Cardiovascular System:

Heart:
- Muscular organ that pumps blood throughout the body
- Size of a fist
- Located near the middle of the chest just off to the left
- Each minute, the average adult heart pumps approx. 5 quarts of blood through the blood vessels

Blood:
- Brings oxygen, nutrients and other necessary materials to your body cells and carries waste products away

Cardiovascular System:
- Provides a pathway through which blood can carry materials throughout the body

Your heart has a left and right side, which is separated by a thick wall called the septum.

Each side has two chambers:
- Atrium - Receives blood entering the heart
- Ventricle - This is the chamber that pumps blood from the heart to the body or to the lungs

How does the blood get from the atrium and ventricle?
- There are flap like valves located between the atrium and ventricle
- These valves keep the blood from moving back into the atrium when the ventricle is contracting
- The closing of the valves are responsible for the sound of your heart beat

The two valves are:
- Bicuspid valve (mitral valve) - Located on the left side of the heart
- Tricuspid valve - Located on the right side of the heart
The walls of the ventricles are much thicker than the walls of the atrium because the thick, muscular walls (myocardium) enable the ventricle to contract with enough force to propel blood to the lungs or all the parts of the body.

The heart acts as a double pump:
- The right side of the heart pumps blood to the lungs (pulmonary circulation)
- The left side of the heart pumps blood to the body (septemic circulation)

Circulation of blood through the heart, lungs and body:

Blood from most of the body flows into the right atrium through the superior vena cava and inferior vena cava
- Deoxygenated blood (little O2 and contains a lot of CO2)

Passes from the right atrium into the right ventricle, where blood is pumped to the lungs through the right and left pulmonary artery.
- The only arteries in the human body that carry deoxygenated blood
In the lungs, deoxygenated blood is exchanged for oxygenated blood (O2 rich blood). This exchange takes place in the capillaries that surround the alveoli.

Oxygenated blood then returns to the left atrium through the right and left pulmonary veins.
- These are the only two veins in the human body that carry oxygenated blood
Blood then passes from the left atrium to the left ventricle, where blood is pumped to the body through the aorta (largest artery in the human body)

Blood flows through the body passing O2 into the cells and the cells are releasing CO2 back into the blood.

Deoxygenated blood returns to the right atrium and the cycle begins over again.

(See page 371 for a diagram of circulation)

Pulmonary and Systemic circulation:

- The heart pumps blood through an extensive network of blood vessels. Blood vessels all connected together will extend over 100,000 miles.
Pulmonary Circulation:
- Blood leaves the right ventricle through the pulmonary arteries and travels to the lungs to release CO2 and pick up O2. Then the blood is pumped through the pulmonary veins back to the left atrium to be pumped to the cells of the body.
- Pulmonary veins are the only veins that carry oxygenated blood
- Pulmonary arteries are the only arteries that carry deoxygenated blood

Systemic Circulation:
- Blood leaves the left ventricle through the aorta, then into smaller arteries (thick walled elastic vessels that carry blood away from the heart) where blood is carried to the organs (brain, stomach) and other parts of the body (bones and muscles)
- As the artery enters the organ it forms arterioles (small arteries that connect arteries to capillaries) than into capillaries (smallest blood vessels in the body). Capillaries are so small that the blood cells can only pass through them single file.
- From the capillaries blood flows into venules (small veins that connect capillaries to veins). Veins are large, thin walled slightly elastic vessels that carry blood back to the heart. There are valves inside veins to prevent blood back flow.

Coronary Arteries:
- Are arteries that carry oxygenated blood to the heart muscle

Regulation of the Heartbeat:
In the walls of the right atrium is a group of cells called the pacemaker.
- Regulates the rate
- Brain signals control the increase and decrease of the heartbeat
- If the natural pacemaker malfunction an artificial one can be surgically placed inside the body.

