An Illustrated
Dissection Guide
To The...*Mammalian*

Heart

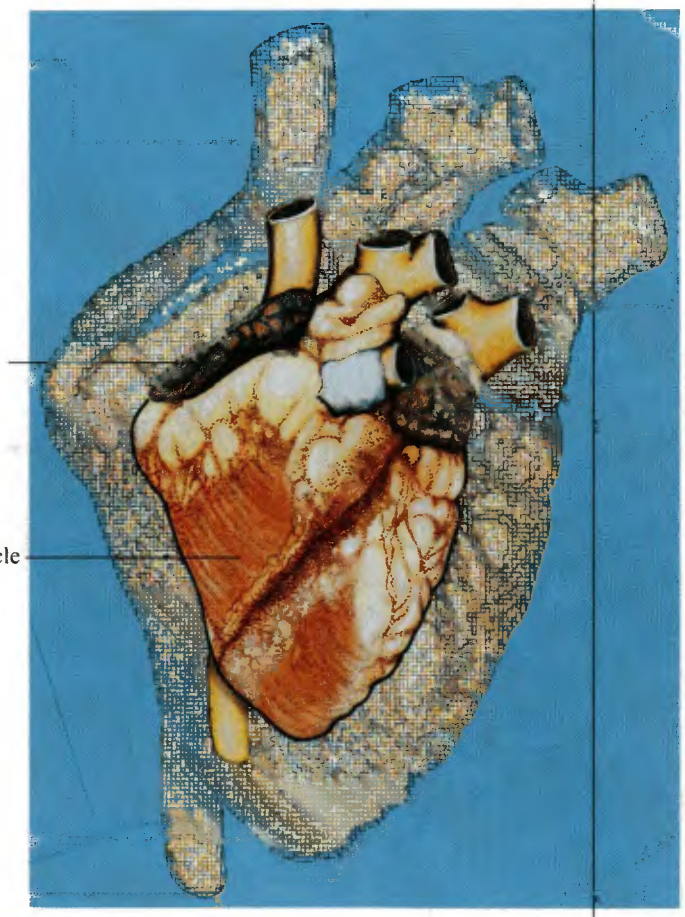

Figure 1. Exterior view; ventral side.

by David H. Hall

The Mammalian Heart

Because mammals are warm blooded (endothermic) and generally very active animals, they have high metabolic rates. One major requirement of a rapid metabolism is the need for oxygen and nutrients to reach body cells in sufficient quantities to satisfy their needs. Metabolic wastes need to be carried away quickly for disposal so that they do not interfere with cell operations. These functions are carried out by the animal's circulatory system that is driven by the heart.

External Anatomy

Preserved sheep hearts are the most commonly dissected mammalian heart. This is due to their low cost and ready availability. Sheep hearts from meat packing houses usually come with major blood vessels trimmed very close to the heart itself. This is normal and, although not ideal from a dissecting standpoint, they are still very easy to work with. The illustrations in this guide were drawn from actual specimens. However, for added clarity, we drew the illustrations with the major vessels extended.

Preserved hearts come in two ways: with the *pericardium,* and without the pericardium. The pericardium is a membranous sac that envelopes the heart. It protects the heart and separates it from the rest of the thoracic cavity. The pericardium is a tough sac that is attached to the heart where large vessels emerge. Remove the pericardium by cutting it away from the heart. The whitish lumpy tissue on the outer surface of the heart is fat tissue. The bulk of heart tissue is the reddish brown heart muscle or *myocardium.* The chambers of the heart are lined with a tissue called the *endocardium.* The endocardium is continuous with the endothelium which lines the blood vessels of the body.

