

Laboratory Exercise

38

Heart Structure

Materials Needed

Textbook
Dissectible human heart model
Preserved sheep or other mammalian heart
Dissecting tray
Dissecting instruments

For Learning Extension:

Colored pencils

Safety

- Wear disposable gloves when working on the heart dissection.
- Save or dispose of the dissected heart as instructed.
- Wash the dissecting tray and instruments as instructed.
- Wash your laboratory table.
- Wash your hands before leaving the laboratory.

The heart is a muscular pump located within the mediastinum and resting upon the diaphragm. It is enclosed by the lungs, thoracic vertebrae, and sternum, and attached at its superior end (the base) are several large blood vessels. Its inferior end extends downward to the left and terminates as a bluntly pointed apex.

The heart and the proximal ends of the attached blood vessels are enclosed by a double-layered pericardium. The innermost layer of this membrane (visceral pericardium) consists of a thin covering closely applied to the surface of the heart, whereas the outer layer (parietal pericardium with fibrous pericardium) forms a tough, protective sac surrounding the heart. Between the parietal and visceral layers of the pericardium is a space, the pericardial cavity, that contains a small volume of serous (pericardial) fluid.

Purpose of the Exercise

To review the structural characteristics of the human heart and to examine the major features of a mammalian heart.

LEARNING OUTCOMES

After completing this exercise, you should be able to

- 1 Identify and label the major structural features of the human heart and closely associated blood vessels.
- 2 Match heart structures with appropriate locations and functions.
- 3 Compare the features of the human heart with those of another mammal.

EXPLORE

Procedure A—The Human Heart

1. Review the section entitled “Structure of the Heart” in chapter 15 of the textbook.
2. As a review activity, label figures 38.1, 38.2, and 38.3.
3. Complete Part A of Laboratory Report 38.
4. Examine the human heart model, and locate the following features:

heart

base (superior region where blood vessels emerge)

apex (inferior, rounded end)

pericardium (pericardial sac)

fibrous pericardium (outer layer)

parietal pericardium (inner lining of fibrous pericardium)

visceral pericardium (epicardium)

pericardial cavity (between parietal and visceral pericardial membranes)

myocardium (cardiac muscle)

endocardium (lines heart chambers)

atria

right atrium

left atrium

auricles

ventricles

right ventricle

left ventricle

atrioventricular orifices

atrioventricular valves (AV valves)

- tricuspid valve (right atrioventricular valve)
- mitral valve (bicuspid valve; left atrioventricular valve)

semilunar valves

- pulmonary valve
- aortic valve

chordae tendineae

papillary muscles

atrioventricular sulcus

interventricular sulci

- anterior sulcus
- posterior sulcus

superior vena cava

inferior vena cava

pulmonary trunk

pulmonary arteries

pulmonary veins

aorta

left coronary artery

- circumflex artery
- anterior interventricular (descending) artery

right coronary artery

- posterior interventricular artery
- marginal artery

cardiac veins

- great cardiac vein
- middle cardiac vein
- small cardiac vein

coronary sinus (for return of blood from cardiac veins into right atrium)

