

Heart Dissection



Introduction

Mammals have four-chambered hearts and double circulation. The heart of a bird or mammal has two atria and two completely separated ventricles. The double-loop circulation is similar to amphibians and reptiles, but the oxygen-rich blood is completely separated from oxygen-poor blood. The left side of the heart handles only oxygenated blood, and the right side receives and pumps only deoxygenated blood. With no mixing of the two kinds of blood, and with a double circulation that restores pressure after blood has passed through the lung capillaries, delivery of oxygen to all parts of the body for cellular respiration is enhanced. As endotherms, which use heat released from metabolism to warm the body, mammals require more oxygen per gram of body weight than other vertebrates of equal size. Birds and mammals descended from different reptilian ancestors, and their four-chambered hearts evolved independently - an example of convergent evolution.

Objective

Using a pig heart, students will observe the major chambers, valves, and vessels of the heart and be able to describe the circulation of blood through the heart to the lungs and back and out to the rest of the body. *(The pig heart is used because it is very similar to the human heart in structure, size, & function.)*

Materials

Dissecting pan, dissecting kit, safety glasses, lab apron, pig heart, & gloves

Procedure - External Structure

When you have finished dissecting the heart, dispose of the heart as your teacher advises and clean, dry, and return all dissecting equipment to the lab cart. Wash your hands thoroughly with soap.

1. Place a heart in a dissecting pan & rinse off the excess preservative with tap water. Pat the heart dry.
2. Examine the heart and locate the thin membrane or **pericardium** that still covers the heart. The pericardium or pericardial sac, is a double-layered closed sac that surrounds the heart and anchors it. The pericardium consists of two tissues layers - the **visceral pericardium** that covers the

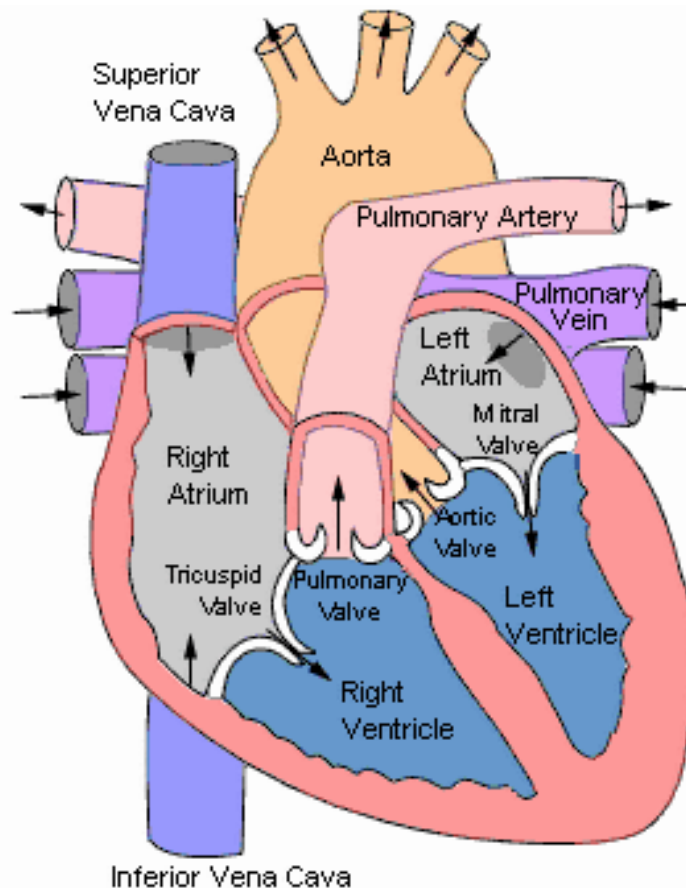
- surface of the heart & the **parietal pericardium** covering the inner surface of the parietal sac. These two tissue layers are continuous with each other where the vessels enter or leave the heart. The slender gap between the parietal & visceral surfaces is the **pericardial cavity** & is filled with fluid to reduce friction between the layers as the heart pumps.
3. After examining the pericardium, carefully remove this tissue. Located below the pericardium is the muscle of your heart called the **myocardium**. Most of the myocardium is located in the lower two chambers of the heart called **ventricles**.
 4. Locate the tip of the heart or the **apex**. Only the left ventricle extends all the way to the apex.
 5. Place the heart in the dissecting pan so that the front or **ventral** side is towards you (the major blood vessels are on the top and the apex is down). The front of the heart is recognized by a **groove** that extends from the right side of the broad end of the heart diagonally to a point above & to your left of the apex.



