The Heart

Gross Anatomy of the Human Heart

The heart is a cone-shaped organ about the size of a fist. It is located within the medial cavity of the thorax. The lungs are lateral to the heart, posterior is the vertebral column and anterior is the sternum.

- Its pointed apex extends to the left and rests on the diaphragm.
- Its broader base lies below the second rib and points toward the right shoulder.

- The heart is enclosed inside a double-walled fibroserous sac, the **pericardium**.

- The thin **epicardium** (visceral pericardium) is closely applied to the heart muscle.

- The **parietal pericardium** is attached at the heart apex to the diaphragm.

- The serous fluid that is produced by the membranes allows the heart to beat in an almost frictionless environment.

- **Pericarditis**, an inflammation of the pericardium, causes painful adhesions to form between the serous pericardial layers. These adhesions do interfere with the hearts movements.

- The walls of the heart are made mainly of cardiac muscle, the **myocardium**.

- The myocardium is reinforced internally by a dense fibrous connective tissue network.

    - This network is known as the fibrous skeleton of the heart.
    - It is thicker and more complicated in some areas, mainly around the valves and the base of the great vessels leaving the heart.

Heart Chambers

The heart is divided into four chambers: two superior **atria** (singular, atrium) and two inferior **ventricles.** Each is lined by a thin serous endothelium known as the **endocardium**.

- The **interatrial** or **interventricular septum**, depending on which chambers it divides, is the septum that divides the heart longitudinally.

- The atria are receiving chambers in the heart.

- The *right atrium receives oxygen-poor blood* from the body via the **superior** and **inferior venae cavae** and the coronary sinus.
- The *left atrium receives oxygen-rich blood* from the lungs via four **pulmonary veins**.

- The inferior thick-walled ventricles are the discharging chambers and they form the bulk of the heart.

    - The ventricles force blood out of the heart into the arteries that emerge from the heart base.
    - The right ventricle pumps blood into the **pulmonary trunk**, which sends the blood to the lungs to be oxygenated.
    - The left ventricle discharges blood into the **aorta**.

- The **aorta** is where all systemic arteries of the body diverge to supply the body tissues with blood.

Heart Valves

A one-way blood flow through the heart chambers is enforced by four valves.

- The **atrioventricular (AV) valves** are located between the atrial and ventricular chambers on each side. They prevent backflow into the atria when the ventricles are contracting.

- The **bicuspid** or **mitral valve** (the left AV valve) has two cusps, or flaps, of endocardium.

- The **tricuspid valve** (the right AV valve) has three cusps of endocardium.

- The cusps are anchored to the ventricular walls by small white collagenic cords known as the **chordae tendineae** (literally, heart strings).

- The chordae tendineae originate from **papillary muscles**, small bundles of cardiac muscle, that project from the myocardial wall.

- During **diastole**, the blood flows passively into the atria and then into the ventricles (the period of ventricular filling).

- **Systole** is when the ventricles contract and compress the blood in their chambers. During this, the intraventricular blood pressure rises.

- The second valve set includes the **pulmonary** and **aortic semilunar valves**. Each of these is composed of three pocket like cusps. They guard the bases of the two large arteries leaving the ventricular chambers.

- During systole, the valve cusps are forced open and flatten against the artery walls as the ventricles discharge their blood.

Pulmonary and Systemic Circulations

The heart is a double pump. The right side is the **pulmonary circulation pump**. This pump shunts the carbon dioxide-rich blood in its chambers to the lungs to unload carbon dioxide and pick up oxygen. The second circuit is called the **systemic circulation pump**. It carries oxygen-rich blood from the left heart through the body tissues. It provides the functional blood supply to all of the body's tissues.

Cardiac Muscle

- Cardiac muscle is found only in the heart. It is involuntary, therefore, ensuring a constant blood supply.

- The cardiac cells are arranged in spiral or figure-8-shaped bundles.

- The **intercalated discs**, the areas where the cells interdigitate, and the branching cells are the features that allow for a continuity to cardiac muscle that is not seen in other muscle tissues.

Dissection of a Sheep Heart

Sheep hearts are similar in size and structure to human hearts. Very valuable educational tools.

Important Terms:

Auricles – two wrinkled earlike flaps of tissue projecting from the atrial chambers

Brachiocephalic artery – splits to form the right carotid and subclavian arteries which supply blood to the right side of the head and right forelimb, respectively

Pectinate muscle – comblike ridges of muscle throughout the right atrium

Coronary sinus – returns venous blood of the coronary circulation to the right atrium

Fossa ovalis – an oval depression in the interatrial septum; it marks the site of the foramen ovale which allows blood to bypass the fetal lungs by passing from the right to the left atrium

Moderator band – a bundle of cardiac muscle fibers connecting the interventricular septum to anterior papillary muscles