5. Label the human heart model in figure 38.4.

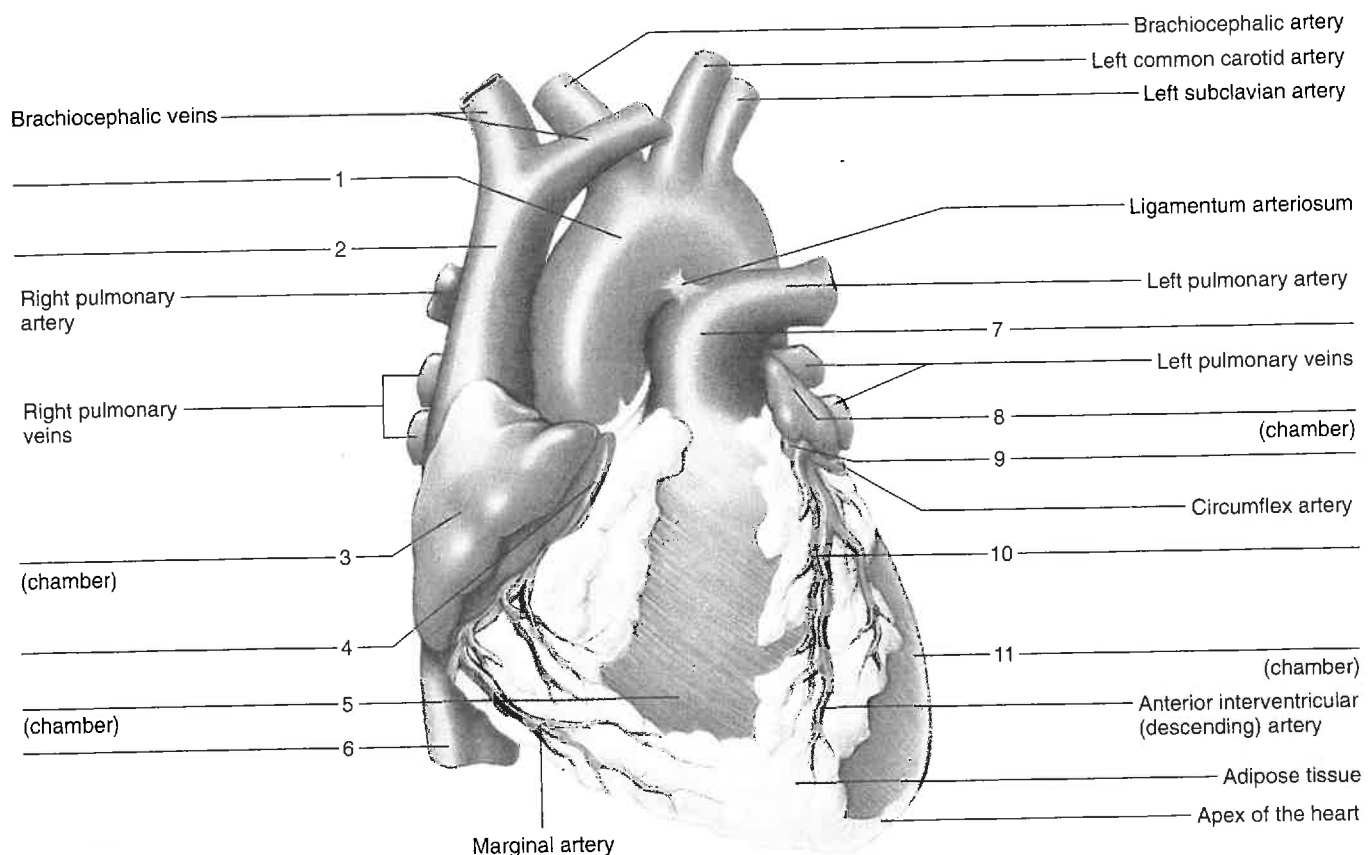


Figure 38.1 Label this