

LABORATORY EXERCISE #10

HOW IS THE HEART ADAPTED TO CARRY OUT ITS FUNCTIONS?

INTRODUCTION

The heart is an organ which pumps blood continually for your entire life. It is made of a special muscle tissue which has its own intrinsic ability to contract without reference to the brain. This is called cardiac muscle. It is under the coordinated control of a pacemaker system, and it can pump from 5 liters per minute (your entire blood volume) to 35 liters per minute.

Today you will dissect a sheep's heart, a heart which is very similar to your own in both structure and function. As you examine the structure of the heart and its accompanying vessels, continually relate the structures you find with their functions.

STUDENT OBJECTIVES

1. Identify the structures of a mammalian heart.
2. Relate each structure to its function.
3. Improve dissection technique.

PRE-LAB QUESTIONS:

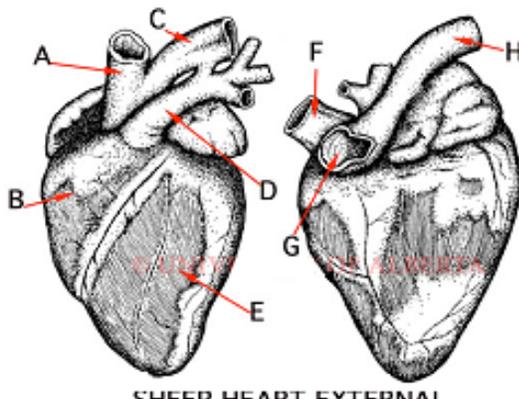
1. Describe the functions of the atrio-ventricular (tricuspid, bicuspid) and the semilunar (pulmonary and aortic) valves. What is a node?
2. Describe the pathway of blood through the human heart and lungs starting from the vena cava and ending in the aorta. Imagine you are a drop of blood embarking on this intrepid journey. Include all the valves in your description.
3. Compare the heart structure and circulation of the amphibian, bird, and mammal. (You MUST use your biology textbook or some outside source.) Use diagrams if you wish to illustrate your comparisons.

MATERIALS

Sheep's heart, dissection kit, dissection pan lined with a paper towel, pins, tape, pen, paper, rubber gloves (optional), a sheep pluck for demonstration, charts or diagrams of the heart, glass rod

PROCEDURE

1. Work in pairs. Make flags, 4 cm. x 1 cm. labeled with names of the heart structures listed below. Place a pin through each flag and place the flag into the parts listed as you identify each in turn. Your teacher will mark you on the completeness of your labeled, dissected heart.
Make flags for each of the following parts
 - a. External flags: aorta, superior vena cava, pulmonary vein, pulmonary artery, inferior vena cava, right auricle, left auricle, coronary blood vessels, apex
 - b. Internal flags: right atrium, left atrium, right ventricle, left ventricle, bicuspid valve, tricuspid valve, semilunar valve, chordae tendinae, papillary muscles, septum
2. External Observation
 - a. Along with your lab teacher, identify the DORSAL, VENTRAL, ANTERIOR, and POSTERIOR aspects of the heart. Review the terms FRONTAL and SAGITTAL sections.
 - b. Observe the small, thin-walled ATRIA on the anterior end. In contrast, note the large, thick-walled posterior VENTRICLES. Locate the APEX, the pointed posterior end.
 - c. Observe the ventral aspect of the heart. Note the presence of the CORONARY BLOOD VESSELS which wrap around the ventricles. Sometimes they are obscured by white fat.



