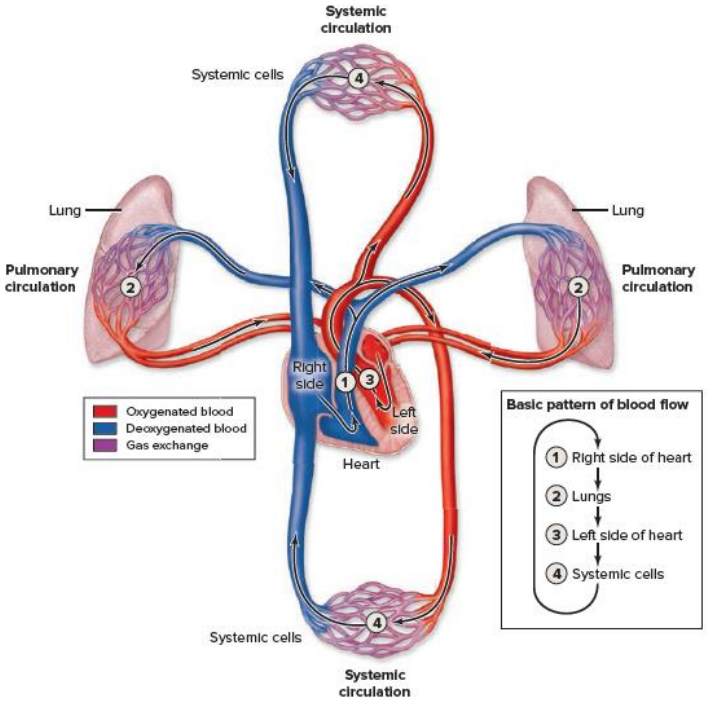
THE HEART – Textbook and Lecture Slides



As the center of the cardiovascular system, the heart connects to blood vessels that transport blood between the heart and all body tissues. The two basic types of blood vessels are **arteries** which transport blood away from the heart and **veins** which transport blood back to the heart. Most arteries carry oxygen rich blood (except for pulmonary arteries) and most veins carry oxygen poor blood (except for pulmonary veins).

The hearts anatomy ensures the **unidirectional flow** of blood through it. Backflow is prevented by valves within the heart, it acts like 2 side by side pumps that work at the same rate and pump the same volume of blood, one directs blood into the lungs for respiratory exchange and the other directs blood to body tissues for nutrient and respiratory gas delivery. The heart develops **blood pressure** through alternate cycles of heart wall contraction and relaxation. Blood pressure is the force of blood pushing against the inside walls of the vessels and minimum blood pressure is essential for pushing blood through blood vessels.

Blood vessels: arteries carry blood away from the heart (mostly carry oxygenated blood), capillaries supply body cells with nutrients and oxygen and take waste products away and veins return blood to the heart (mostly carry deoxygenated blood).

Heart: is a muscular organ that pumps blood through the vessels.

Blood: is a fluid connective tissue that is transported in the cardiovascular system.

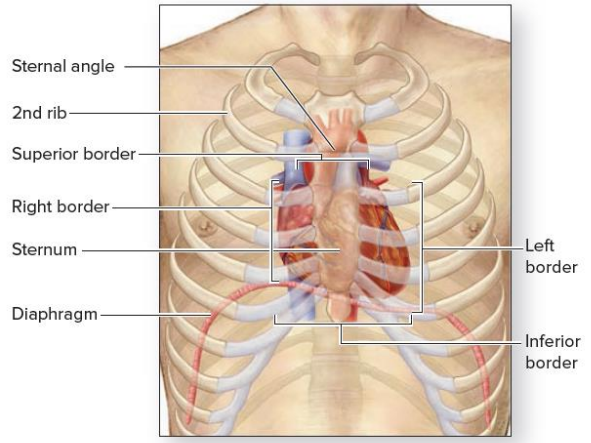
PULMONARY AND SYSTEMIC CIRCULATION

The cardiovascular system consists of 2 circulations: the pulmonary circulation and the systemic circulation. The **pulmonary circulation (low pressure system)** conveys deoxygenated blood from the right side of the heart, through blood vessels to the lungs for the pickup of oxygen and the release of carbon dioxide and then back through blood vessels to the left side of the heart (pumps blood from the right side of the heart through pulmonary vessels, to the lungs and back to the left side of the heart, oxygen poor). The **systemic circulation (high pressure system)** moves oxygenated blood from the left side of the heart through blood vessels to the systemic cells such as those of the liver, skin, muscle and brain. Nutrients, respiratory gases and waste are exchanged with these systemic cells before blood is returned to the right side of the heart. (Right side of the heart – lungs – the left side of the heart – systemic tissues of body – back to the right side of the heart.) (Pumps blood from the left side of the heart, through systemic vessels in peripheral tissues and back to the right side of the heart, oxygen rich). These both function at the same time by the heart contracting from the right to the left side. The blood pressure in the systemic circuit is much higher than the pulmonary circuit.

