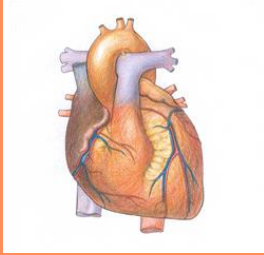
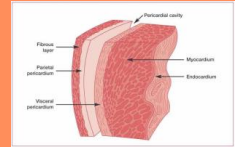
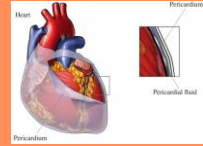


Cardiovascular System



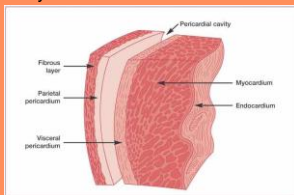
I. Structure of the Heart

- A. Average adult heart is 14 cm long and 9 cm wide.
- B. Lies in the **mediastinum**.
- C. Enclosed in the **pericardium**.
 1. **Fibrous pericardium**- Outer, tough connective tissue.
 2. **Visceral pericardium (epicardium)**- Inner, delicate layer, folds to become;
 - a) The **parietal pericardium** that lines the fibrous pericardium.
 - b) Between parietal and visceral pericardia is the **pericardial cavity** (serous fluid)



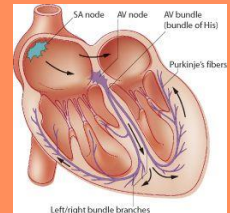
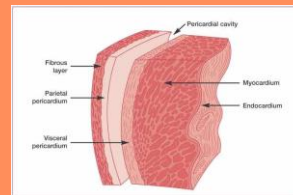
II. Wall of the Heart

- A. **Epicardium** (visceral pericardium)
 1. Connective tissue and epithelium.
 2. Houses blood and lymph capillaries, coronary arteries and veins.
- B. **Myocardium** (middle layer)
 1. Consists of cardiac muscle.
 2. Thickest layer of the heart wall.



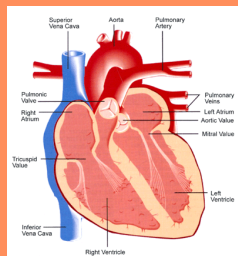
II. Wall of the Heart

- C. **Endocardium** (inner layer)
 1. Smooth and is made up of connective tissue and epithelium.
 2. Continuous with the endothelium of major vessels joining the heart.
 3. Houses **Purkinje fibers**.



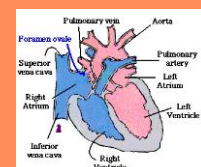
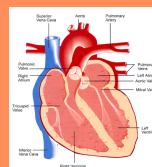
III. Heart Chambers (4)

- A. Two atria on top.
 1. **Atria** receive blood returning to the heart.
 2. Have thin walls.
 3. Ear-like auricles project from their exterior.
- B. Two **ventricles** below.
 1. Thick-muscled.
 2. Pump blood to the body.



III. Heart Chambers (4)

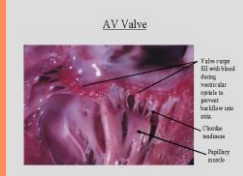
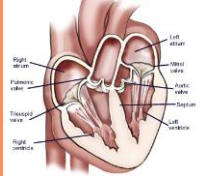
- C. A thick septum divides the right side from the left.
- D. The right ventricle has a thinner wall than does the left ventricle.
 1. Right pumps blood only to lungs.
 2. Left pumps to the entire body.
- E. The left atrium receives blood from four pulmonary veins.
- F. Blood never mixes in heart (except in fetus).



IV. Valves (4)

A. Atrioventricular (A-V) valves (2)

1. **Tricuspid valve** (right).
2. **Bicuspid or mitral valve** (left).
3. Have cusps to which **chordae tendinae** attach.
4. Chordae tendinae
 - a) Attached to **papillary muscles**.
 - b) Pull valves shut
 - c) Prevent the backflow of blood through valves.



