

Fetal Pig Dissection Manual

2019



Introduction

Fetal pigs are readily available, since farmers find it profitable to breed female pigs which they plan to sell. Thus, pig fetuses are byproducts of the slaughter houses. The period of gestation is 112 to 115 days, and there are, on the average, about seven to eight offspring in a litter. At birth the pigs vary from 12 to 14 inches in length. The approximate age of the fetus can be determined by measuring the length of the body from the tip of the snout to the rump (not including the tail). The following are approximate body length to age relationships:

Gestation Table

Length of Specimen	Approximate Age in Days from Fertilization
4 cm	56 days
20 cm	75 days
25 cm	100 days
30 cm	105 days
35 cm	111 days
40 cm	115 days (full term)

As a laboratory animal the fetal pig has several advantages. It is relatively inexpensive so that usually a maximum of two students can be assigned to an animal. Since they are small, they do not require much storage space. The animals are mammals and, therefore, their structures are like those of humans. In addition to relatively mature organs, there are also fetal structures present that are directly comparable to those of human beings. These include the umbilical cord and the circulatory structures which are specialized for fetal circulation.

As the fetal pig is dissected and studied, the structures identified should be compared with those of the human. Dissection is not merely “cutting” the animal, but a systematic technique of bringing into view structures which, in their normal position, cannot readily be seen. Follow instructions exactly. Do not cut or remove any structure unless directed to do so. Always separate structures carefully, especially blood vessels, by moving connective tissues out of the way. It is best to use the dull probe for this task.

You may find that the substances used to preserve the specimens are irritating to your skin. If so, wear thin vinyl or plastic gloves. Remove as much of the preservative from your specimen as possible by frequently washing it with tap water. Keep your fingers away from your eyes during dissection.

At the conclusion of each laboratory period, clean up the working area thoroughly. Put the pig in the container provided by your teacher. To identify your pig, you should attach an earring that is unique, making it easy for you to find your pig each time a dissection is made. Do not leave any solid material in the sink. Clean and dry the laboratory table and the dissection tools that were assigned to you.

The terms right and left always refer to the pig’s right and left. In a quadruped, *anterior* or *cranial* refers to the head end; *posterior* or *caudal* to the tail end; *dorsal* or *superior* to the back; *ventral* or *inferior* to the belly. *Lateral* refers to the side, *medial* to the position of a structure nearer the midline of the body.

Day 1: External Anatomy Examination

1. Each group should obtain a dissecting tray, fetal pig, dissecting equipment (scalpel, scissors, probe, forceps), and personal equipment (goggles and gloves). Use the autopsy report for recording of all observations.
2. Cut the fetal pig bag near the top and carefully drain all the preservative fluid into the sink. If any splashes on the counter, rinse off thoroughly. To make the room smell as best as possible, run the water for a few seconds to wash all the fluid down the drain, making sure to rinse the whole bottom of the sink off.

