DISSECTION OF A SHEEP HEART

I. INTRODUCTION

A. You will soon appreciate the point made previously— the heart models just don't teach us what a real heart is like! Dissecting a sheep heart will give you an accurate understanding of many aspects of the heart— the delicacy of the valves, the thickness of the great vessels, an inside view of the coronary arteries, and the difference in thickness of the walls of the two ventricles. The sheep heart is about the size of the human heart, and the few differences will be pointed out.

B. Work in groups of two. If an odd number of students are in the lab, one group of three students should use two hearts. Besides the heart, you will need a yellow kit of five dissecting tools, a dissecting tray, gloves for all (actually optional), a bag, tag, and a tie for storage.

C. It will be necessary to take the sheep heart home for further study. It doesn't need refrigeration, because it has been treated with a mild preservative. Don't let your cats or dogs sniff it out— it can harm them if eaten. Storage instructions follow the end of the dissection procedure.

D. Proceed through the dissection step by step. Make sure you identify each structure before you go on to the next. Be careful that each of the four cuts is made correctly. Compare your heart to the samples already dissected before you cut. Ask your instructor for the assistance you need.

E. Pages 34 and 35, which contain the dissection illustration, are duplicated on the last pages of this lab guide. It may be convenient to remove the last pages so that the illustrations are readily available as you dissect.

II. DISSECTION PROCEDURES

A. External features of the heart

1. Getting oriented: Your heart should not have much fat attached to it. Follow your instructor's directions if it does. Use Fig. 1.1 to orient the heart so that the base is superior and the apex is inferior. “Right” or “left” always refer to the heart's right and left.
2. Finding the anterior side: Refer to Fig. 1.1. When the anterior side is facing you, it is like a washing machine—most of the plumbing goes out the back. When the anterior side faces you, the **pulmonary trunk artery** is anterior, but slopes away from you. When the anterior side faces you, the **anterior interventricular sulcus** lies to the right side of the apex. If the posterior side faces you, the posterior interventricular sulcus goes directly to the apex. See Fig. 1.2.

3. The auricles and atria: With the anterior side facing you, find the flap-like **right and left auricles**. They are extensions of the right and left atria. The atria are more easily seen once the heart is opened.

4. The ventricles: Find the **right ventricle** to the right of the anterior interventricular sulcus. Find the **left ventricle** to the left of the anterior interventricular sulcus. Which one forms part of the apex? (R/L) Which one seems larger? (R/L) Actually, the space inside each is the same size.

5. The sulci (plural of “sulcus”): You have already used the shallow **anterior interventricular sulcus** as a landmark. On the opposite side, find the equally shallow **posterior interventricular sulcus** (Fig. 1.2). Between the atria and the ventricles, under the auricles, find the deep **coronary sulcus**. Trace it all around the heart (“coronary” means “crown”).

6. The great vessels: Orient the heart so that you are looking at the anterior side. Atop the base, in order from anterior to posterior, are the **pulmonary trunk artery**, the **aorta**, and the **superior vena cava**. Note the letters “PAS” as a reminder of the order. The pulmonary trunk artery is thick-walled, and is probably cut off short. Posterior to it is the thicker-walled aorta. The short branch off the right side of the aorta is the **brachiocephalic artery**, which supplies the right side of the head and arm. Push the **blunt probe** into the aorta and out the brachiocephalic artery to observe how it branches off the aorta. The superior vena cava is thin-walled and may be harder to find. It is on the posterior side of the right atrium. Once you find it, stretch it by inserting a finger into it. The **inferior vena cava** will be located later.

7. The layers of the heart wall: The **epicardium** is the thin, transparent layer covering the heart. It is another name for the **visceral pericardium**. Take your sharp probe and pull a bit of it up. The **myocardium** is the heart muscle; 99% of the heart is made of it. The inside is lined with thin **endocardium**, which will be seen later, once the heart is opened.
B. The right heart—internal anatomy

1. Two incisions will be made to open the right heart fully. It is strongly recommended that you check with your instructor and/or with the display heart before you cut.