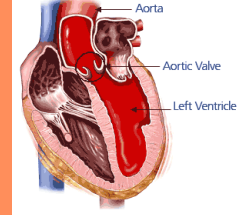
IV. Valves (4)

B. Pulmonary Valve

1. At the base of the pulmonary trunk
2. Prevents return of blood to the right ventricle.

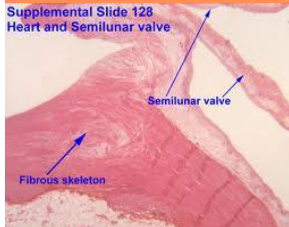
C. Aortic Valve

1. At base of aorta
2. Prevents return of blood to the left ventricle.



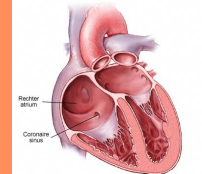
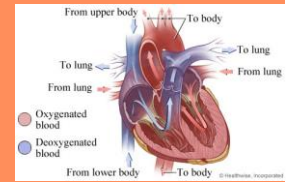
V. Skeleton of the Heart

- A. Rings of dense connective tissue.
- B. Surround each valve.
- C. Prevent dilating of tissue in this area.



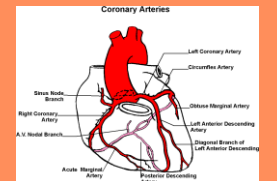
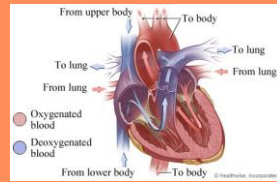
VI. Path of Blood through the Heart

- A. Blood returns to the right atrium via;
 1. Inferior and superior **venae cavae**
 2. **Coronary sinus**.
- B. Right atrium contracts
 1. Forces blood through the tricuspid valve
 2. Into the right ventricle.
- C. Right ventricle contracts
 1. Closes the tricuspid valve
 2. Forces blood through the pulmonary valve
 3. Into the pulmonary trunk
- D. Pulmonary arteries carry blood to the lungs.



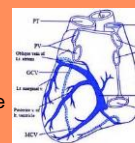
VI. Path of Blood through the Heart

- E. Blood returns to the left atrium via the pulmonary veins.
- F. Left atrium contracts
 1. Forces blood through the left bicuspid valve
 2. Into the left ventricle.
- G. Left ventricle contracts
 1. Closes the bicuspid valve
 2. Force blood through the aortic valve
 3. Into the coronary artery
 4. Aortic blood goes to body.



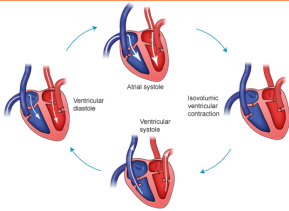
VII. Blood Supply to the Heart

- A. **Coronary Arteries**
 1. The first branches off of the aorta
 2. Right and left branches feed the heart muscle.
- B. **Anastomoses**
 1. Connections between smaller branches of the arteries
 2. Alternate pathways for blood should one pathway become blocked.
- C. **Cardiac veins**
 1. Drain blood from the heart muscle
 2. Carry it to the **coronary sinus**, which empties into the right atrium.



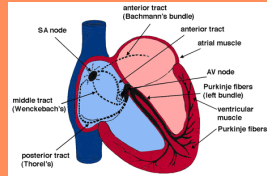
VIII. Heart Sounds

- A. Vibrations in heart tissues
- B. Due to blood rapidly changing velocity within the heart.
- C. Described as a "lub-dup" sound.
 1. "lub" as ventricles contract and A-V valves are closing.
 2. "dup" as ventricles relax and aortic and pulmonary valves are closing.



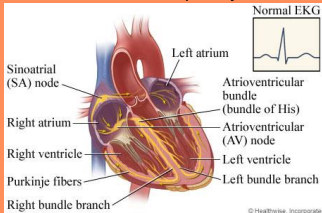
IX. Cardiac Conduction System

- A. **Sinoatrial node (S-A node or pacemaker)**
 1. Self-exciting mass of specialized muscle.
 2. On the posterior right atrium.
 3. Generates the impulses for the heartbeat.
- B. **Cardiac Muscle Fibers**
 1. Fibers that act as a unit.
 2. One exists in the atria (**atrial syncytium**).
 3. One in the ventricles (**ventricular syncytium**).