anterior view of the human heart. 1

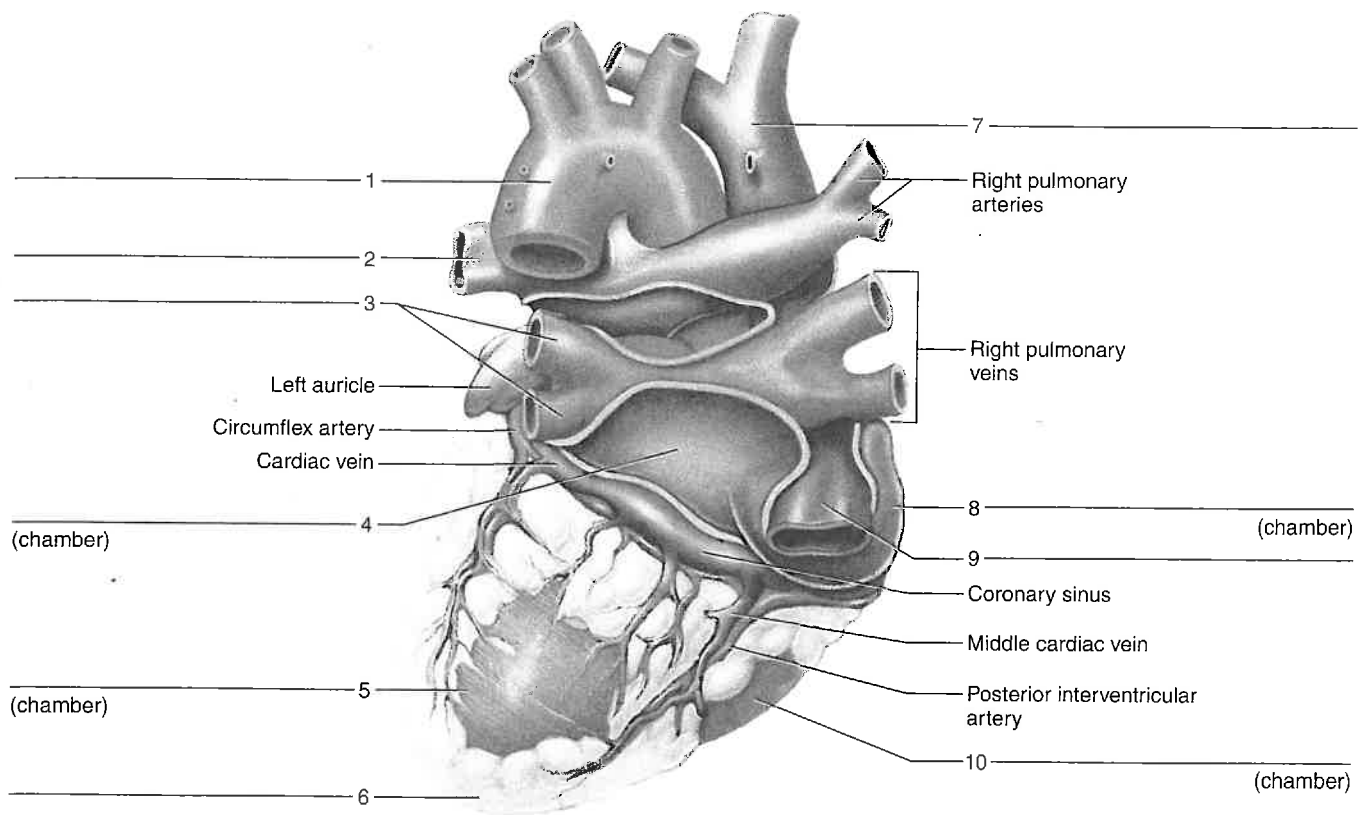


Figure 38.2 Label this posterior