

Background Information

The blood vessels of a fetal mammal, such as the pig, closely resemble those of the human adult. Modifications for fetal life include a placental circulation, by way of the umbilical cord, and two devices to bypass the lungs, since the lungs are not functional before birth. The arteries of the fetal pig have been injected with red latex and the veins with blue latex.

Procedure

1. You are to follow the steps listed below and find each structure that is in bold print. Do not go to the next structure until you have successfully located the indicated bold term on your fetal pig.
2. If you cannot find a specific blood vessel, bring your pig to the instructor for help.
3. Learning the names of the blood vessels is much like learning a street map or a river map. You should make a map of the vessels as you follow the numbered steps for the heart, venous and arterial systems. Your teacher may provide you with a simplified drawing to help you find these blood vessels.

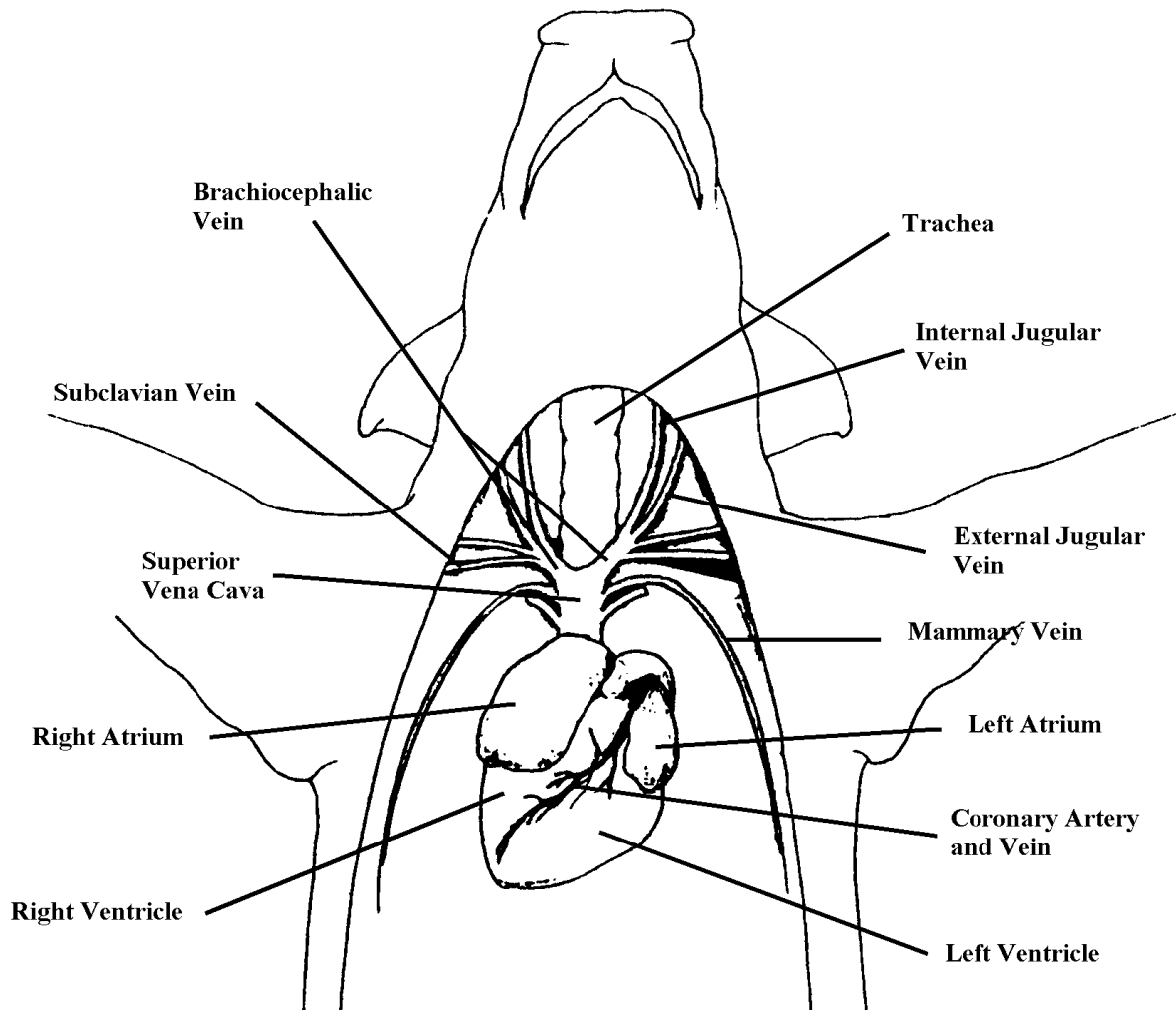
The Heart

1. Observe the **pericardium** surrounding the heart. After determining the structures to which it is attached, remove the parietal layer of the pericardium. The visceral layer of the pericardium forms the epicardium of the heart, the outermost layer of the heart.
2. Note that the **apex** of the heart is directed toward the left. The heart is tilted so that the greater part of the right ventricle lies directly in front, along the ventral surface of the heart. The left ventricle forms the apex of the heart.
