Bio13A Lab Manual

Biology 13A Lab #9: Cardiovascular System 1—Blood & Heart Anatomy

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**Expected Learning Outcomes**
At the end of this lab, you will be able to
- identify red blood cells and specific types of white blood cells on a prepared slide;
- explain the functions of white blood cells;
- identify external and internal features of the heart;
- use dissection techniques to locate and identify major vessels, chambers, valves, etc. in the sheep heart, and:
- trace the flow of blood through the heart.

**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 doorlike valves. The heart has the strength to push the blood through the arteries to remote tissues in the head and limbs. Blood must reach every cell to deliver oxygen and nutrients and to pick up wastes. Blood returns to the heart in veins before it circulates again. Today we will explore blood and heart structure and function.
Activity 1: Examination of Blood

Examine the prepared human blood slide under the microscope. Use the chart or your textbook to identify the following cells. After you have found a representative of each type, draw 4-5 erythrocytes, a few platelets, and a neutrophil and a lymphocyte (white blood cells).

- **Erythrocytes (Red Blood Cells)** are the most numerous. They are pink in color and are round with a lighter spot in the middle. The light spot is really a depression that is less dense so allows the light to shine through.

- **Platelets (Thrombocytes)** are actually fragments of big cells that have split apart. They are small purplish dots on the slide.

**Leukocytes (White Blood Cells)**

- **Neutrophils** are the most numerous WBC. They have large multi-lobed nuclei that look like sausage links. They have pinkish granules in the cytoplasm.

- **Eosinophils** have two-lobed, dark nuclei and red granules in the cytoplasm.

- **Basophils** have fewer granules than eosinophils; the granules have a bluish tint and they have large, kidney-shaped lobed nuclei.

- **Lymphocytes** have large nuclei; so large they almost seem to have no cytoplasm.

- **Monocytes** are very large WBCs with large, variably shaped nuclei.

**Normal Blood Values**

Monocytes: 3% to 8% (increase in chronic infections)
Lymphocytes: 20-25% (increase in antibody reactions)
Neutrophils: 60-70% (increase in acute infections)
Eosinophils: 2-4% (increase in allergic reactions)
Basophils: 0.5-1% (increase in chronic infections)

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

1. Define cardiovascular system.
2. Explain the functions of erythrocytes, thrombocytes, and neutrophils.
3. Which type of white blood cell is most numerous in normal blood? Which is most rare?
Activity 2: Human Heart Model

Identify the following structures on the human heart model and fill in the appropriate structures for the diagram that follows.

Chambers:
- Right Atrium
- Right Ventricle
- Left Atrium
- Left Ventricle

A) Superior Vena Cava
B) Inferior Vena Cava
C) Pulmonary Artery
D) Pulmonary Veins
E) Aorta

1. Right Atrioventricular Valve (Tricuspid Valve)
2. Left Atrioventricular Valve (Bicuspid Valve)

1. Coronary Sinus
2. Coronary Arteries

Figure 9.2 Heart Diagram
Write the names for the structures in the pictures above.

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**Activity 3: Sheep Heart Dissection**

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

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. Determine anterior and posterior sides of the sheep heart. A clue is the **anterior 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 (see fig. 12.11 in Seeley, Stephens, and Tate).
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.

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

10. 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
11. 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.

12. Cut through the myocardium of the left side of the heart, using the anterior ventricular 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.

13. 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?
3. What structures prevent the backflow of blood into the atria when the ventricles contract?
4. Trace a drop of blood through the heart, beginning at the superior vena cava.