Blood Pressure:
- Is the force with which blood pushes against the walls of the blood vessels
- Normal reading is 120 over 80
- The 120 is called systolic pressure (is the force caused by the serge of blood that moves as a result of the contraction of the ventricles)
- The 80 is called diastolic pressure (is the force recorded when the ventricles relax)

Blood:
- A complex tissue that consists of different types of cells suspended in a watery solution
- Average adult has about 4 to 6 quarts of blood in their body
- Plasma is the liquid part of blood
- Straw color
- 55% of the blood volume
- Mostly water with dissolved substances
  - Nutrients
  - Glucose
  - Waste products (urea)

Blood Cells:

- **Red Blood Cells (RBC)**
  - Carries oxygen to the cells of the body
  - Contains hemoglobin – iron containing substances that gives blood its red color
    - Hemoglobin with O2 – bright red
    - Hemoglobin with CO2 – dull red or blue blood

- **White Blood Cells (WBC)**
  - Protects the body against disease
  - Larger than the RBC
  - Part of the immune system

- **Platelets**
  - Clotting cells
  - Clotting factors combine with other proteins in the plasma
  - Together from a net of the fibers

Transfusion and Blood Groups:

**Transfusion** – blood taken from one individual and placed in another individual

- **Blood Groups**
  - Classification of proteins found in the red blood cells
    - A
    - B
    - AB
    - O

- **RH Factor**
  - Protein found on the surface of red blood cells
    - RH- (does not contain an RH factor)
    - RH+(contains a RH factor)

  Example: O+  (Red blood cells with O proteins and contains an RH factor)
In some ways, every person's blood is the same. But, when analyzed under a microscope, distinct differences are visible. In the early 20th century, an Austrian scientist named Karl Landsteiner classified blood according to those differences. He was awarded the Nobel Prize for his achievements. Landsteiner observed two distinct chemical molecules present on the surface of the red blood cells. He labeled one molecule "A" and the other molecule "B."

- If the red blood cell had only "A" molecules on it, that blood was called type A.
- If the red blood cell had only "B" molecules on it, that blood was called type B.
- If the red blood cell had a mixture of both molecules, that blood was called type AB.
- If the red blood cell had neither molecule, that blood was called type O.
- If two different blood types are mixed together, the blood cells may begin to clump together in the blood vessels, causing a potentially fatal
situation. Therefore, it is important that blood types be matched before blood transfusions take place.

- In an emergency, type O blood can be given because it most likely to be accepted by all blood types.
- However, there is still a risk involved. A person with type A blood can donate blood to a person with type A or type AB.
- A person with type B blood can donate blood to a person with type B or type AB.
- A person with type AB blood can donate blood to a person with type AB only.
- A person with type O blood can donate to anyone.
- A person with type A blood can receive blood from a person with type A or type O.
- A person with type B blood can receive blood from a person with type B or type O.

Most cardiovascular disorders are at least partly related to choices that a person makes – choices about such things as nutrition, exercise and smoking.

Heart Disorders:
- Coronary Heart Disease
  - Arteriosclerosis
    - Build up of cholesterol and other fatty materials on artery walls, which restricts the flow of blood
    - As cholesterol collects in the coronary arteries, less blood and therefore less O2 is able to reach the heart muscle
      - This can cause a pain called angina pectoris
    - Heart attack occurs when blood flow to part of the heart muscle is blocked
- There are two types of cholesterol
  - LDL (Low Density Lipoproteins)
    - Causes arteriosclerosis
  - HDL (High Density Lipoproteins)
    - Good cholesterol

- **Structural Problems:**
  - Congenital heart disorder
    - Opening between the left and right side of the heart
    - Faulty heart valve
  - Rheumatic heart disease
    - Caused by rheumatic fever
      - Caused by untreated strep throat
    - Damages the valves in the heart

- **Hypertension:**
  - Blood pressure that is consistently higher than normal
  - Stroke
    - Blood flow to a part of the brain is suddenly cut off

- **Blood Disorders:**
  - Anemia
    - A condition in which there are too few RBC or too little hemoglobin in the blood
  - Sickle-cell disease
    - Is a condition in which RB cells curve into a sickle shape because of a flaw in the hemoglobin
  - Hemophilia
    - Is an inherited disorder in which the plasma lacks certain substances necessary for normal blood clotting