3. The **atria** lie anterior to the **ventricles**. Each atrium has a conspicuous ear-like appendage called the auricle on the ventral surface.
4. A groove, the **coronary sulcus**, separates the right atrium from the right ventricle. The anterior **longitudinal sulcus** is the groove that separates the right ventricle from the left ventricle. Dorsal to this sulcus is the **interventricular septum**. The coronary blood vessels are located in these grooves.

The Venous System

5. Observe the anterior vena cava, the large vessel entering the anterior part of the right atrium. (This vein is called the **superior vena cava** in humans.) The anterior vena cava drains the head, neck, and arms.
6. Trace this vessel forward and note that it is formed by the union of the two **brachiocephalic veins** (see Figure 1).
7. Trace the left brachiocephalic vein forward. This vein is formed by the union of the small left **internal jugular vein**, which lies next to the left common carotid artery, the larger left **external jugular vein**, which lies lateral to this, and the **subclavian vein**, which drains the arm. In humans the internal jugular is larger than the external jugular.
8. Trace the subclavian vein through the chest wall. In the axillary region this vein is known as the axillary vein. On the arm it becomes the **brachial vein**. In order to follow the vein on the arm, slit the skin and muscles on the ventral surface of the arm.
9. Locate the posterior vena cava posterior to the heart and trace it forward to the point where it drains into the right atrium. This large vein, called the **inferior vena cava** in humans, drains the lower portion of the body.

