

Heart

B.Sc Second year Zoology (Honours) Paper - 4

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The Cardiovascular System

The cardiovascular system consists of:

- (1) the heart, which pumps blood
- (2) the blood vessels, through which the blood flows.

The beating of the heart sends blood into the blood vessels. In humans, blood is always contained within blood vessels.

Circulation Performs Exchanges

- Circulation of blood depends on the beating of the heart, the purpose of circulation is to serve cells.
- Cells are surrounded by tissue fluid that is used to exchange substances between the blood and cells.
- Blood removes waste products, extra salts and water from tissue fluid through kidneys.
- Blood also brings tissue fluid the oxygen and nutrients cells require to continue their existence.
- Blood would not be able to continue to perform this function if it did not become oxygenated in the lungs. At the lungs, blood drops off carbon dioxide and picks up oxygen.

- Nutrients enter the bloodstream at the intestines and transport much needed substances to the body's cells.
- The liver is important, because it takes up amino acids from the blood and returns needed proteins. Liver proteins transport substances such as fats in the blood.
- The liver also removes toxins and chemicals that may have entered the blood at the intestines, and its colonies of white blood cells destroy bacteria and other pathogens.
- Thousands of miles of blood vessels, which form an intricate circuit reaching almost every cell of the body, move the blood and its contents through the body to and from all the body's organs.

Functions of the Cardiovascular System

1. Contractions of the heart generate blood pressure, which moves blood through blood vessels.
2. Blood vessels transport the blood from the heart into arteries, capillaries, and veins; and blood then returns to the heart so the circuit can be completed;
3. Gas exchange (pickup of carbon dioxide and drop-off of oxygen for the cells) occurs at the smallest diameter vessels, the capillaries
4. The heart and blood vessels regulate blood flow, according to the needs of the body.
5. The lymphatic system assists the cardiovascular system because lymphatic vessels collect excess tissue fluid and return it to the cardiovascular system.
6. When exchanges occur between blood and tissue fluid, fluid collects in the tissues. This excess fluid enters lymphatic vessels, which start in the tissues and end at cardiovascular veins in the shoulders. As soon as fluid enters lymphatic vessels, it is called lymph. *Lymph, you will recall, is a fluid tissue, as is blood.*

The Heart Is a Double Pump

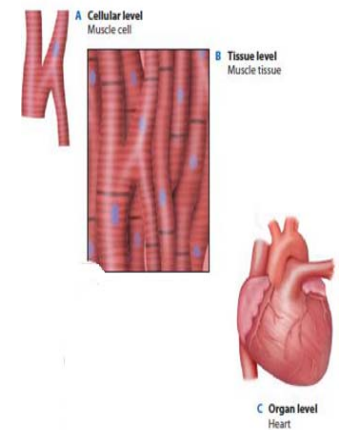
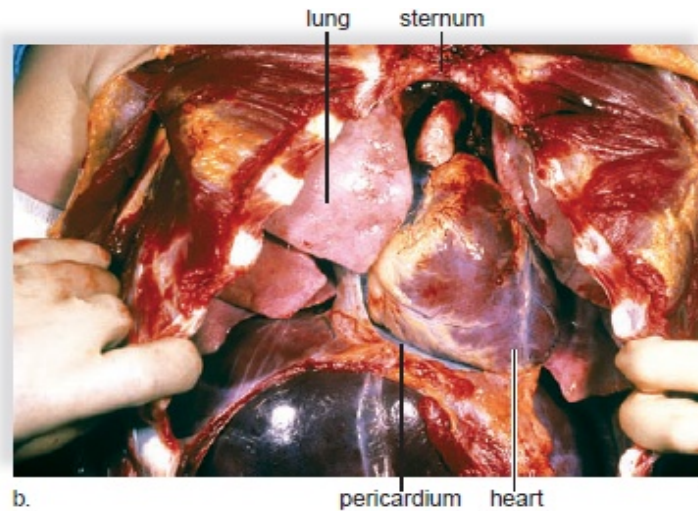
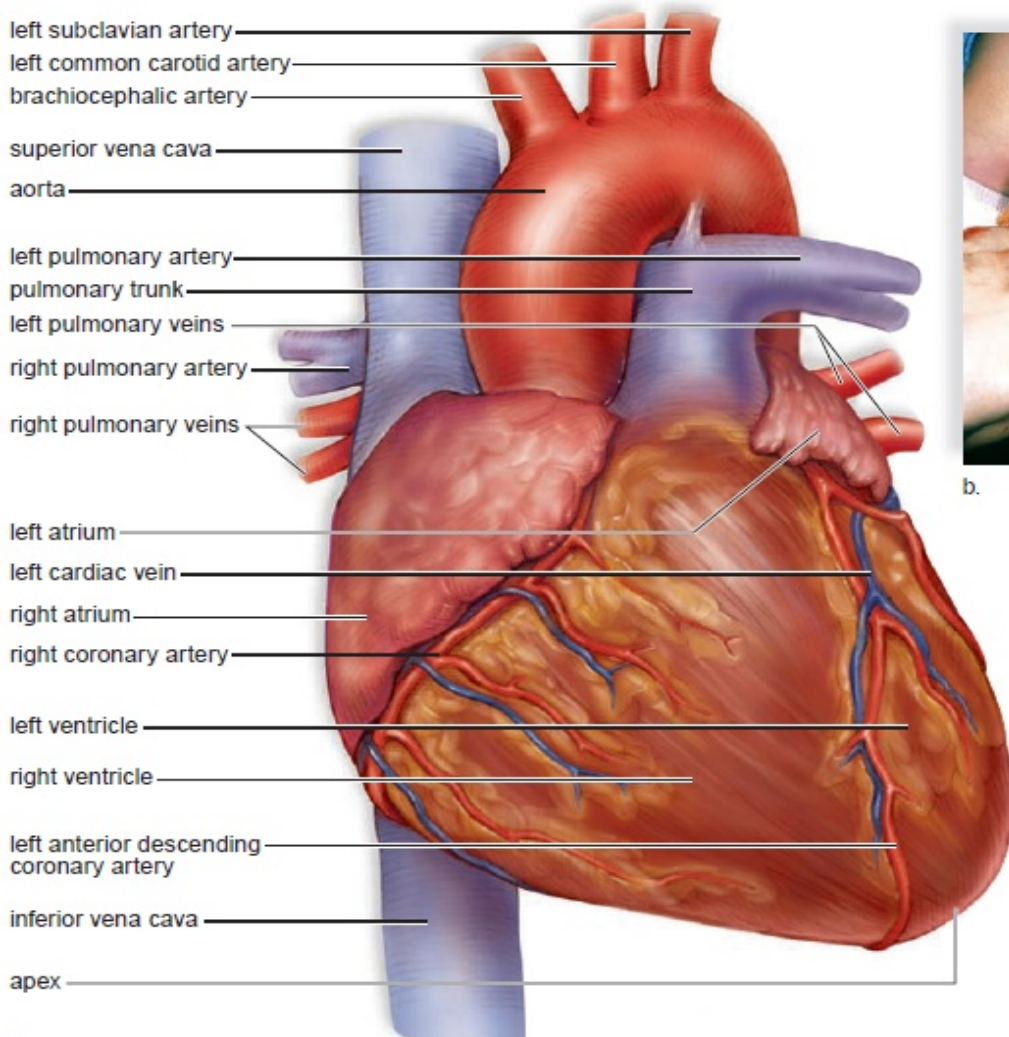