view of the human heart. 1

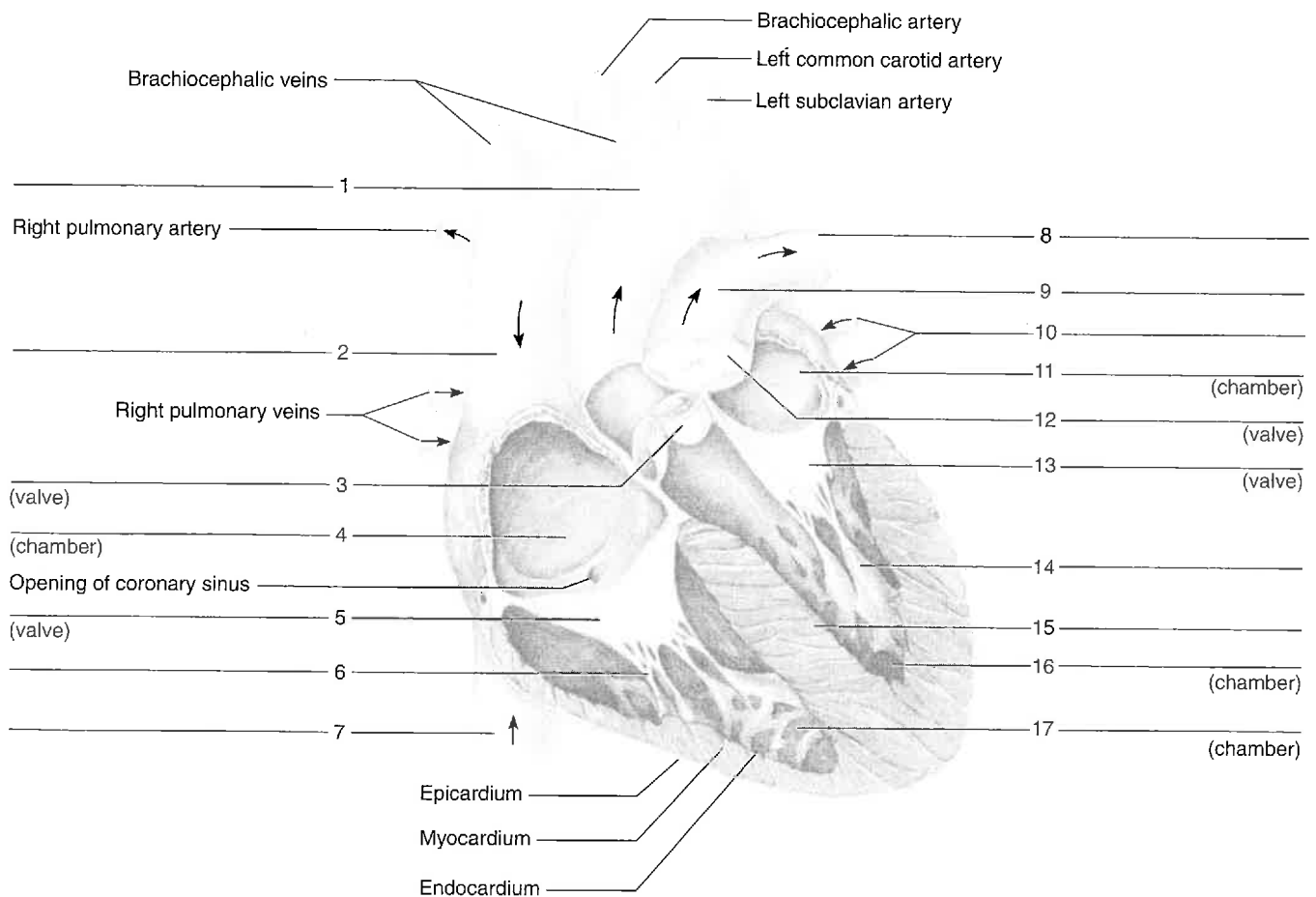
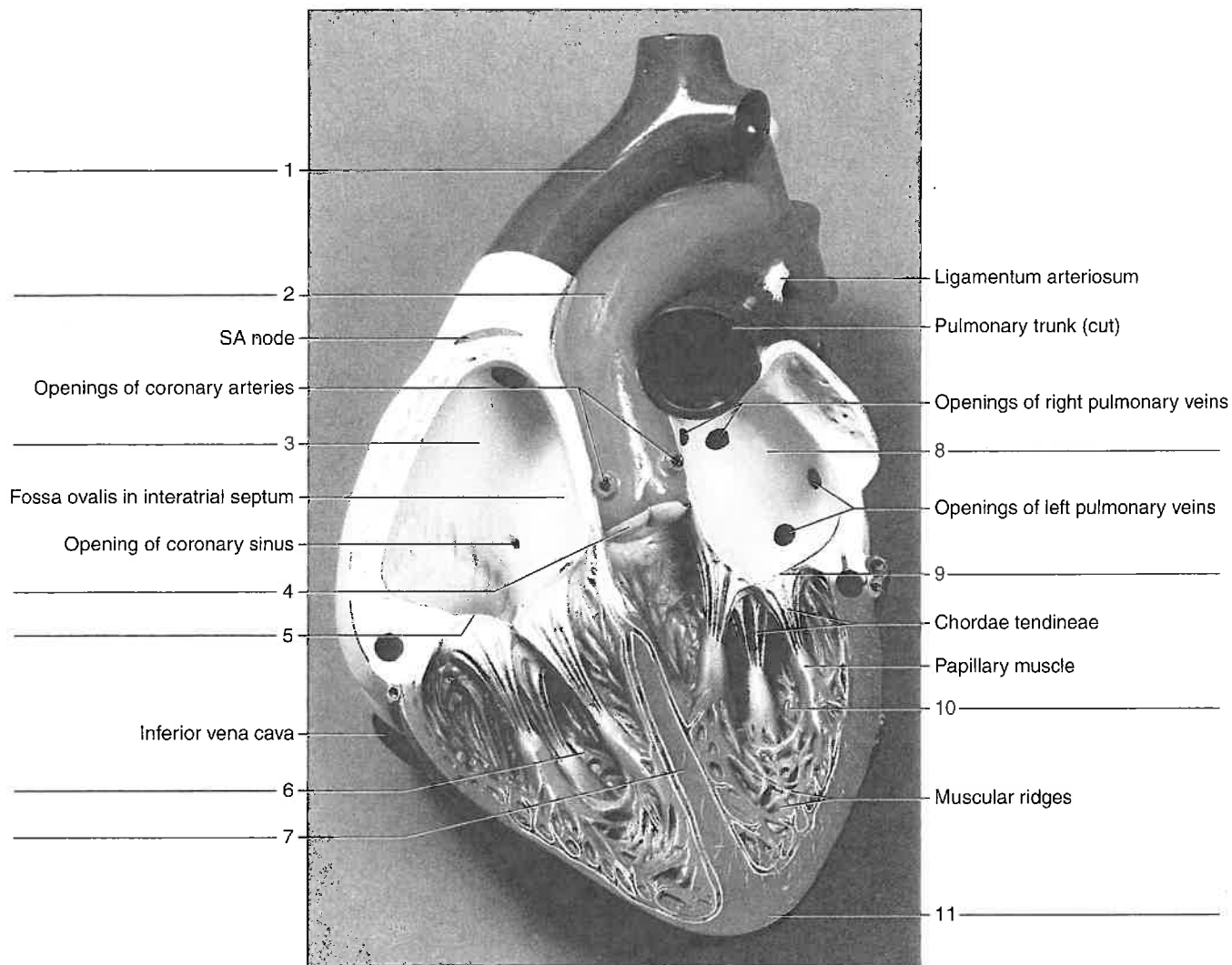


