- Tar contains compounds shown to cause cancer

Tobacco and Respiratory System

- Effects:
  - **Nicotine** and **carbon monoxide** paralyze cilia
  - Particles stick to walls of respiratory tract or enter lungs
  - Without cilia to sweep it away, mucus becomes trapped in airways (smoker's cough)
  - Also causes lining of respiratory tract to swell reduces air flow to alveoli

Healthy Lung

Smoker's Lung

Diseases

- Smoking reduces **life expectancy**
- **Bronchitis**-constricting of bronchi
- **Emphysema** (loss of elasticity in tissue of lungs)
- **Lung Cancer** (easily spreads to other parts of the body)
  - 160,000 people diagnosed each year in US
  - Most die in 5 years