Introduction to Cardiovascular System

- The Pulmonary Circuit
  - Carries blood to and from gas exchange surfaces of lungs

- The Systemic Circuit
  - Carries blood to and from the body

- Blood alternates between pulmonary circuit and systemic circuit
Introduction to Cardiovascular System

- Three Types of Blood Vessels
  - Arteries
    - Carry blood away from heart
  - Veins
    - Carry blood to heart
  - Capillaries
    - Networks between arteries and veins
Introduction to Cardiovascular System

- Four Chambers of the Heart
  - Right atrium
    - Collects blood from systemic circuit
  - Right ventricle
    - Pumps blood to pulmonary circuit
  - Left atrium
    - Collects blood from pulmonary circuit
  - Left ventricle
    - Pumps blood to systemic circuit
Anatomy of the Heart

- Great veins and arteries at the base
- Pointed tip is **apex**
- Surrounded by pericardial sac
- Sits between two pleural cavities in the **mediastinum**
Anatomy of the Heart

The Pericardium

- Double lining of the pericardial cavity
  - Parietal pericardium
    - Outer layer
  - Visceral pericardium
    - Inner layer of pericardium
Anatomy of the Heart

- The Pericardium
  - Pericardial cavity
    - Is between parietal and visceral layers
    - Contains pericardial fluid
  - Pericardial sac
    - Fibrous tissue
    - Surrounds and stabilizes heart
Anatomy of the Heart

- Superficial Anatomy of the Heart
  - Atria
    - Thin-walled
    - Expandable outer *auricle* (atrial appendage)
  - Sulci
    - Coronary sulcus: divides atria and ventricles
    - *Anterior interventricular sulcus* and *posterior interventricular sulcus*:
      - separate left and right ventricles
      - contain blood vessels of cardiac muscle
Anatomy of the Heart

- **The Heart Wall**
  - **Epicardium** (outer layer)
    - Visceral pericardium
    - Covers the heart
  - **Myocardium** (middle layer)
    - Muscular wall of the heart
    - Concentric layers of cardiac muscle tissue
    - Atrial myocardium wraps around great vessels
    - Two divisions of ventricular myocardium
  - **Endocardium** (inner layer)
    - Simple squamous epithelium
Anatomy of the Heart

- Internal Anatomy and Organization
  - **Interatrial septum**: separates atria
  - **Interventricular septum**: separates ventricles
  - **Atrioventricular (AV) valves**
    - Connect right atrium to right ventricle and left atrium to left ventricle
    - The fibrous flaps that form bicuspid (2) and tricuspid (3) valves
    - Permit blood flow in one direction: atria to ventricles
Anatomy of the Heart

- The Right Atrium
  - Superior vena cava
    - Receives blood from head, neck, upper limbs, and chest
  - Inferior vena cava
    - Receives blood from trunk, viscera, and lower limbs
  - Coronary sinus
    - Cardiac veins return blood to coronary sinus
    - Coronary sinus opens into right atrium
Anatomy of the Heart

- The Right Atrium
  - Foramen ovale
    - Before birth, is an opening through interatrial septum
    - Connects the two atria
    - Seals off at birth, forming fossa ovalis
Anatomy of the Heart

- The Right Atrium
  - Pectinate muscles
    - Contain prominent muscular ridges
    - On anterior atrial wall and inner surfaces of right auricle
The Right Ventricle

- Free edges attach to *chordae tendineae* from *papillary muscles* of ventricle
- Prevent valve from opening backward

Right atrioventricular (AV) Valve

- Also called *tricuspid valve*
- Opening from right atrium to right ventricle
- Has three cusps
- Prevents backflow
Anatomy of the Heart

The Pulmonary Circuit

- **Conus arteriosus** (superior end of right ventricle) leads to **pulmonary trunk**
- Pulmonary trunk divides into left and right pulmonary arteries
- Blood flows from right ventricle to pulmonary trunk through pulmonary valve
- Pulmonary valve has three semilunar cusps
Anatomy of the Heart

- The Left Atrium
  - Blood gathers into left and right pulmonary veins
  - Pulmonary veins deliver to left atrium
  - Blood from left atrium passes to left ventricle through left atrioventricular (AV) valve
  - A two-cusped bicuspid valve or mitral valve
Anatomy of the Heart

- The Left Ventricle
  - Holds same volume as right ventricle
  - Is larger; muscle is thicker and more powerful
  - Systemic circulation
    - Blood leaves left ventricle through **aortic valve** into **ascending aorta**
    - Ascending aorta turns (**aortic arch**) and becomes **descending aorta**
Anatomy of the Heart

- Structural Differences between the Left and Right Ventricles
  - Right ventricle wall is thinner, develops less pressure than left ventricle
  - Right ventricle is pouch-shaped, left ventricle is round
Anatomy of the Heart

- **The Heart Valves**
  - Two pairs of one-way valves prevent backflow during contraction
  - **Atrioventricular (AV) valves**
    - Between atria and ventricles
    - Blood pressure closes valve cusps during ventricular contraction
    - Papillary muscles tense chordae tendineae: prevent valves from swinging into atria
Anatomy of the Heart

- The Heart Valves
  - **Semilunar valves**
    - Pulmonary and aortic tricuspid valves
    - Prevent backflow from pulmonary trunk and aorta into ventricles
    - Have no muscular support
    - Three cusps support like tripod
Anatomy of the Heart

- **Aortic Sinuses**
  - At base of ascending aorta
  - Sacs that prevent valve cusps from sticking to aorta
  - Origin of right and left coronary arteries
Anatomy of the Heart

- The Blood Supply to the Heart = Coronary Circulation
  - Coronary arteries and cardiac veins
  - Supplies blood to muscle tissue of heart
Anatomy of the Heart

- The Coronary Arteries
  - Left and right
  - Originate at aortic sinuses
  - High blood pressure, elastic rebound forces blood through coronary arteries between contractions
Anatomy of the Heart

- The Cardiac Veins
  - Return blood to right atrium eventually