

Pulmonary and Systemic Circuits (fig 19.1)

- **Heart**: a muscular double pump
 - **Pulmonary Circuit**—to and from lungs
 - **Systemic Circuit**—to and from body tissues
 - **Atria**—receive blood each circuit
 - **Ventricles**—strongest pumping chambers of the heart

Layers of the Pericardium and Heart Wall (fig.19.3)

- **Pericardium**—2 layers
 - **Fibrous pericardium**: strong layer of dense CT
 - **Serous pericardium**:
 - parietal layer of the serous pericardium
 - in between serous fluid for lubrication
 - Visceral layer of the serous pericardium (**epicardium**)
 - **Myocardium**: where the heart muscles lay
 - Cardiac muscle arranged in circular and spiral patterns
 - **Endocardium**
 - Endothelium on a layer of CT
 - Lines the internal walls of the heart
 - Part of the heart valves

Heart Location & Arrangement of Cardiac Muscles (fig.19.4)

- Circular and spiral arrangement of cardiac muscles in the myocardium of the heart

GROSS ANATOMY OF THE HEART STUDY FIG. 19.5

Right Atrium and Right Ventricle

- Pulmonary side
- **Right Atrium**: receives blood from systemic circuit
- **Pectinate Muscles**: ridges inside anterior of right atrium
- **Right Ventricle**: receives blood from right atrium through the **tricuspid valve**
- Pumps blood into pulmonary circuit via the **pulmonary trunk**
- **Internal walls of right ventricle**
 - **Papillary muscles**
 - **Chordae tendineae**
- Pulmonary semilunar valve
 - Located at the opening of right ventricle and pulmonary trunk

Left Atrium and Left Ventricle

- **Left Atrium**: receives oxygen-rich blood from pulmonary veins
 - Mitral Valve (left atrioventricular valve)
- **Left Ventricle**: forms apex of the heart
 - Papillary Muscles
 - Chordae tendineae
- Pumps blood through systemic circuit via
 - Aortic semilunar valve (aortic valve)

Heart Valves (fig. 19.6a)

- Composed of **endocardium** (CT core)
- Atrioventricular (AV) valves between atria and ventricles
- Aortic and pulmonary valves at junctions of ventricles and great arteries
- **Fibrous skeleton**: dense CT, surrounds all valves
 - Anchor valve cusps, prevent over-dilation
 - Points of insertion for cardiac muscles, block spread of electrical impulses

Function of the Atrioventricular Valves (fig 19.7)

- **AV valves open**: *Atrial pressure > ventricular pressure*
 1. Blood returning to the heart fills atria, pressing against the AV valves. The increased pressure forces AV valves open
 2. As ventricles fill, AV valve flaps hang limply into ventricles
 3. Atria contract, forcing additional blood into ventricles
- **AV valves closed**: *Atrial pressure < ventricular pressure*
 1. Ventricles contract, forcing blood against AV valve cusps
 2. AV valves close
 3. Papillary muscles contract and chordae tendineae tighten, preventing valve flaps from everting to atria.

Function of the Semilunar Valves (fig 19.8)

- **Semilunar valves open**
 1. As ventricles contract and intra ventricular pressure rises, blood is pushed up against semilunar valves, forcing them open
- **Semilunar valves closed**
 1. As ventricles relax and intraventricular pressure falls, blood flows back from arteries, filling the cusps of semilunar valves and forcing them to close

Heart Sounds

- “lub-dup”—sound of valves closing
 - “lub”—the AV valves closing (atria contract together)
 - “dub”—the semilunar valves closing (ventricles contract together)
- Each valve sound is best heard near a different **heart corner**

Heartbeat

- 70-80 beats per minute at rest
 - Systole—contraction of a heart chamber
 - Diastole—expansion of a heart chamber
- Systole and Diastole also refer to
 - *Stage of heartbeat when ventricles contract and expand*

Structure of Heart Wall

- Walls differ in thickness
 - Atria—thin walls
 - Ventricles—thick walls
 - Systemic circuit has the thickest
 - Longer than pulmonary circuit
 - Offers greater resistance to blood flow
- **Left ventricle**—*three times thicker* than right
 - Exerts more pumping force
 - Flattens right ventricle into a crescent shape

Cardiac Muscle Tissue (fig 19.12)

- Forms a thick layer called **myocardium**
 - Striated like skeletal muscle
 - Contractions pump blood through the heart and into blood vessels
 - Contracts by sliding filament mechanism
- Cardiac muscle cells
 - Short & Branching
 - Have one or two nuclei only
 - Internal
 - Cells join at **intercalated discs**
 - Complex junctions occur here
 - Forms cellular networks
 - Adjacent sarcolemmas *interlock*
 - Cells are separated by delicate **endomysium**
 - Binds adjacent cardiac fibers
- Not all cardiac cells are innervated
 - Will contract in rhythmic manner without innervation