Figure 5.3 The heart functions as a double pump.

a. The venae cavae and the pulmonary trunk are attached to the right side of the heart. The aorta and pulmonary veins are attached to the left side of the heart. Blood vessels are colored red if they carry O₂-rich blood and blue if they carry O₂-poor blood. **b.** Photograph of a heart in its natural position in the chest.

- The heart is a cone-shaped, muscular organ located between the lungs, directly behind the sternum (breast bone).
 - The heart is tilted so that the apex (the pointed end) is oriented to the left.
 - To approximate the size of your heart, make a fist, then clasp the fist with your opposite hand.

 - The major portion of the heart is the interior wall of tissue called the myocardium, consisting largely of cardiac muscle tissue.
 - The muscle fibers of myocardium are branched. Each fiber is tightly joined to neighbouring fibers by structures called intercalated disks.
 - The intercalated disks include gap junctions and desmosomes.
 - Gap junctions are used to aid (help) in simultaneous contractions of the cardiac fibers.
 - Desmosomes include arrangements of protein fibers that tightly hold the membranes of adjacent cells together and prevent overstretching.
- heart is surrounded by the pericardium, a thick, membranous sac that supports and protects the heart.

- The inside of the pericardium secretes pericardial fluid (a lubrication fluid), and the pericardium slides smoothly over the heart's surface as it pumps the blood.
internally, a wall called the septum separates the heart into a right side and a left side.
- The heart has four chambers.
- The two upper, thin-walled atria are called the right atrium and the left atrium.
- Each atrium has a wrinkled, earlike flap on the outer surface called an auricle.
- The two lower chambers are the thick-walled ventricles, called the right ventricle and the left ventricle.

- Heart valves keep blood flowing in the right direction and prevent its backward movement.
- The valves that lie between the atria and the ventricles are called the atrioventricular (AV) valves. These valves are supported by strong fibrous strings called chordae tendineae.

- The *chordae tendineae* are attached to papillary muscles that project from the ventricular walls.
- *Chordae tendineae anchor* the valves, preventing them from inverting when the heart contracts.
- The *AV valve on the right side* is called the *tricuspid valve* because it has three flaps, or cusps.
- The *AV valve on the left side* is called the *bicuspid valve* because it has two flaps. The bicuspid valve is commonly referred to as the *mitral valve*, because it has a shape like a bishop's hat, or miter.
- The remaining two valves are the *semilunar valves*, with flaps shaped like half-moons.
- These valves lie between the ventricles and their attached vessels. The semilunar valves are named for their attached vessels: The *pulmonary semilunar valve* lies between the right ventricle and the pulmonary trunk. The *aortic semilunar valve* lies between the left ventricle and the aorta.