A=brachiocephalic artery
C=aorta

B=right ventricle
D=pulmonary trunk

E=left ventricle
G=posterior vena cava

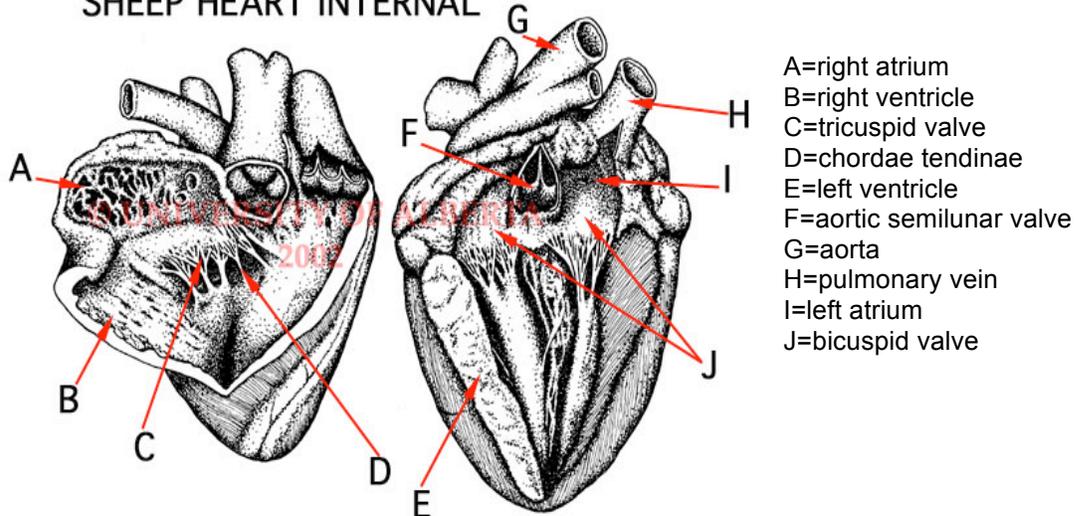
F=pulmonary vein
H=anterior vena cava

- d. Locate the AORTA and the PULMONARY ARTERY which leave the anterior aspect of the heart. The aorta is large and thick-walled. The pulmonary artery has thinner walls and is more ventral. Later in the internal observation, you must draw and then confirm your identification.

3. Internal Observation

- a. You will be making a frontal incision, almost separating the dorsal (back) half from the ventral (front) half of the heart. Using your scalpel, start at the apex and make a cut in the anterior direction. Cut through the ventricles, but stop halfway through the atria. Leave the two halves attached. It makes it easier to observe the valves this way. After observing the valves, you can separate the halves. As you continue the dissection, you might have to make additional incisions to better observe the structures.
- b. Identify the LEFT and RIGHT ATRIA and the LEFT and RIGHT VENTRICLES. Observe the difference between the thickness of the left and right ventricle walls and then compare them to the thickness of the atrial walls. The wall between the left side and the right side of the heart is known as the SEPTUM.

SHEEP HEART INTERNAL



The valves between the atria and the ventricles are called the ATRIO-VENTRICULAR VALVES. Identify the thin, white TRICUSPID VALVE between the right atrium and right ventricle. Identify the BICUSPID VALVE (sometimes called the mitral valve) located between the left atrium and left ventricle. Note how they are attached to long thin tendons, the CHORDAE TENDINAE. These tendons in turn are attached to the PAPILLARY MUSCLES. Move the ventricles walls in and out, mimicking the contractions. Observe how the valves respond to this action. Determine which way the blood would flow. (The “lubb” sound you hear with a stethoscope is the sound of closing of the atrio-ventricular valves and the “dubb”, or second sound, is the action of the semilunar valves closing. The term “diastole” refers to the relaxing of the heart muscle and the “systole” describes the contraction phase).

- c. Locate the PULMONARY ARTERY, which takes the blood out of the right ventricle. Carefully push the end of a glass rod upward through the semilunar valve to find the passageway. Identify the AORTA which carries blood from the left ventricle. Contrast the SEMILUNAR VALVES with the ATRIO-VENTRICULAR VALVES (tricuspid and bicuspid) in terms of structure and function.
- d. Does your sheep heart have the VENA CAVA? These blood vessels, which bring blood to the right atrium, are often missing on the sheep hearts purchased for dissection. The PULMONARY VEINS, which bring blood from the lungs to the left atrium, are also sometimes missing. Compare your heart to a chart or diagram of the heart.
- e. Insert all the “flags” into the appropriate structures. Have your teacher check your flag insertions.
- f. Draw and identify as many as you can of the internal structures of the heart within your incision.