Figure 1 Veins of the Thorax and Neck Region

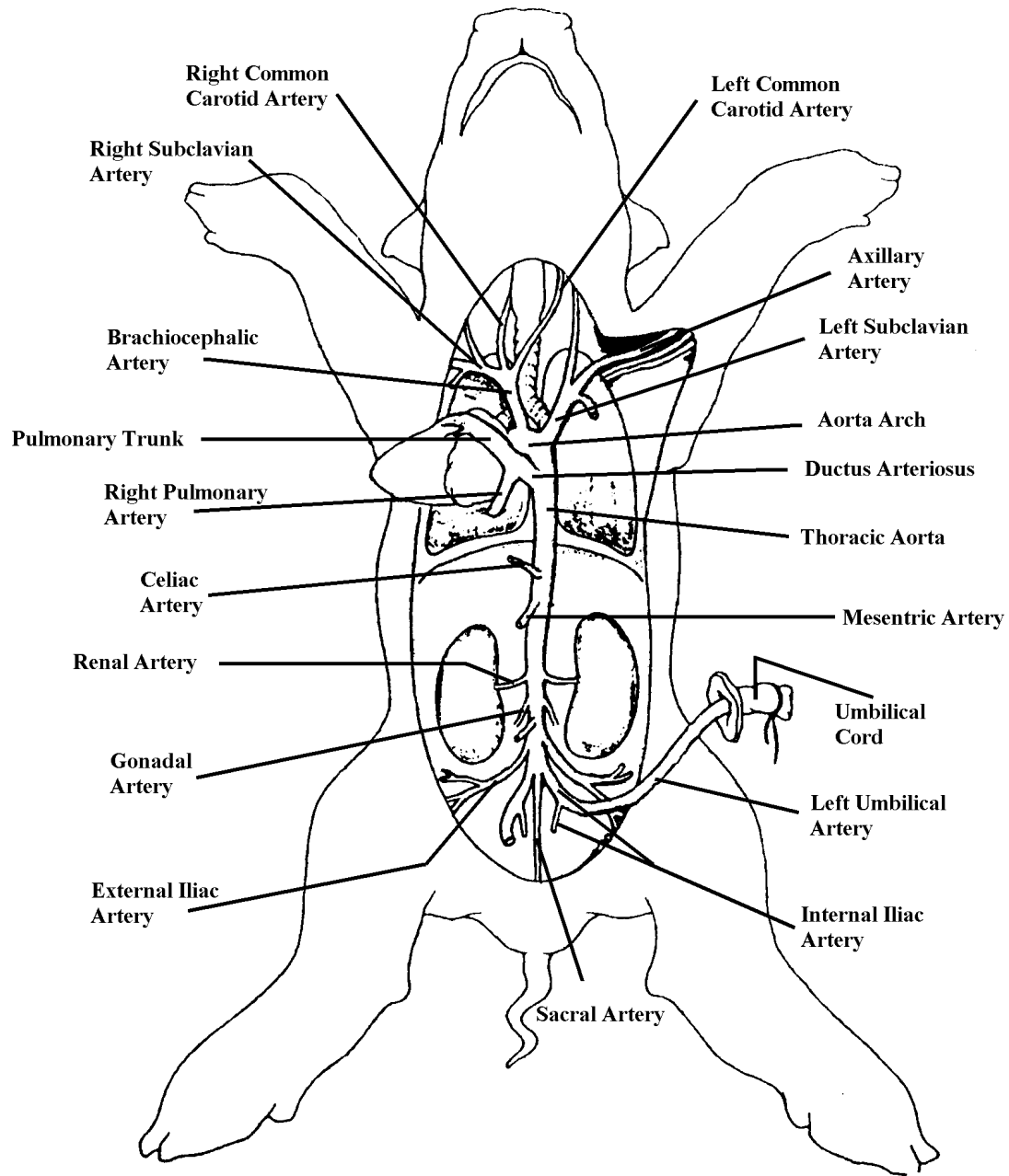


10. Trace the **inferior vena cava** back through the diaphragm into the abdominal cavity, where it lies to the right of the aorta. In order to see the vein and its tributaries, it will be necessary to dissect away the peritoneum.
11. The **hepatic veins** drain blood from the liver into the **inferior vena cava**. To locate these veins, gently scrape away tissue of the liver. Several hepatic veins may be located in this manner. The **umbilical vein** (carrying fresh oxygenated blood from the placenta) passes through the liver and connects with one of the larger hepatic veins.
12. Locate the **renal veins**, which carry blood from the kidneys into the **inferior vena cava**.
13. Returning to the thoracic cavity, push the left lung toward the right side of the body. Locate the **hemiazygos vein** which receives blood from the **intercostal veins**. The hemiazygos vein enters the dorsal surface of the right atrium.
14. The other major veins will be dissected with the arteries.