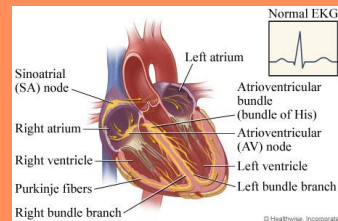
X. Electrical Conduction

- A. S-A impulses spread through the atrial syncytium.
- B. Atria contract.
- C. Impulses travels through **junctional fibers**.
- D. Into **atrioventricular node (A-V node)**
 1. In the interatrial septum.
 2. Ensures atria contract completely.



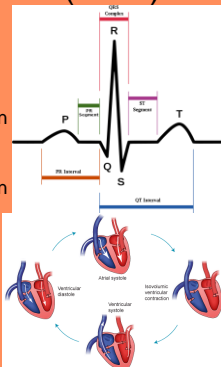
X. Electrical Conduction

- E. Impulse passes through A-V bundle (**bundle of His**) located in the interventricular septum.
- F. Impulse spreads over the ventricles and through Purkinje fibers.
- G. **Purkinje fibers** stimulate contraction of the papillary muscles.



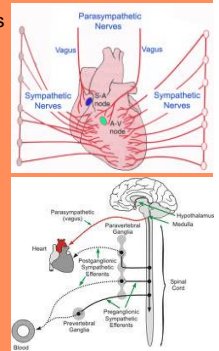
XI. Electrocardiogram (ECG)

- A. Recording of the electrical changes during a cardiac cycle.
- B. **P wave**
 1. The first wave
 2. Corresponds to the depolarization of the atria.
- C. **QRS complex**
 1. Corresponds to the depolarization of ventricles
 2. Hides the repolarization of atria.
- D. **T wave**
 1. Ends the ECG pattern.
 2. Corresponds to ventricular repolarization.



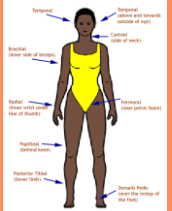
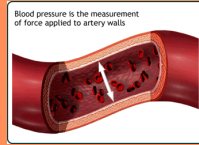
XII. Regulation of the Cardiac Cycle

- A. Pumping adjusts to the current needs of the body.
- B. The CNS controls heart rate.
 1. S-A node is innervated by sympathetic and parasympathetic divisions
 - a) Sympathetic speeds up.
 - b) Parasympathetic slows down.
 2. Medulla oblongata regulates the divisions.
 3. Cerebrum and hypothalamus also influence heart rate.
 4. Body temperature and the concentrations of certain ions affect heart rate.



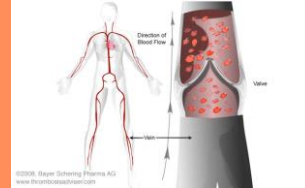
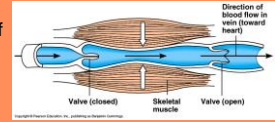
XIII. Blood Pressure

- A. Force of blood against the inner walls of blood vessels.
- B. Arterial Blood Pressure
 1. **Systolic**- Ventricular contraction, arterial pressure is at its highest.
 2. **Diastolic**- Ventricles are relaxing, arterial pressure is at its lowest (**pressure**).
 3. **Pulse**- Body points where the surge of blood can be felt.



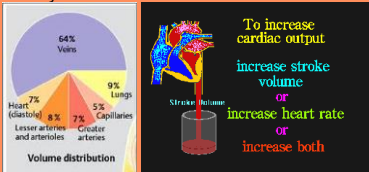
XIII. Blood Pressure

- C. Venous Blood Flow
 1. Some pressure as result of heart action.
 2. Drains blood by
 - a) Skeletal muscle contraction
 - b) Breathing movements
 - c) Vasoconstriction of veins.



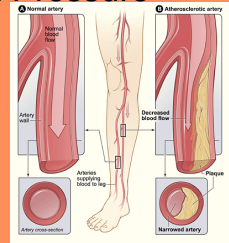
XIV. Factors that Influence Arterial Blood Pressure

- A. Heart Action
 1. Stroke volume (70 ml in male)
 2. Heart rate (cardiac output)
- B. Blood Volume varies with age, body size, and gender (5L or 8%).
- C. Pressure is directly proportional to the volume of blood within the system.