Front or Ventral Side of the Heart

6. The heart is now in the pan in the position it would be in a body as you face the body. Locate the following **chambers** of the heart from this surface:
 - **Left atria** - upper chamber to your right
 - **Left ventricle** - lower chamber to your right

- **Right atria** - upper chamber to your left
- **Right ventricle** - lower chamber to your left

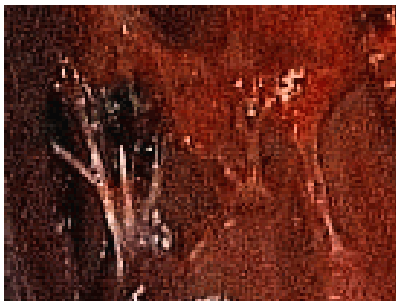


7. While the heart is still in this position in the dissecting pan, locate these blood vessels at the broad end of the heart:
- **Coronary artery** - this blood vessel lies in the groove on the front of the heart & it branches over the front & the back side of the heart to supply fresh blood with oxygen & nutrients to the heart muscle itself.
 - **Pulmonary artery** - this blood vessel branches & carries blood to the lungs to receive oxygen & can be found curving out of the right ventricle (upper chamber to your left)
 - **Aorta** - major vessel located near the right atria & just behind the pulmonary arteries to the lungs. Locate the curved part of this vessel known as the **aortic arch**. Branching from the aortic arch is a large artery that supplies blood to the upper body.
 - **Pulmonary veins** - these vessels return oxygenated blood from the right & left lungs to the left atrium (upper chamber on your right)

- **Inferior & Superior Vena Cava** - these two blood vessels are located on your left of the heart and connect to the right atrium (upper chamber on your left). Deoxygenated blood enters the body through these vessels into the right receiving chamber. Use your probe to feel down into the right atrium. These vessels do not contain valves to control blood flow.

Procedure - Internal Anatomy:

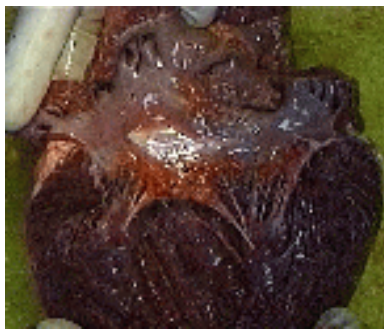
8. Use scissors to cut through the side of the pulmonary artery and continue cutting down into the wall of the right ventricle. Be careful to just cut deep enough to go through the wall of the heart chamber. (Your cutting line should be above & parallel to the groove of the coronary artery.)
9. With your fingers, push open the heart at the cut to examine the internal structure. If there is dried blood inside the chambers, rinse out the heart.
10. Locate the **right atrium**. Notice the thinner muscular wall of this receiving chamber.
11. Find where the **inferior & superior vena cava** enter this chamber & notice the lack of **valves**.
12. Locate the valve that between the right atrium and right ventricle. This is called the **tricuspid valve**. The valve consists of three leaflets & has long fibers of connective tissue called **chordae tendinae** that attach it to **papillary muscles** of the heart. This valve allows blood flow from the right atrium into the right ventricle during **diastole** (period when the heart is relaxed). When the heart begins to contract (**systole** phase), ventricular pressure increases until it is greater than the pressure in the atrium causing the tricuspid to snap closed.



Tricuspid Valve

13. Use your fingers to feel the thickness of the right ventricle and its smooth lining. Also note the network of irregular muscular cords on the inner wall of this chamber.

14. Find the **septum** on the right side of the right ventricle. This thick muscular wall separates the right & left pumping ventricles from each other.
15. Inside the right ventricle, locate the **pulmonary artery** that carries blood away from this chamber. Find the one-way valve called the **pulmonary valve** that controls blood flow away from the right ventricle at the entrance to this blood vessel.
16. Using your scissors, continue to cut open the heart. Start a cut on the outside of the left atrium downward into the left ventricle cutting toward the apex to the septum at the center groove. Push open the heart at this cut with your fingers & rinse out any dried blood with water.
17. Examine the **left atrium**. Find the openings of the **pulmonary veins** from the lungs. Observe the one-way, **semi-lunar valves** at the entrance to these veins.
18. Inside this chamber, look for the valve that controls blood flow between the upper left atrium and lower left ventricle. This valve is called the **bicuspid or mitral valve**. This valve consists of two leaflets & blood flows from the left atrium into the left ventricle during diastole.



Bicuspid or Mitral Valve

19. Examine the **left ventricle**. Notice the thickness of the ventricular wall. This heart chamber is responsible for pumping blood throughout the body.
20. Using your scissors, cut across the left ventricle toward the aorta & continue cutting to expose the valve.
21. Count the three flaps or leaflets on this valve leading from the left ventricle into the aorta and note their half-moon shape. This is called the **aortic valve**.
22. Using scissors, cut through the aorta and examine the inside. Find the hole or coronary sinus in the wall of this major artery. This leads into the **coronary artery** which carries blood to and nourishes the heart muscle itself.

23. Answer the questions on your lab report.