The Arterial System

15. Locate the **pulmonary artery** on the ventral surface of the heart. Trace it down to its origin in the right ventricle; then follow it toward the lungs, noting that it branches into a right and left pulmonary artery (see Figure 2).
16. At the point of branching of the pulmonary artery, the large **ductus arteriosus** passes anteriorly to connect to the aorta. The ductus arteriosus is larger than either the right or left pulmonary artery. It serves as a pathway for blood to bypass the fetal lungs and go directly into the systemic pathway via the aorta.
17. The **aorta** arises from the left ventricle. Locate this vessel dorsal and anterior to the pulmonary artery. The first branches of the dorsal aorta are the small, right and left **coronary arteries**, which arise from the base of the aorta. The left coronary artery is visible on the ventral surface of the heart in the anterior longitudinal sulcus; the right coronary artery is in the coronary sulcus. The coronary arteries supply the heart muscle with fresh, oxygenated blood and other needed nutrients. Even though blood constantly flows through the inside of the heart, nutrients are not transferred to the heart muscle at this point but rather from the heart's own arterial vessels.
18. The dorsal aorta passes anteriorly for a short distance and then turns to the left. This region of the aorta is called the **aortic arch**.
19. To enable you to see the arteries branching off the aortic arch, free the anterior vena cava from the arteries beneath.
20. The first branch off the aortic arch is the **brachiocephalic artery**. This artery gives rise to the **right subclavian artery** and then the right and left common **carotid arteries**. If you place your finger tips along the side of your trachea, you may feel your pulse. You are detecting the blood being pushed through your carotid artery.
21. Trace the common carotids toward the head along each side of the trachea. These arteries branch to form the external and internal carotid arteries at the anterior border of the larynx.
22. Returning to the aortic arch, locate the **left subclavian artery**, which supplies the left side of the chest and the left arm. Locate the right and left internal mammary (sternal) arteries, which supply the pectoralis muscles and mammary glands. These vessels arise from the subclavian arteries on either side of the sternum.
23. The subclavian artery becomes the axillary artery as it crosses the axillary space, and then the **brachial artery** on the upper arm.
24. Pull the organs in the chest gently to the pig's right to expose the dorsal aorta. As this vessel passes through the thorax, it is called the **thoracic aorta**. Remove the pleural membranes to expose the aorta in the thorax.
25. Note the **intercostal arteries** emerging from the thoracic aorta. These supply the intercostal muscles.
26. Trace the descending aorta through the diaphragm. The first major branch from the abdominal aorta is the **celiac artery** (see Figure 2). In order to locate this artery it will be necessary to scrape away the peritoneum covering the anterior end of the **abdominal aorta** immediately beneath the diaphragm. This large artery supplies the liver, pancreas, spleen, and duodenum.
27. Locate the **mesenteric artery**, the unpaired vessel located a short distance below the origin of the celiac artery. This vessel supplies the small intestine and a portion of the large intestine.
28. Locate the **renal arteries** (which supply the kidney) below the mesenteric artery.
29. The right and left **genital arteries** (testicular or ovarian) are small vessels that emerge from the ventral surface of the aorta, below the renal arteries near the base of the aorta. If your specimen is a male, follow the testicular artery to the **inguinal canal**.
30. The paired **external iliac arteries** arise from the base of the aorta. They continue downward on each side to become the **femoral artery**. Locate this vessel and the **femoral vein** by teasing away the ventral thigh muscles after removing the skin.

Figure 2 Major Arteries of the Fetal Pig (Heart Pulled to the right)



31. Locate the **internal iliac arteries** below the point at which the external iliacs arise from the aorta. These give rise to the large **umbilical arteries**, which pass lateral to the bladder.
32. The small median sacral artery can be seen emerging from the base of the aorta between the two internal iliac arteries.
33. Locate the two common **iliac veins**, which unite to form the **inferior vena cava**. Each common iliac vein is formed by the union of the internal and external iliac veins. These veins can be located next to the corresponding artery.

Dissection of the Fetal Heart

1. To dissect the fetal heart, make an incision through the lateral wall of each **atrium or auricle**. Carefully remove the latex that is present in each chamber.
2. Observe the point of entrance of the **superior and inferior venae cavae** into the right atrium.
3. Locate the **foramen ovale** (the opening in the interatrial septum) near the dorsal wall of the heart, just anterior to the entrance of the inferior vena cava. At this time in fetal life, the opening is quite small. Pass a probe through the foramen ovale (see Figure 3). Blood returning to the heart by way of the inferior vena cava passes from the right atrium directly to the left atrium, bypassing the lungs. This structure closes after birth, leaving the depression, the fossa ovalis.
4. Continue the lateral incision down on each side of the heart in order to examine the interior of the **ventricles**. Try to locate the four one-way valves. Two are called the **A-V valves** and separate the atria from the ventricles. The other two are found in the base of the pulmonary trunk and the aorta. They are called **semilunar valves** and prevent blood from flowing back into the ventricles of the heart.

Figure 3 Longitudinal Section Through the Fetal Pig Heart