Figure 38.3 Label this frontal section of the human heart. The arrows indicate the direction of blood flow. 1



Terms:

Aorta
Aortic valve
Apex
Interventricular septum
Left atrium
Left ventricle

Mitral valve
Right atrium
Right ventricle
Superior vena cava
Tricuspid valve

Figure 38.4 Identify the features indicated on this anterior view of a frontal section of a human heart model, using the terms provided. (Note: The pulmonary valve is not shown on the portion of the model photographed.) 1



Learning Extension

Use red and blue colored pencils to color the blood vessels in figure 38.3. Use red to illustrate a blood vessel high in oxygen, and use blue to illustrate a blood vessel low in oxygen. You can check your work by referring to the corresponding figures in the textbook, presented in full color.

EXPLORE

Procedure B—Dissection of a Sheep Heart

1. Obtain a preserved sheep heart. Rinse it in water thoroughly to remove as much of the preservative as possible. Also run water into the large blood vessels to force any blood clots out of the heart chambers.

2. Place the heart in a dissecting tray with its ventral surface up (fig. 38.5), and proceed as follows:

a. Although the relatively thick *pericardial sac* probably is missing, look for traces of this membrane around the origins of the large blood vessels.

b. Locate the *visceral pericardium*, which appears as a thin, transparent layer on the surface of the heart. Use a scalpel to remove a portion of this layer and expose the *myocardium* beneath. Also note the abundance of fat along the paths of various blood vessels. This adipose tissue occurs in the loose connective tissue that underlies the visceral pericardium.

c. Identify the following:

right atrium

right ventricle

left atrium

left ventricle

atrioventricular sulcus

anterior interventricular sulcus

d. Carefully remove the fat from the anterior interventricular sulcus, and expose the blood vessels that pass along this groove. They include a branch of the *left coronary artery* (anterior interventricular artery) and a *cardiac vein*.

3. Examine the dorsal surface of the heart (fig. 38.6), and proceed as follows:

a. Identify the *atrioventricular sulcus* and the *posterior interventricular sulcus*.

b. Locate the stumps of two relatively thin-walled veins that enter the right atrium. Demonstrate this connection by passing a slender probe through them. The upper vessel is the *superior vena cava*, and the lower one is the *inferior vena cava*.

4. Open the right atrium. To do this, follow these steps:

a. Insert a blade of the scissors into the superior vena cava and cut downward through the atrial wall (fig. 38.6).

b. Open the chamber, locate the *right atrioventricular valve* (*tricuspid valve*), and examine its cusps.