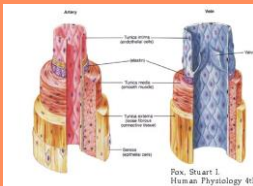
XIV. Factors that Influence Arterial Blood Pressure

- D. Peripheral Resistance
 1. Friction between blood and the walls of blood vessels.
 2. Increasing resistance increases pressure.
 3. Occurs with sympathetic constriction of blood vessels and blockage
- E. Blood Viscosity
 1. Ease with which a fluid flows.
 2. More viscous the blood, the greater its resistance



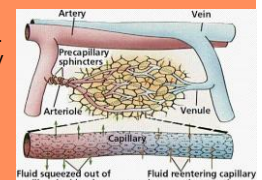
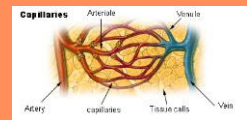
XV. Blood Vessels

- A. Arteries
 1. Strong, thick-walled, elastic vessels
 2. Adapted for carrying high-pressure blood.
 3. Arterial wall consists of an **endothelium, tunica media, and tunica externa.**
 4. Become smaller as they divide and become **arterioles.**
 5. Capable of vasoconstriction and vasodilatation.



XV. Blood Vessels

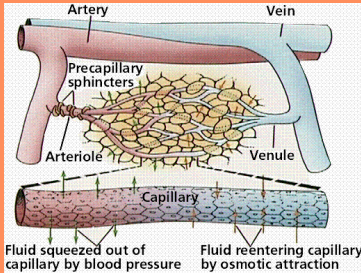
- B. Capillaries
 1. Smallest blood vessels
 2. Consist of only a layer of endothelium.
 3. Capillary permeability
 - a) More permeability in the liver, intestines, and certain glands.
 - b) Less in muscle and considerably less in the brain (blood-brain barrier).
 4. Density varies from one body part to the next (more in metabolically active-muscle)



XV. Blood Vessels

5. Precapillary Sphincters

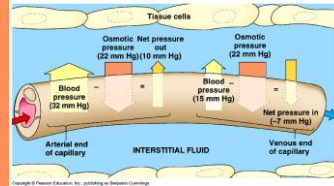
- Regulate the amount of blood entering a capillary bed.
- Allows capillary beds to be shut down



XV. Blood Vessels

6. Exchanges in the Capillaries

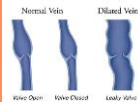
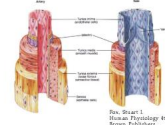
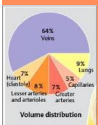
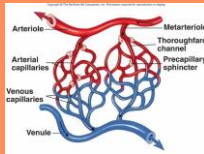
- Blood entering is high in oxygen and nutrients.
- Hydrostatic pressure drives fluids and very small molecules out.
- Nutrients and oxygen diffuse out into tissues.
- Plasma proteins remain in the blood.
- At the **venule** end, osmosis returns fluid to the bloodstream.



XV. Blood Vessels

C. Veins

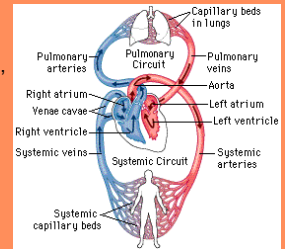
- Formed from merging **Venules** from capillaries
- Have the same three layers as arteries.
- Have a flap-like valve inside to prevent backflow of blood.
- Thinner and less muscular than arteries.
- Do not carry high-pressure blood.
- Also function as blood reservoirs.



XVI. Paths of Circulation

A. Pulmonary Circuit

- Blood flow to and from lungs
- Right Ventricle, pulmonary arteries, lungs, alveolar capillaries, pulmonary veins, to the left atrium.



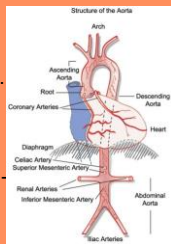
B. Systemic Circuit

- Blood flow to and from body
- Left ventricle, aorta, systemic arteries, systemic veins, superior and inferior vena cavae, right atrium.