Ventral View

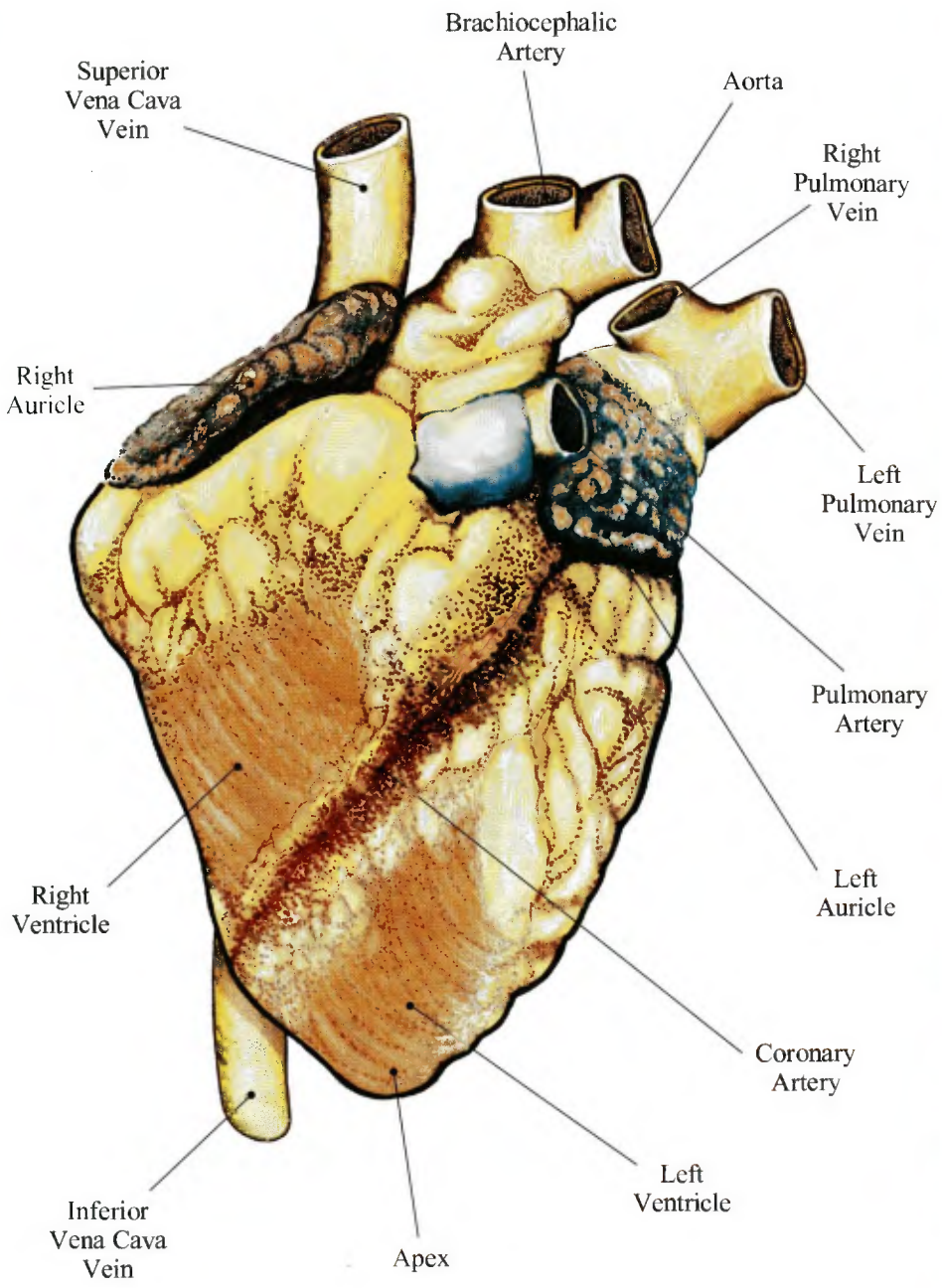

Figure 1. Exterior view, ventral side.

Place your heart in position as shown in Figure 1. This is the *ventral* side of the heart. The line running diagonally down from the right side (facing you) of the heart to the bottom left side is the *coronary artery*. The pointed bottom of the heart is called the *apex*. Locate and familiarize yourself with the following features pointed out in Figure 1:

Superior (Cranial) Vena Cava—Deoxygenated blood is returned to the heart from the head and shoulder regions through this large vein.

Inferior (Caudal) Vena Cava—Deoxygenated blood is returned to the heart from the regions of body below the shoulders via this large vein.