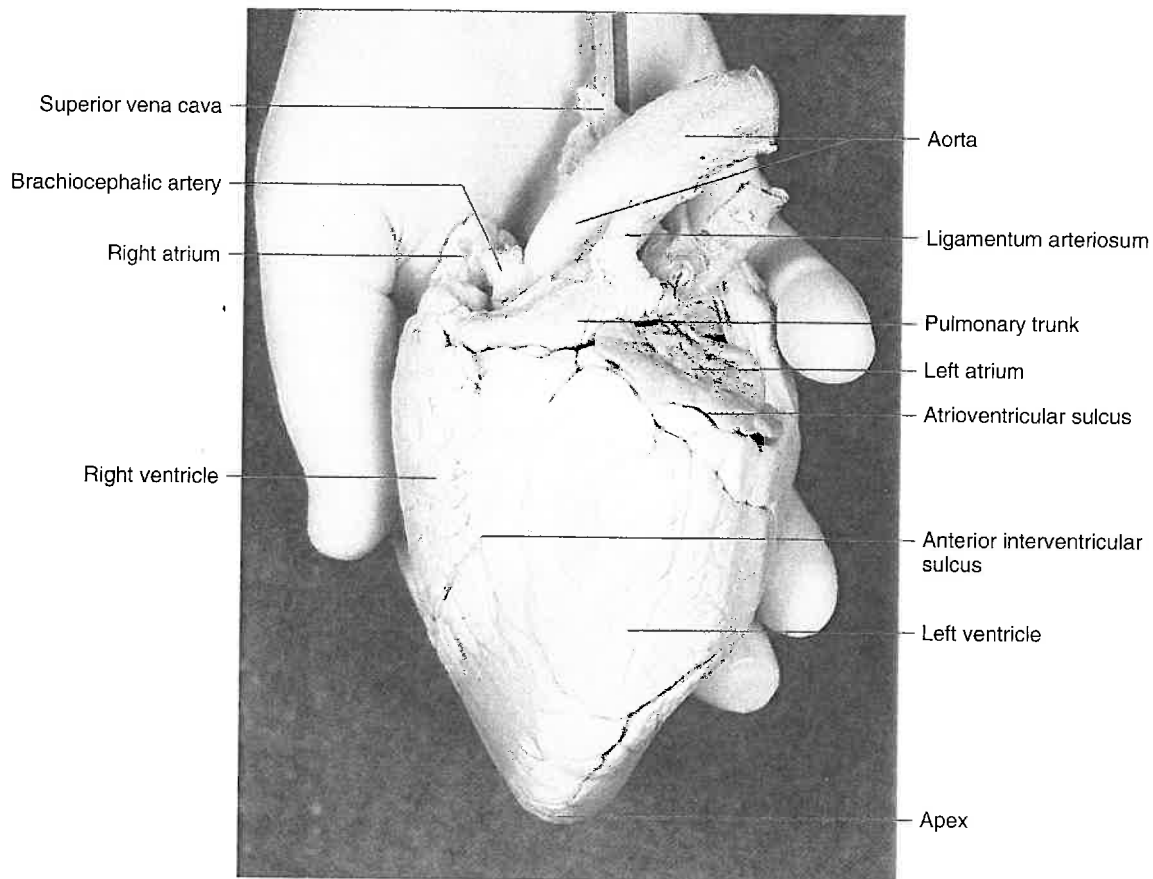


Figure 38.5 Ventral surface of sheep heart.