2. Right heart incision 1 (Fig. 1.1 and 1.2): With the anterior side facing you, find the pulmonary trunk artery. Using a sharp probe, etch a line from the pulmonary trunk artery inferiorly along the right ventricle, 2 cm from the anterior interventricular sulcus and parallel to it. Continue the line around the posterior side of the right ventricle, stopping about 2 cm from the posterior interventricular sulcus. Insert one blade of the scissors into the pulmonary trunk artery and cut the anterior wall of the right ventricle open along your etched line.

3. Open the pulmonary trunk artery and using the blunt probe, gently find the pulmonary semilunar valve at the base of the artery. It is composed of three delicate cusps (“flaps”) which are often compared to three shirt pockets. You can probably see two of its cusps; the third has been cut.

4. Open the right ventricle more to observe the interventricular septum. This is the rear wall of the right ventricle; it forms the wall of the left ventricle also—hence the name. Push on it firmly with your thumb. Is it thick or thin? Note the smooth, thin, shiny endocardium that lines it.

5. Right heart incision 2 (Fig. 1.2): Turn the heart to the posterior side. Insert a finger into the superior vena cava and stretch it open. With your sharp probe, etch a line beginning on the superior vena cava inferiorly, about 2 cm from the posterior interventricular sulcus and parallel to it. This line should meet with the end of the first incision you have already made. Insert one blade of your scissors into the superior vena cava and cut along the etched line until your scissors meet with the first cut. Loosen any internal tissue by snipping it. You now have a flap as in Fig.1.2, allowing you to open the right ventricle like a book.

6. The tricuspid valve (Fig. 1.3): Between the right atrium and the right ventricle is the stringed, flap-like tricuspid valve. Use the blunt probe to lift the three flaps, which are more or less continuous with each other. Note how the thin, whitish chordae tendinae (the “heartstrings”) attach the cusps of the tricuspid valve to the papillary muscles, which look like small bumps. The chordae tendinae anchor the valve to the papillary muscles and prevent it from “blowing out” when the ventricle contracts.
7. The moderator band (Fig. 1.3) is a gray band of muscle stretched between the anterior and posterior right ventricle. It is not present in humans. In mammals which have it, it may prevent overstretch of the right ventricle.

8. Toward the posterior part of the right atrium (Fig. 1.3) are two holes arranged like the letter “B.” The upper, larger hole is the inferior vena cava. Poke your little finger out through it. It is oriented a little differently from that of the human heart. Inferior to it is a smaller opening, the coronary sinus. This is the thin-walled vein that brings back “blue” blood from the heart muscle itself. Gently probe into it with the blunt probe. Can you see the coronary sinus from the outside, in the coronary sulcus?

C. The left heart– internal anatomy

1. You will make two incisions to open the left side of the heart completely. Again, check with your instructor and/or with the display heart before you cut.

2. Left heart incision 1: Turn the heart to the posterior side. Now your left and its left are on the same side. On the left atrium, instead of the four pulmonary veins, you will most likely find one or two good-sized holes, where the butcher separated the heart from the lungs. Insert a finger into the left-most hole down into the left ventricle. Notice how thick the left ventricle wall is, and how much space is inside. Etch a line with the sharp probe from the same hole inferiorly, all the way down the left lateral side of the heart. Now, using the scalpel, cut the left side of the heart open along the etched line.

3. Open the entire left heart like a book (Fig 1.4) The thin but tough bicuspid valve separates the left atrium from the left ventricle. This large valve, composed of two cusps, is also called the mitral valve. Thick chordae tendineae anchor the bicuspid valve to large papillary muscles. The huskier appearance of the left ventricle compared to the right reflects its workload– it pushes blood to the entire body, while the right ventricle just pushes blood to the lungs.

4. Left heart incision 2 (Fig. 1.4): Take your blunt probe and push it up under the bicuspid valve, up through the left ventricle and out the aorta. This is the pathway taken by blood pumped out of the left ventricle. Leave the probe in the aorta. Now, take a scalpel and cut down through
all the heart tissue—aorta, muscle, bicuspid valve—right to the probe, until you can lift it straight out. You have just opened the aorta.