Right Auricle—Blood is pushed from the superior and inferior vena cava veins into this thin walled chamber and is then pumped into the right ventricle.

Right Ventricle—Blood pumped from the auricle enters this thick walled chamber and is pumped under higher pressure to the lungs via the *aorta pulmonary artery*.

Right & Left Pulmonary Veins—Oxygenated blood is returned to the heart from the lungs by these vessels.

Left Auricle—Oxygenated blood from the pulmonary veins is pumped from this thin walled chamber into the left ventricle.

Left Ventricle—Blood is pumped from this chamber out through a large vessel, the *aorta*, to the body.

Brachiocephalic Artery—The first major branch off of the aorta and the major artery to the forelimbs and head.

Coronary Artery—This artery supplies blood to the myocardium (heart muscle tissue) directly. There are actually two coronary arteries: a left coronary artery which can be seen along the ventral side, and a right coronary artery which runs across the dorsal side. These arteries are the first arterial branches off the aorta.

Dorsal View

(Figure 2)

Compare your heart with Figure 2 and identify all the features that are illustrated. As previously mentioned many preserved hearts come from the supply houses with the major vessels trimmed very close to the heart. Although this is less than ideal, identification of the vessels and their entrances into the heart can easily be accomplished. Often it is helpful to place labeled dowels or pencils into the vessel apertures as you identify them. This helps in keeping track of the vessels already identified.

