17.1E: Great Vessels of the Heart

Great vessels are the major vessels which directly carry blood into or out of the heart.

Learning Objectives

• Describe the great vessels that carry blood to and from the heart

Key Points

• Five great vessels enter and leave the heart: the superior and inferior vena cava, the pulmonary artery, the pulmonary vein, and the aorta.
• The superior vena cava and inferior vena cava are veins that return deoxygenated blood from circulation in the body and empty it into the right atrium.
• The pulmonary artery carries deoxygenated blood from the right ventricle into the lungs for oxygenation.
• The pulmonary veins carry oxygenated blood from the lungs into the left atrium where it is returned to systemic circulation.
• The aorta is the largest artery in the body. It carries oxygenated blood from the left ventricle of the heart into systemic circulation.
• The aorta has many subdivisions that branch off into smaller arteries. These subdivisions are the ascending and descending aorta, the aortic arch, and the thoracic and abdominal aorta.

Key Terms

• pulmonary arteries: The arteries that take deoxygenated blood away from the right side of the heart and into the
capillaries of the lungs for the purpose of gas exchange.

- **aorta**: The great artery which carries the blood from the heart into systemic circulation.
- **venae cavae**: The two large vessels, the superior and inferior vena cava, that bring deoxygenated blood from systemic circulation to the heart.

The human circulatory system is a double system, meaning there are two separate systems of blood flow: pulmonary circulation and systemic circulation. The adult human heart consists of two separated pumps, the right side (right atrium and ventricle,) which pumps deoxygenated blood into the pulmonary circulation, and the left side (left atrium and ventricle), which pumps oxygenated blood into the systemic circulation. Great vessels are the major vessels that carry blood into the heart and away from the heart to and from the pulmonary or systemic circuit. The great vessels collect and distribute blood across the body from numerous smaller vessels.

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**The Venae Cavae**

Head and upper extremities

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**The Systemic Circuit**: The venae cavae and the aorta form the systemic circuit, which circulates blood to the head, extremities and abdomen.

The superior and inferior vena cava are collectively called the venae cavae. The venae cavae, along with the aorta, are the great vessels involved in systemic circulation. These veins return deoxygenated blood from the body into the heart, emptying it into the right atrium. The venae cavae are not separated from the right atrium by valves.
Superior Vena Cava

The superior vena cava is a large, short vein that carries deoxygenated blood from the upper half of the body to the right atrium. The right and left subclavian veins, jugular veins, and thyroid veins feed into the superior vena cava. The subclavian veins are significant because the thoracic lymphatic duct drains lymph fluid into the subclavian veins, making the superior vena cava a site of lymph fluid recirculation into the plasma. The superior vena cava begins above the heart.

Inferior Vena Cava

The inferior vena cava is the largest vein in the body and carries deoxygenated blood from the lower half of the body into the heart. The left and right common iliac veins converge to form the inferior vena cava at its lowest point. The inferior vena cava begins posterior to the abdominal cavity and travels to the heart next to the abdominal aorta. Along the way up the body from the iliac veins, the renal and suprarenal veins (kidney and adrenal glands), lumbar veins (from the back), and hepatic veins (from the liver) all drain into the inferior vena cava.

The Aorta

The aorta is the largest of the arteries in systemic circulation. Blood is pumped from the left ventricle through the aortic valve into the aorta. The aorta is a highly elastic artery and is able to dilate and constrict in response to blood pressure and volume. When the left ventricle contracts to force blood through the aortic valve into the aorta, the aorta expands. This expansion provides potential energy to help maintain blood pressure during diastole, when the aorta passively contracts. Blood pressure is highest in the aorta and diminishes through circulation, reaching its lowest points at the end of venous circulation. The difference in pressure between the aorta and right atrium accounts for blood flow in the circulation, as blood flows from areas of high pressure to areas of low pressure.

Components of the Aorta

The aortic arch contains peripheral baroreceptors (pressure sensors) and chemoreceptors (chemical sensors) that relay information concerning blood pressure, blood pH, and carbon dioxide levels to the medulla oblongata of the brain. This information is processed by the brain and the autonomic nervous system mediates the homeostatic responses that involve feedback in the lungs and kidneys. The aorta extends around the heart and travels downward, diverging into the iliac arteries. The five components of the aorta are:

1. The ascending aorta lies between the heart and the arch of aorta. It breaks off into the aortic sinuses, some of which form the coronary arteries.
2. The arch of aorta is the peak of the aorta, which breaks off into the left carotid artery, brachiocephalic trunk, and the left subclavian artery.
3. The descending aorta is the section from the arch of aorta to the point where it divides into the common iliac arteries. It is subdivided into the thoracic and abdominal aorta.
4. The thoracic aorta is the part of the descending aorta above the diaphragm. It branches off into the bronchial, mediastinal, esophageal, and phrenic arteries.
5. The abdominal aorta is the part of the descending aorta below the diaphragm, which divides into the iliac arteries and branches into the renal and suprarenal arteries. This part of the aorta is vulnerable to bursting and hemorrhage (aneurysm) from persistently high blood pressure.

The Pulmonary Arteries

The pulmonary arteries carry deoxygenated blood from the right ventricle into the alveolar capillaries of the lungs to unload carbon dioxide and take up oxygen. These are the only arteries that carry deoxygenated blood, and are considered arteries because they carry blood away from the heart. The short, wide vessel branches into the left and right pulmonary arteries that deliver deoxygenated blood to the respective lungs. Blood first passes through the pulmonary valve as it is ejected into the pulmonary arteries.

![Pulmonary Circuit](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(Boundless)/17%3A...)  

**Pulmonary circuit**: Diagram of pulmonary circulation. Oxygen-rich blood is shown in red; oxygen-depleted blood in blue.

The Pulmonary Veins

The pulmonary veins carry oxygenated blood from the lungs to the left atrium of the heart. Despite carrying oxygenated blood, this great vessel is still considered a vein because it carries blood towards the heart. Four pulmonary veins enter the left atrium. The right pulmonary veins pass behind the right atrium and superior vena cava while the left pass in front of the descending thoracic aorta. The pulmonary arteries and veins are both considered part of pulmonary circulation.