5. Open the **aorta** wide. At its base, look for the **aortic semilunar valve**. Like the other semilunar valve, it is composed of three delicate cusps like shirt pockets. Probe each with a **blunt probe**. You have probably cut one of them.

6. To find openings of the all-important **right and left coronary arteries**, use your blunt probe to find an opening within the “shirt pocket” of the right-most cusp of the aortic semilunar valve. This is the opening of the **right coronary artery**. Now probe into the left-most cusp; the hole in its “shirt pocket” is the opening to the **left coronary artery**.

7. Insert your index finger into the **right atrium** and your thumb into the **left atrium**. Squeeze. The muscle in between is the **interatrial septum**, the wall shared by both atria.

8. Turn the heart so that the posterior side faces you. Open the **right atrium**. From inside the right atrium push your left little finger into the **inferior vena cava** and bend it toward the heart. The thin membrane that you feel is the **fossa ovalis**, part of the interatrial septum. Before birth the fossa ovalis was a one-way valve that allowed blood to pass from right atrium to left atrium. It closed shortly after the first breath was taken, and grew closed within a few weeks.

D. Clean-up instructions: Bag, tag, and tie the sheep heart. Take it home, or store it in the lab drawer that your instructor assigns you. Wash all five dissecting tools and return them to the yellow kit. Rinse out the dissecting pan.

III. **HELPFUL TIPS FOR STUDYING THE SHEEP HEART**

A. As you study the heart, use other hearts correctly dissected by other students. This is one of the best ways to learn the heart.

B. Use the word list from “The Human Heart” lab (pages 22-23), items 1.B-1.D to review the sheep heart. The exceptions are as follows: You will not see the right and left pulmonary veins or the ligamentum arteriosus on the sheep heart. Add **anterior interventricular sulcus, posterior interventricular sulcus, moderator band**, and the **openings of the right and left coronary arteries** to the sheep heart list.
C. Use a heart model to trace the flow of blood through the right heart:

“Blue” blood enters the ______________ _______________ (chamber) through the _____________ __________ _________ (vessel), ___________ __________ _________ (vessel), and _________________ __________ (vessel). It passes through the _________________ valve and enters the ___________ _________________ (chamber). Blood leaves through the _________________ ___________ valve and goes into the _________________ _______________ , to the _________________ (organs) to pick up oxygen.

D. Trace the flow of through the left heart: Red blood from the lungs enters the ______________ _______________ (chamber) through the four _________________ __________ (vessels). Blood flows through the _________________ valve into the _________________ _______________ (chamber). It leaves through the _________________ _______________ valve, entering the _________________(vessel).

E. The heart really does feed itself first, because the first branches off the aorta are the right and left _________________ _______________ (vessels).
Optional notes on the heart

1. Many of the problems associated with the heart occur if the blood supply to the heart is impaired because of atherosclerosis of the **right and left coronary arteries and their branches**.

2. Mild decrease in blood flow to the heart muscle can cause pain called **angina pectoris**, but obstruction of the arteries causes death to cardiac cells which cannot get oxygen and nutrients through the blood (**myocardial infarction**, the technical term for a "heart attack").

3. Why is the heart said to "feed itself first?"

4. Angioplasty refers to a surgical technique in which a small balloon is threaded into the obstructed coronary artery and inflated to reopen it.

5. Coronary bypass surgery is done by removing vessels from other parts of the person's body, such as the great saphenous vein, and suturing it between the aorta and the end of the obstructed artery. "Triple" or "quadruple" bypass surgery refers to the number of grafts that are put in place. If the smaller branch arteries of the major coronary arteries are also occluded with atherosclerosis, can you see why bypass surgery would not make a difference?

6. Interestingly, the low pressure veins of the heart are not the culprit in these types of problems.

7. The diet, supplements, and lifestyle habits that effectively reduce the incidence of heart disease are well known.
Illustrations of the Heart Dissection