Dorsal View

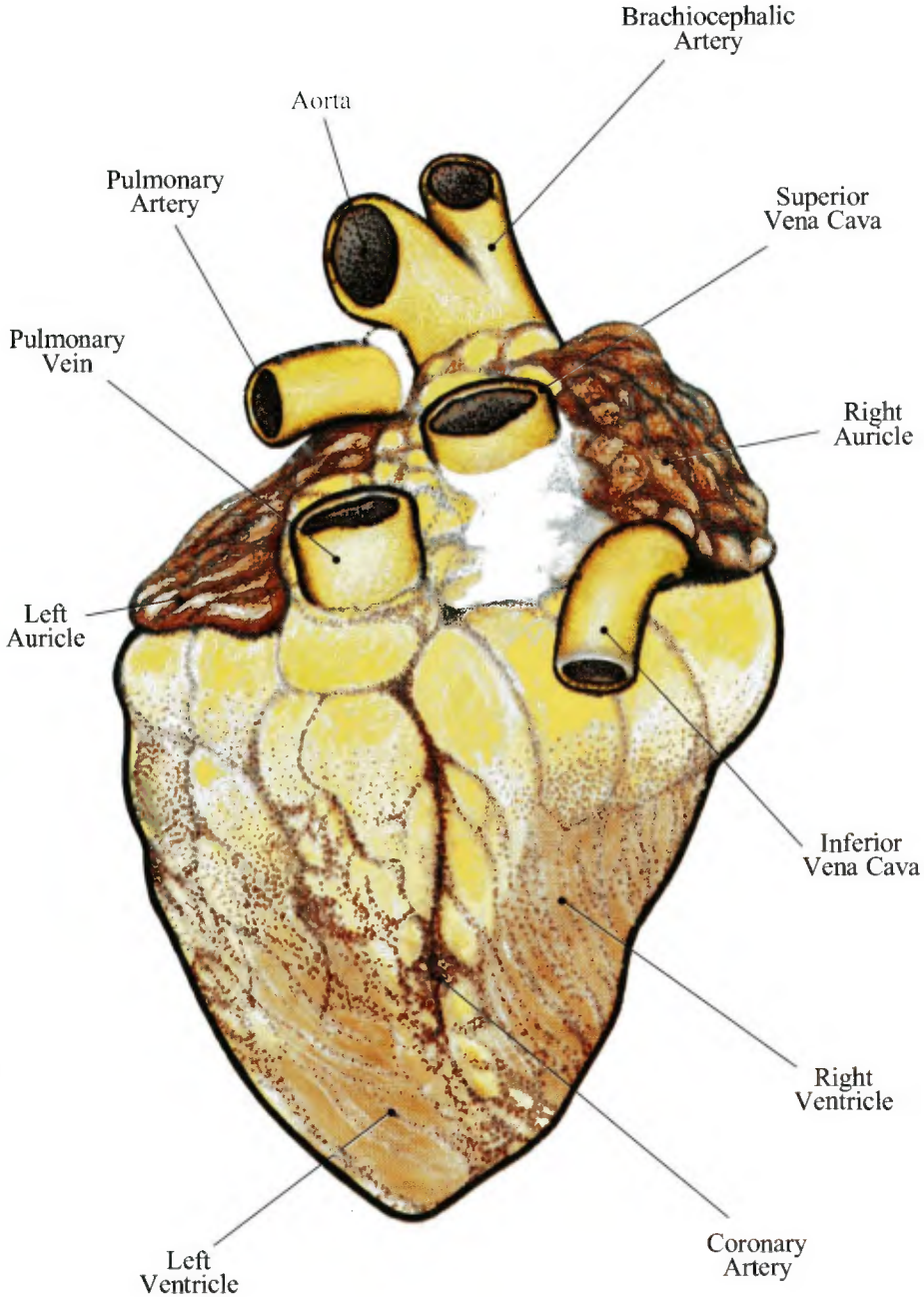

Figure 2. Exterior view, dorsal side.