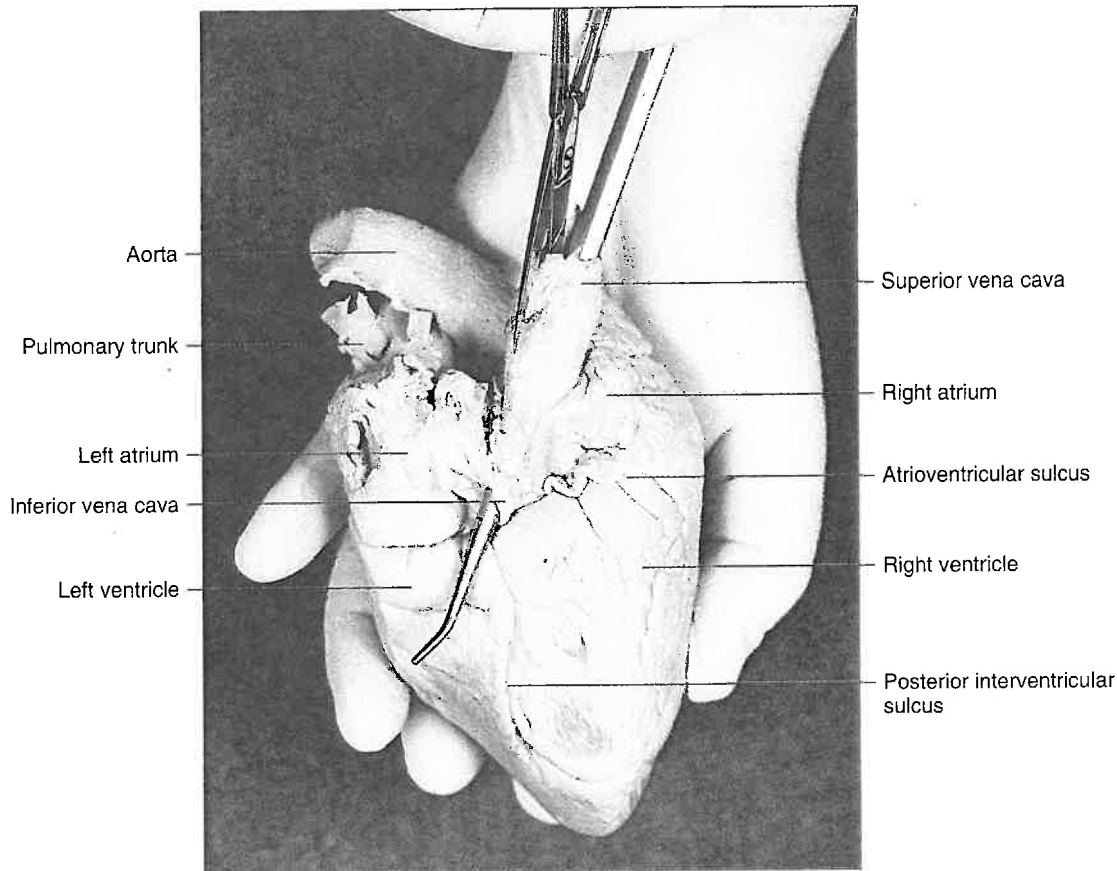


Figure 38.6 Dorsal surface of sheep heart. To open the right atrium, insert a blade of the scissors into the superior (anterior in sheep) vena cava and cut downward.

- c. Also locate the opening to the *coronary sinus* between the valve and the inferior vena cava.
- d. Run some water through the right atrioventricular valve to fill the chamber of the right ventricle.
- e. Gently squeeze the ventricles, and watch the cusps of the valve as the water moves up against them.
5. Open the right ventricle as follows:
 - a. Continue cutting downward through the right atrioventricular valve and the right ventricular wall until you reach the apex of the heart.
 - b. Locate the *chordae tendineae* and the *papillary muscles*.
 - c. Find the opening to the *pulmonary trunk*, and use the scissors to cut upward through the wall of the right ventricle. Follow the pulmonary trunk until you have exposed the *pulmonary valve*.
 - d. Examine the valve and its cusps.
6. Open the left side of the heart. To do this, follow these steps:
 - a. Insert the blade of the scissors through the wall of the left atrium and cut downward to the apex of the heart.
- b. Open the left atrium, and locate the four openings of the *pulmonary veins*. Pass a slender probe through each opening, and locate the stump of its vessel.
- c. Examine the *left atrioventricular valve (bicuspid valve)* and its cusps.
- d. Also examine the left ventricle, and compare the thickness of its wall with that of the right ventricle.
7. Locate the aorta, which leads away from the left ventricle, and proceed as follows:
 - a. Compare the thickness of the aortic wall with that of a pulmonary artery.
 - b. Use scissors to cut along the length of the aorta to expose the *aortic valve* at its base.
 - c. Examine the cusps of the valve, and locate the openings of the *coronary arteries* just distal to them.
8. As a review, locate and identify the stumps of each of the major blood vessels associated with the heart.
9. Discard or save the specimen as directed by the laboratory instructor.
10. Complete Part B of the laboratory report.