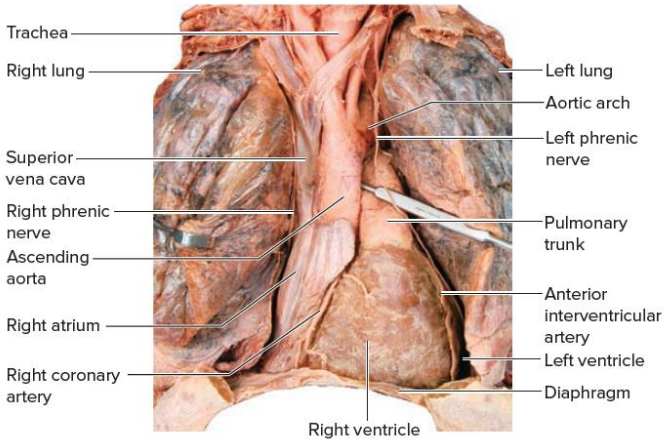
POSITION OF THE HEART

The heart is located left of the body midline posterior to the sternum in the **mediastinum** which is a space between the sternum (ventral), the vertebral column (dorsal), the lungs (right and left lateral) and the diaphragm (caudal). The heart is slightly rotated such that its right side or **right border** (primarily formed by the right atrium and ventricle) is located more anteriorly, whereas its left side or **left border** (primarily found by the left atrium and ventricle) is located more posteriorly. The posterosuperior surface of the heart, formed primarily by the left atrium is called the base. The pulmonary veins that enter the left atrium border this base. The **superior border** is formed by the great arterial trunks (ascending aorta and pulmonary trunk) and the superior vena cava. The inferior end is the

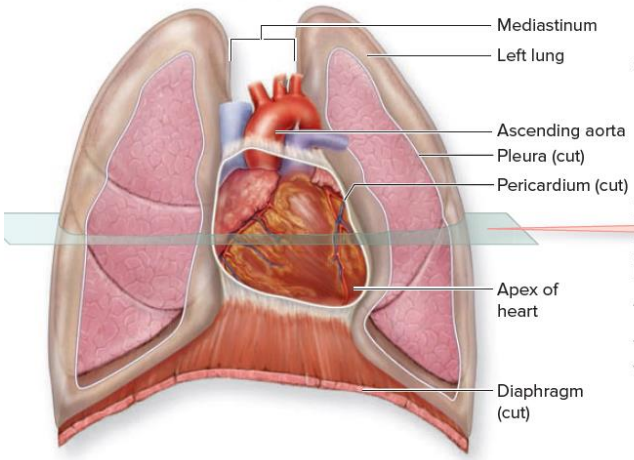
apex and it projects slightly anteroinferiorly toward the left side of the body. The inferior border is formed by the **right ventricle.** The heart is a fist-sized conical organ that is located left of the body midline, posterior to the sternum in the mediastinum, the right side (right atrium and ventricle) is located more anteriorly and the left side (left atrium and ventricle) is located more posteriorly.



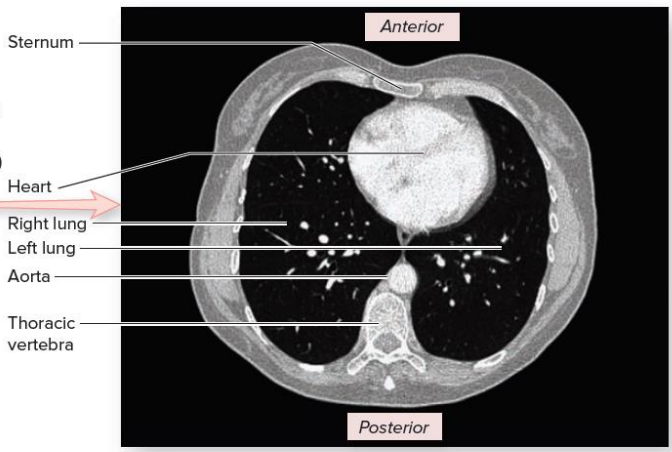
(a) Borders of the heart



(b) Heart and lungs, anterior view



(c) Serous membranes of the heart and lungs



(d) Cross-sectional view in CT scan

CHARACTERISTICS OF THE PERICARDIUM

The heart is contained within the **pericardium,** a fibrous sac and serous lining. The pericardium restricts the heart's movements so that it doesn't bounce and move about in the thoracic cavity, and prevents the heart from overfilling with blood. The pericardium is composed of two parts. The outer portion is a tough, dense connective tissue layer called the **fibrous pericardium.** This layer is attached inferiorly to the diaphragm and superiorly to the base of the great vessels. The inner portion is a thin, double-layered serous membrane called the **serous pericardium.** The serous pericardium may be subdivided into a **parietal layer** of serous pericardium that lines the inner surface of the fibrous pericardium, a **visceral layer** of serous pericardium (also called the **epicardium**) that covers the outside of the heart. The parietal and visceral layers reflect (fold back) along the great vessels, where these layers become continuous with one another. The **pericardial cavity** is a thin space between the parietal and visceral layers of the serous pericardium. Serous fluid is secreted into this space to lubricate the serous membranes and decrease friction when the heart beats. The pericardial cavity is a potential space with just a thin lining of serous fluid.