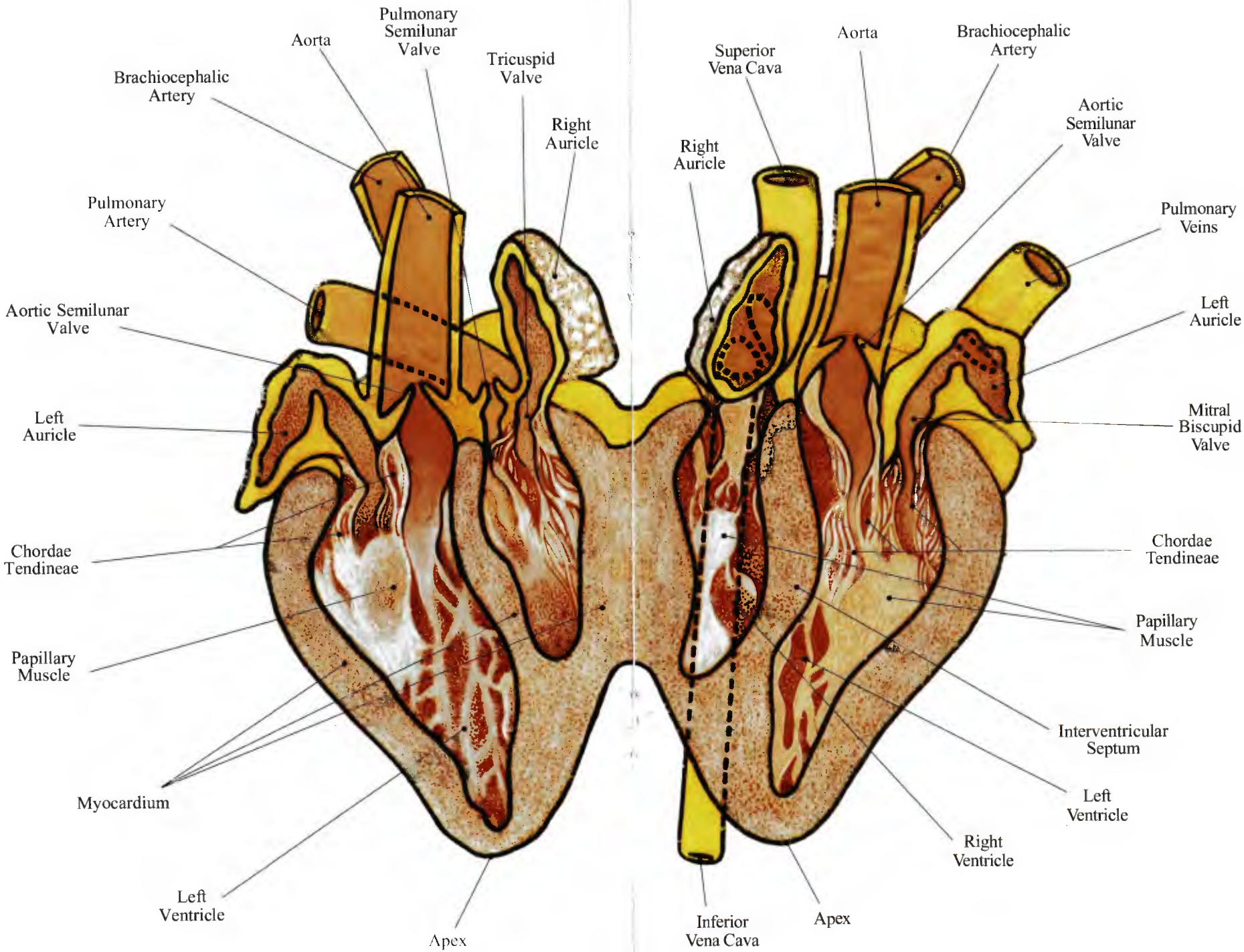

Figure 3. Frontal section of the heart.

Internal Anatomy

With a sharpened kitchen knife slice your heart almost in half as shown in Figure 3. The cut must go through the middle of the left auricle through the aorta and the right auricle. Cut straight down completely through the left and middle of the heart and almost completely through the right side. Leave a small flap of tissue between the left and right ventricle connecting the two halves together. Identify all of the parts listed (previously described parts are not listed again).

Tricuspid Valve—This valve is made up of three flaps of rounded tissue suspended by fibrous chords (the *chordae tendineae*) that extend into the ventricle. This valve allows the flow of blood from the right auricle into the right ventricle. It prevents blood from flowing back into the right auricle when the right ventricle contracts.

Pulmonary Semilunar Valve—This valve prevents blood from the pulmonary artery back flowing into the right ventricle after the ventricle contracts.

Mitral Bicuspid Valve—This valve prevents blood from back flowing from the left ventricle back into the left auricle during its contraction.

Aortic Semilunar Valve—Prevents back flow from the aorta into the left ventricle after contraction.

Chordae Tendineae—The "heart strings" or ligaments that support the atrioventricular valves (a fancy name for all four of the valves of the heart).

Papillary Muscle—Areas of the ventricles where the chordea tendineae originate and are attached to the myocardium.

Interventricular Septum—This is a thick wall of myocardium that divides the two ventricles.

The Operation of the Heart

The mammalian heart is basically a four chambered pump with two separate circuits. Each circuit is composed of two chambers: an atrium and a ventricle. The right circuit pumps blood from the body to the lungs. The left circuit pumps blood from the lungs to the body. Refer to Figure 4 as we follow the blood flow to and from the heart.

Blood enters the right circuit of the heart from the large superior and inferior venae cavae into the right atrium. Blood from the coronary vein also enters the right atrium through the coronary sinus. Blood enters the atrium when it is relaxed. When the atrium contracts blood is forced into the right ventricle through the tricuspid valve. The tricuspid valve prevents blood from flowing back into the atrium. Blood enters the ventricle while it is relaxed. When the ventricle contracts it pushes blood through the pulmonary semilunar valve and out to the lungs via the pulmonary arteries. Blood is prevented from returning to the ventricle by the pulmonary semilunar valve.

Oxygenated blood is returned from the lungs via the left circuit of the heart. The left atrium collects the returning blood and pumps it into the left ventricle. The left ventricle then pumps the blood out through the aorta to the body. Because the left ventricle pumps the majority of the bodies blood, it is the strongest chamber of the heart. Note how the myocardium of the left ventricle is thicker than that of the right ventricle.

The heart is a very rhythmic organ that beats in a prescribed fashion. Both atria relax and contract together. Both ventricles also relax and contract together, but opposite the atria. As a result, when the ventricles are relaxed they are both being filled with blood from the contracting atria. When the atria are relaxed, the contracting ventricles are pumping blood through the circulatory system resulting in both atria being filled. When you listen to the heart beat you are hearing the hearts valves closing. The characteristics "lub-dub" sound heard through a stethoscope comes from both pairs of heart valves closing. The "lub" sound comes from both the mitral and tricuspid valves closing while the "dub" sound arises from the closing of both semilunar valves.

