

# 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



The Heart: Valves

# 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

# Anatomy of the Heart

- 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