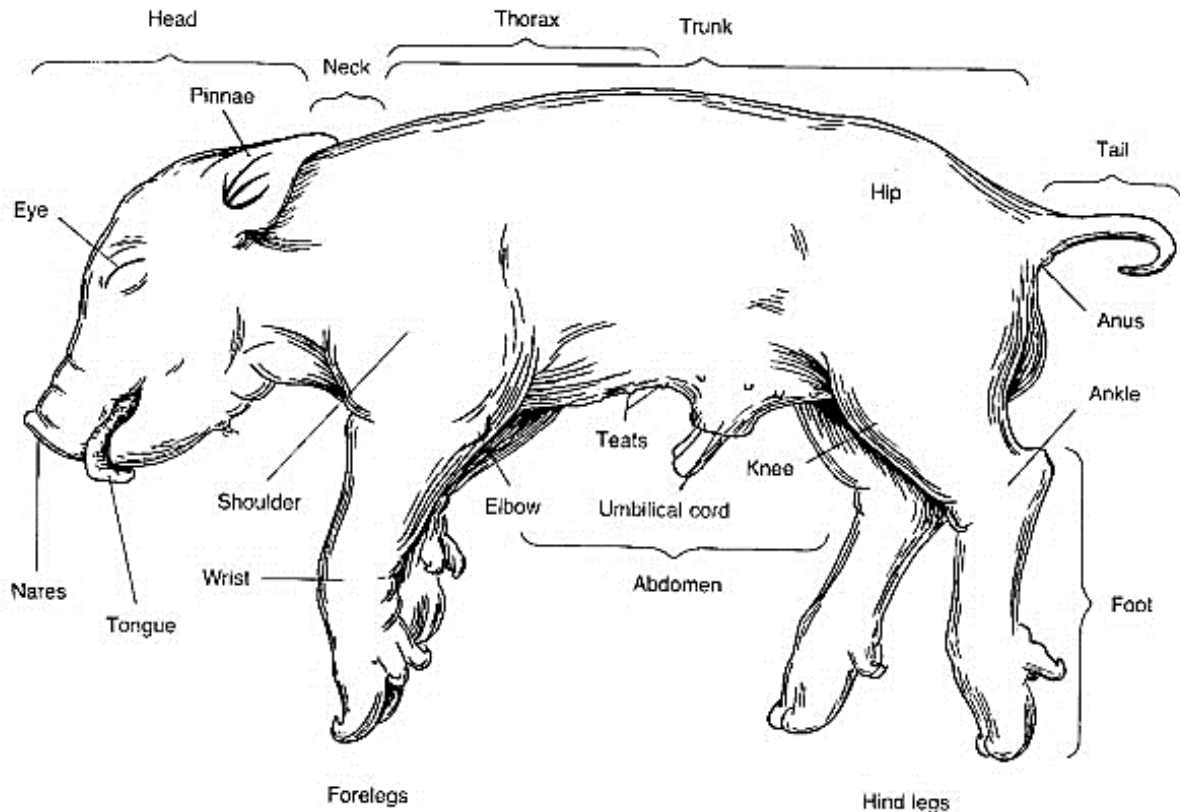


Image 1: Fetal Pig

3. Examine the pig for body hair, although this is usually not conspicuous currently. Is body hair present?
 - a. Look under the chin for some longer hairs.
4. Note the *epitrichium*, the layer of embryonic skin that is visibly peeling. This is lost as the hair develops. It may be removed by rinsing the pig in tap water. Use a sink with a disposal, if possible. The fetal skin will easily plug a sink; and care should be taken to prevent this.
5. On the head locate the following structures:
 - a. The **mouth**, bounded by upper and lower jaws and soft lips, is sometimes partially open, revealing a soft **tongue**. The front end of the head is prolonged into a **snout**. The snout is used for rooting around in the soil for roots, insects, and other materials used by the pig for food. Do you have a snout?
 - b. Observe the two **nostrils** (external nares) at the end of the snout.

- c. The eyes (usually closed) are covered by upper and lower eyelids fringed with eyelashes. Use a probe and pull the upper eyelids apart. The *nictitating* membrane should be visible in the medial corner of the eye. This transparent membrane, which is referred to as a third eyelid, can move across the eyeball with the eye open, thus providing protection. Check your partner's eye for this structure. Is it present?
 - d. Observe the eyes of the pig, carefully remove the eyelid so that you can view the eye underneath. Does it seem well developed? Do you think pigs are born with their eyes open or shut? _____
 - e. The opening into the ear is called the *external acoustic* (auditory) *meatus* and the flattened flap of skin is called the *pinna*, or *auricle*. The pinna and the external acoustic meatus make up the external ear in the pig as well as in the human.
6. **Image 2: Lateral view of pig's head with salivary glands exposed:** Label during *dissection*. Carefully lay the pig on one side in your dissecting pan and cut away the skin from the side of the face and upper neck to expose the **masseter muscle** that works the jaw, **lymph nodes**, and **salivary glands**. The salivary glands kind of look like chewing gum and are often lost if you cut too deeply.

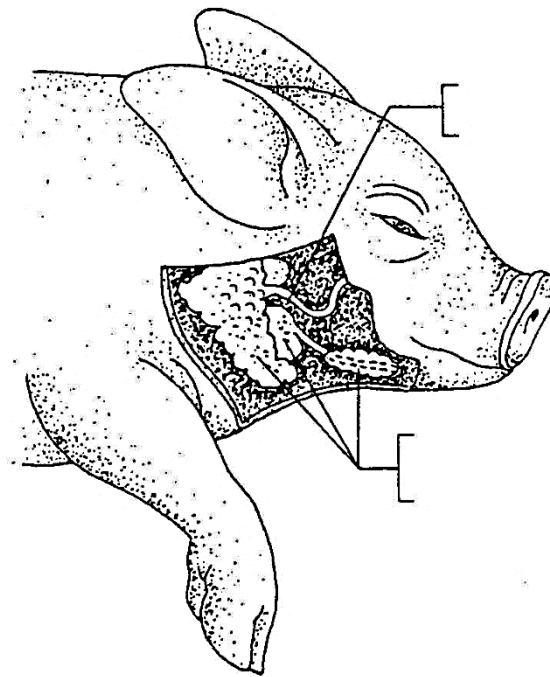
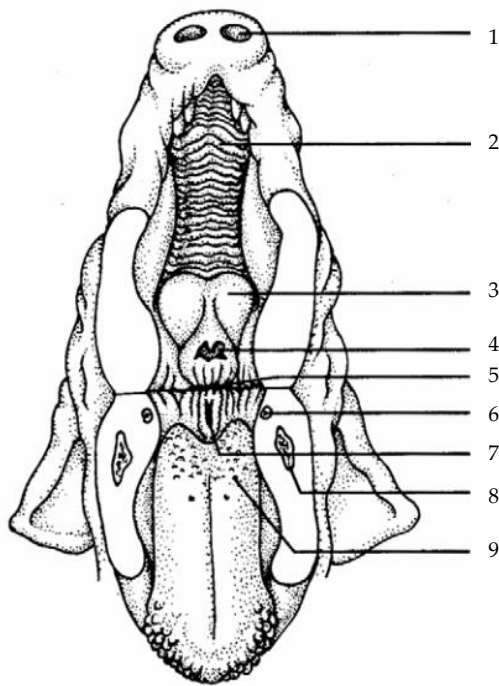