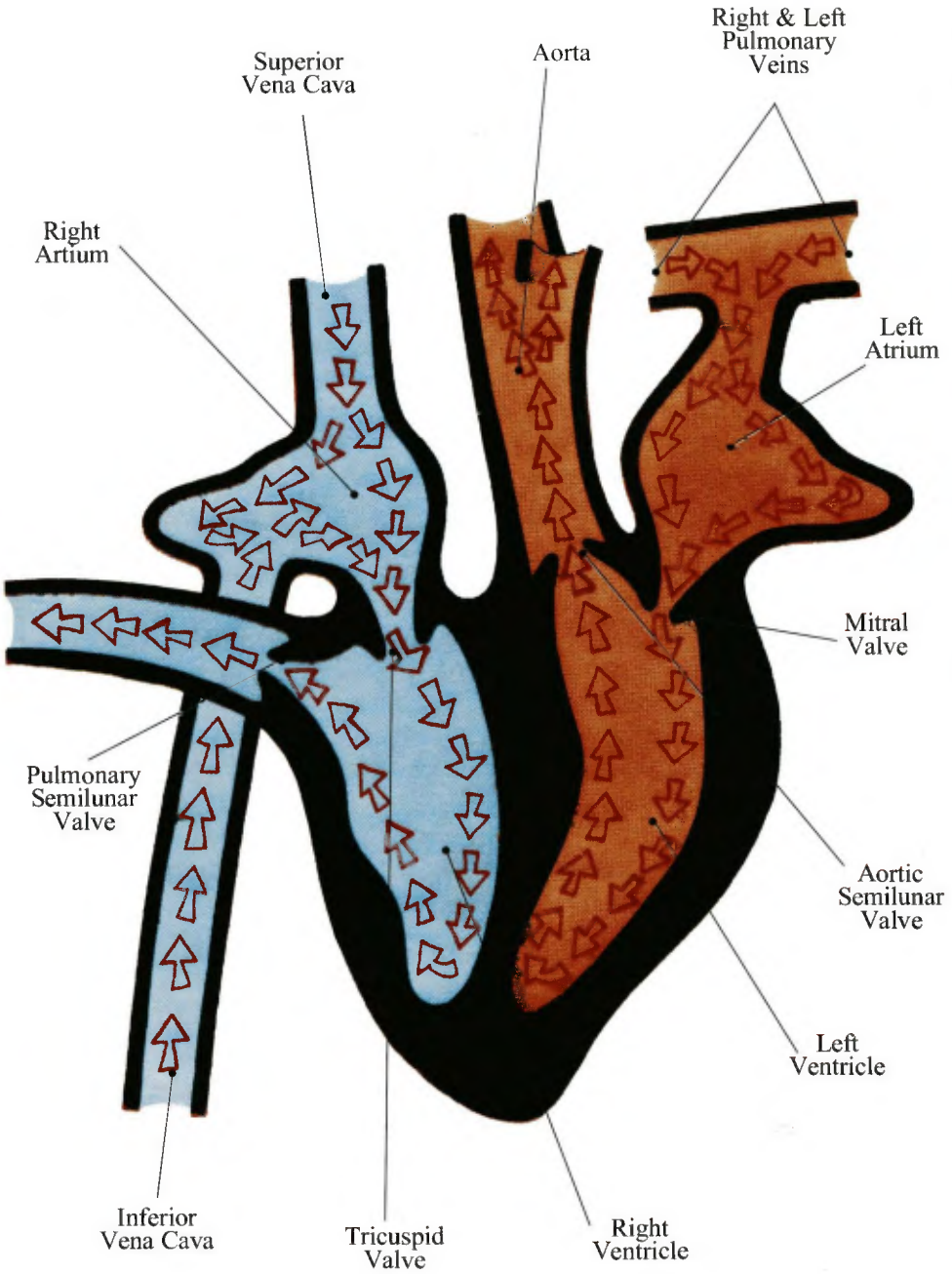

Figure 4. The blood flow through the heart.