Human Anatomy Lab: The Heart

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Expected Learning Outcomes
At the end of this lab, you will be able to
- identify external and internal features of the heart;
- use dissection techniques to locate and identify major vessels, chambers, valves, etc. in the pig heart; and
- examine human hearts to identify pathologies such as congestive heart failure and surgical bypasses.

Introduction
The cardiovascular system consists of blood, blood vessels, and heart. The heart is a marvel of engineering—an integration of moving cells, electrical signals, strong muscular walls, and carved out chambers with door-like valves. The heart has the strength to push the blood through miles of vessels to remote tissues in the head and limbs. Once oxygen and nutrients have been delivered, and wastes picked up, blood returns to the heart before it circulates again. Today we will explore heart structure and function.

What are you required to know for the test?
1. Locate and write down the name of all structures in bold font on the pig hearts and the human heart. (Spelling counts!)
2. Be able to recognize pathologies on the human hearts observed in lab.
3. Be able to answer the functional questions that are included in the Check Your Understanding boxes.

Where does one find the required information?
Consult Chapter 20 in your textbook.

**Activity 1: Pig Heart Dissection**

1. Work in pairs. With your partner, obtain a pig heart, a dissecting pan, and dissecting tools (bamboo sticks, forceps).

2. Examine the heart and note its shape. Note the fat surrounding the heart. The parietal pericardium has mostly been removed. What is the **visceral pericardium** and where would you find it?

3. Identify the **base** and the **apex** of the heart. Locate the ear-shaped flaps called **auricles** that are visible portions of the **right and left atria**. Determine anterior and posterior sides of the sheep heart. A clue is the **anterior interventricular sulcus (longitudinal sulcus)**, which runs diagonally across the anterior surface and roughly marks the division between the **right and left ventricles**. If necessary, gently remove fat in part of the anterior longitudinal sulcus to see the **anterior interventricular artery** running alongside the **great cardiac vein**. The anterior interventricular artery is a branch of the left coronary artery.

4. You can locate the major vessels of the heart by inserting a blunt probe, or your finger, into the vessels and determining which chamber the vessel originated in. Be careful not to tear the tissue.

   First, place the heart in the anatomical position and locate the **pulmonary trunk**, the large vessel that travels diagonally from the area of the right ventricle to the upper part of the heart. It divides into pulmonary arteries that go to the right and left lungs. Often, the vessel has been cut below the division so we cannot identify the pulmonary arteries.

5. Locate the large vessel directly behind the pulmonary trunk. This is the ascending **Aorta**. If you run a probe through this vessel into
the heart it should enter the left ventricle. The first branch of the aorta is the **brachiocephalic artery**.

6. Posterior to the aorta, find the large, comparatively thin-walled **superior vena cava**, which enters into the top of the right atrium. The entrance to the **inferior vena cava** is located on the posterior surface of the heart, in the fat that fills the coronary sinus. It is trickier to find and you will probably need assistance from the instructor.

7. The **pulmonary veins** enter the left atrium, carrying oxygenated blood from the lungs. There are four of these vessels but usually they have been cut near the left atrium and we only see a single large opening into the chamber.

**Internal Structures**

8. Begin your actual dissection by cutting into the pulmonary trunk where it comes off the base of the heart. Continue the cut inferiorly, into the right ventricle, through the **myocardium**, about 1 inch to the right (anatomically) of the anterior interventricular sulcus. Continue the cut toward the apex then make a sharp angle and cut superiorly toward the right atrium. You will end up with a triangular flap.

9. Now you can see the layers of the heart wall. The bulk of the wall is composed of the **myocardium**. The shiny outer surface of the heart is the **epicardium (visceral pericardium)**. Lining the chambers is the **endocardium**.

10. Now, gently lift the flap where you cut through the pulmonary trunk and observe the **pulmonary semilunar valve**. The pocket-like flaps flatten against the walls of the artery when the blood is pumped from the ventricle.

11. Next, continue to lift the wall of the right ventricle and observe the flaps of the **tricuspid valve**. If you look carefully, you will notice that there are three separate thin sheets of tissue. Each is attached to strings called **chordae tendineae**. Follow the strings to where they are anchored on the ventricular wall by the triangular shaped **papillary muscles**. The papillary muscles are not really separate from the walls, but are modifications of the myocardium.

12. Lift the cut flap further superiorly. Above the tricuspid valve, examine the **right atrium**. Inside the chamber, you will find openings where blood from the superior and inferior venae cavae
enters. Near the opening for the inferior vena cava, find the opening for the **coronary sinus**, where blood returns to the atrium from the heart itself. Gently insert a bamboo stick into the opening and wiggle it while watching the outside of the back of the heart. This will enable you to see the position of the coronary sinus.

13. Cut through the myocardium of the left side of the heart, using the anterior interventricular sulcus as a guideline. Cut about 1 inch to the anatomical left of the sulcus, beginning in the thin walled left atrium. Continue the cut through the wall of the ventricle to the apex of the heart.

14. Spread the heart apart and observe the:
   a. **Aortic semilunar valve** at the origin of the aortic artery.
   b. **Bicuspid valve** and its **chordae tendineae** attaching to the **papillary muscles**.

**Check Your Understanding:** Answer the following questions.

1. Which part of the myocardium is thickest? Explain the functional reason that myocardium thickness differs from region to region in the heart.
2. Through what structure does most of the blood from the myocardium drain into the right atrium?
1. What structures prevent the backflow of blood into the atria when the ventricles contract?
2. Trace a drop of blood through the heart, beginning at the superior vena cava.

**Human Heart Observation**

Identify the following structures on the human hearts.

- Anterior interventricular sulcus
- Myocardium
- Papillary Muscles
- Bicuspid and Tricuspid Valves
- Chordae tendineae
- Aorta
- Pulmonary trunk
• Superior and Inferior venae cavae

Depending on the hearts that are available, observe the variation among individuals. Some hearts are very large, due to congestive heart failure. Note the thin myocardium in these giant specimens. You may also observe evidence of bypass surgery. Cardiac disease is the leading cause of death in the U.S., and, thus, it is important that we understand both normal anatomy and pathological changes that may occur.