Image 2: Lateral View of Fetal Pig Head

7. **Open mouth:** Label during *dissection*. Open the pig's mouth and locate the **hard and soft palate** on the roof of the mouth. Can you feel your own hard and soft palates with your tongue?
8. Note the taste buds (also known as **sensory papillae**) on the side of the tongue. Locate the **esophagus** at the back of the mouth. Feel the edge of the mouth for teeth. Does the fetal pig have teeth? _____ Are humans born with teeth? _____

9. Locate the **epiglottis**, a cone-shaped structure at the back of the mouth, a flap of skin helps to close this opening when pigs swallow. The **pharynx** is the cavity in the back of the mouth - it is the junction for food (esophagus) and air (trachea).
10. Using your scissors, cut the corners of the jaw so that the mouth will remain open. Locate the following structures and label them on the diagram below: *tongue, teeth, nasopharynx, glottis, epiglottis, hard palate, soft palate, salivary glands*, and the opening of the *esophagus*.



Identify the structures on the diagram.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

Image 3: Open Mouth of Fetal Pig

11. Carefully examine the external features of your pig beginning with the head. Pay attention to the amount and color of hair, birth marks, and other unique markings. Record your findings as you examine the mouth, nostrils, tongue, ears, and eyes.
12. Note that the short neck joins the thorax in front of the first pair of legs. There is usually an incision in the right lateral part of the neck where the blood was withdrawn, and colored latex was injected. The arteries should be represented with a red latex and while the veins were filled with a blue latex rubber.
13. The trunk can be divided approximately into two general regions, consisting of an anterior **thorax** and a posterior portion, the **abdomen**.
 - a. Note that the front limbs are attached to the thorax. The ribs making up the thorax are soft at this stage of development because they are made of cartilage.
 - b. Locate the **mammae** which are present in both sexes. These form a double row of small teats or mammary papillae on the ventral surface of the abdomen. The number and location of the mammary glands vary in different species, but the glands are one of the distinguishing characteristics of all mammals.
 - c. Observe the **umbilical cord** near the center of the ventral surface of the abdomen. If the cord is long enough, make a fresh cut across the end of it.

Three large blood vessels should now be visible. The largest of these is the *umbilical vein* which carries blood from the placenta to the fetal pig. This vessel may contain blue latex. The other two, smaller and with thicker walls, are the *umbilical arteries*, which may contain red latex. These vessels carry blood from the fetus to the placenta. Between or near the umbilical arteries; is a small, hard core of tissue called the *allantoic stalk*. All the structures present in the cord are embedded in a gelatinous connective tissue. Look up the function of the placenta and record its purpose below. Do all mammals develop from a placenta?

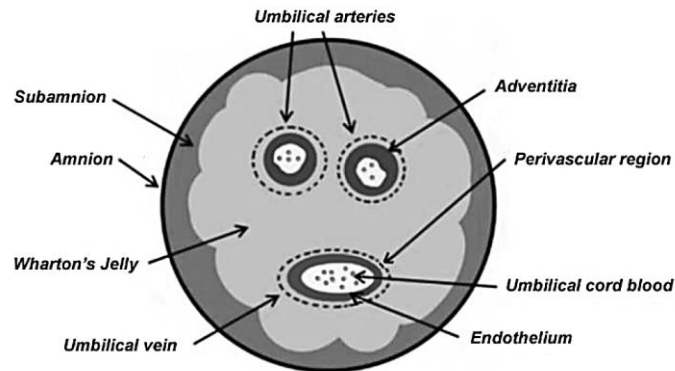


Image 4: Umbilical Cord of Fetal Pig

- d. Locate the *anus* just ventral to the tail. This is the posterior opening of the digestive tract. The anus is a sphincter muscle. Describe a sphincter muscle.
14. Examine the ventral side and note any unusual markings. Note the number and location of mammary papillae (teats). Observe the end of the umbilical cord and identify the umbilical cord vein, artery, and allantoic duct. The allantoic duct is connected to the fetus' bladder and is used for removing metabolic wastes. These structures may be easier to view if you cut off a small portion of the chord.