XVII. Arterial System

A. Aorta

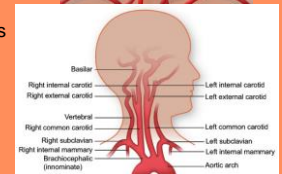
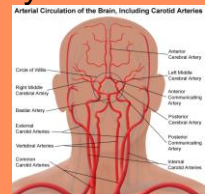
- Largest artery.
- Principal Branches
 - Ascending aorta
 - Branches right and left **coronary arteries** to feed the heart muscle.
 - Aortic arch- forms **brachiocephalic, left common carotid, and left subclavian** arteries.
 - Descending aorta (thoracic aorta)**- feeds many arteries to the thoracic wall and thoracic viscera.
 - Abdominal aorta**- gives off the following branches: celiac, superior mesenteric, suprarenal, renal, gonadal, inferior mesenteric, and common iliac arteries.



XVII. Arterial System

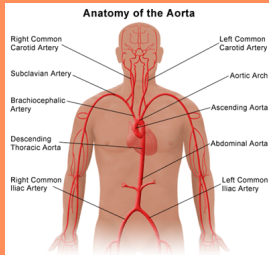
B. Arteries to the Head, Neck, and Brain

- Left and right branches of the **subclavian** feed shoulder and upper limbs
- Left and right **common carotid** arteries feed skull.
- The **vertebral** arteries supply the vertebrae and their associated ligaments and muscles, and brain.



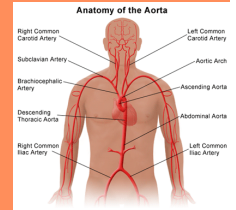
XVII. Arterial System

- C. Arteries to the Thoracic and Abdominal Walls
1. **Thoracic aorta** and **subclavian artery** supply the thoracic wall with blood.
 2. **Abdominal aorta**, and other arteries, supply the abdominal wall with blood.



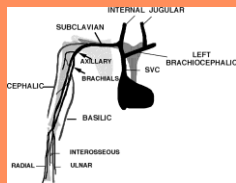
XVII. Arterial System

- D. Arteries to the Pelvis and Lower Limb
1. Abdominal aorta divides to form the **common iliac arteries**
 2. **Common iliacs** supply the pelvic organs, gluteal area, and lower limbs.
 3. The common iliacs divide into internal and external iliac arteries.
 - a) **Internal iliacs** supply blood to pelvic muscles and visceral structures.
 - b) **External iliacs** lead into legs, where they become femoral, popliteal, anterior tibial, and posterior tibial arteries.



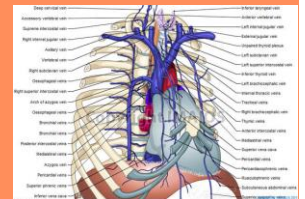
XVIII. Venous System

- A. Characteristics of Venous Pathways
1. Larger veins parallel the courses of arteries.
 2. Smaller veins take irregular pathways and are unnamed.
 3. Veins from the head and upper torso drain into the **superior vena cava**.
 4. Veins from the lower body drain into the **inferior vena cava**.
- B. Veins from the Head, Neck, and Brain
1. **Jugular veins** drain the head.
 2. Unite with the **subclavian veins** to form the **brachiocephalic veins**.



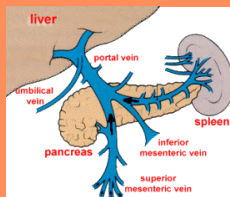
XVIII. Venous System

- C. Veins from the Upper Limb and Shoulder
1. The upper limb is drained by superficial and deep veins.
 2. The basilic and cephalic veins are major superficial veins.
 3. The major deep veins include the radial, ulnar, brachial, and axillary veins.
- D. Veins from the Abdominal and Thoracic Walls
1. **Brachiocephalic**
 2. **Azygos**



XVIII. Venous System

- E. Veins from the Abdominal Viscera
1. **Hepatic Portal System**
 - a) Gastric veins drain the stomach.
 - b) Superior mesenteric veins lead from the small intestine and colon.
 - c) Splenic vein leaves the spleen and pancreas.
 - d) Inferior mesenteric vein carries blood from the lower intestinal area.
 - e) All drain into the **portal vein** (goes to liver).
 2. **Hepatic veins** drain the liver.



XVIII. Venous System

- F. Veins from the Lower Limb and Pelvis
1. Drain the leg and pelvis.
 2. Deep veins
 - a) Anterior and posterior tibial veins
 - b) Unite into the popliteal vein and femoral vein.
 3. Superficial veins- include the small and great saphenous.