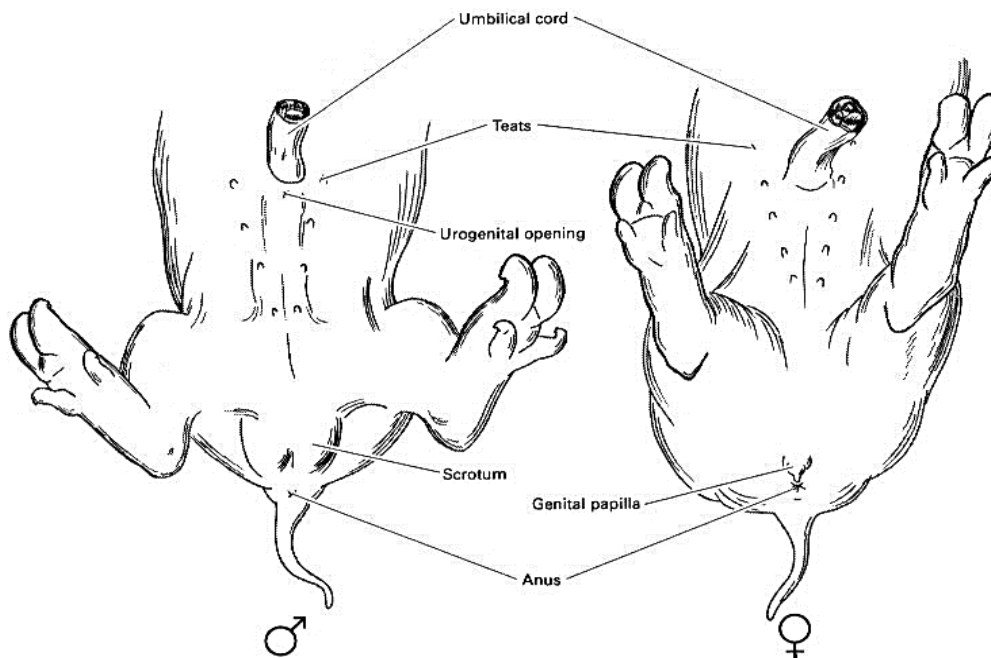


Image 5: Urogenital View of Fetal Pig

15. Determine the sex of your pig by looking for the **urogenital opening**. On females, this opening is located near the **anus**. On males, the opening is located near the **umbilical cord**. Record this in your Notebook.
 - a. If your pig is female, you should also note that **urogenital papilla** is present near the genital opening. Males do not have urogenital papilla.
 - b. Both males and females have rows of **nipples**, and the umbilical cord will be present in both.
16. Determine the gender of your pig by using the figures above. If your pig is male, you will see the urogenital opening posterior to the umbilical cord. It serves as a passageway for urine and semen. Depending on the age you may or may not see scrotal sacs. The penis is not visible, but you can feel it by pressing the skin between the urogenital opening and the scrotal sacs. The males' mammary papillae will never develop but in females they will develop into teats during pregnancy. If your pig is female, you will see the genital papillae under the tail. This releases metabolic wastes and is the opening to the reproductive system. Be sure to observe another group's pig of the opposite gender.
17. Note that there are only *four* toes or digits on each limb as compared to five in humans.
18. Examine the legs and note that they have the same general structure as that of humans and other animals, although they are somewhat modified.
 - a. Examine the posterior surface of one of the hind legs and note the large protuberance about two inches above the toes. This is comparable to the human heel, and the region from it to the toes corresponds to the human foot. Since the pig walks on the tips of the toes, the ankle and most of the foot is above the ground.
 - b. Locate the wrist and elbow of the forelimb and the knee and ankle of the hind limb.
19. Use a piece of string to measure the length of your pig. Stretch the string along its back from the base of its tail to the tip of its nose. Make your measurement in centimeters. How many centimeters is it? Use the data from the Gestation Table to determine the age of your pig in terms of gestation. How many days was the pig in gestation?
20. Place a distinctive earring on your pig so that you will be able to find it easily amongst the others. Most of the fetal pigs will look similar and it will be hard to identify yours. Once pinned, you may now return the pig to its designated container. Wash your hands and clean up the area. Dissecting tools should be cleaned, dried off, and returned to their proper spot.
21. **Lateral view of fetal pig:** Label during *lecture*. Make sure you are familiar with terms of reference: *anterior, posterior, dorsal, ventral*. In addition, you'll need to know the following terms: Medial: toward the midline or middle of the body; Lateral: toward the outside of the body; Proximal: close to a point of reference; Distal: farther from a point of reference.

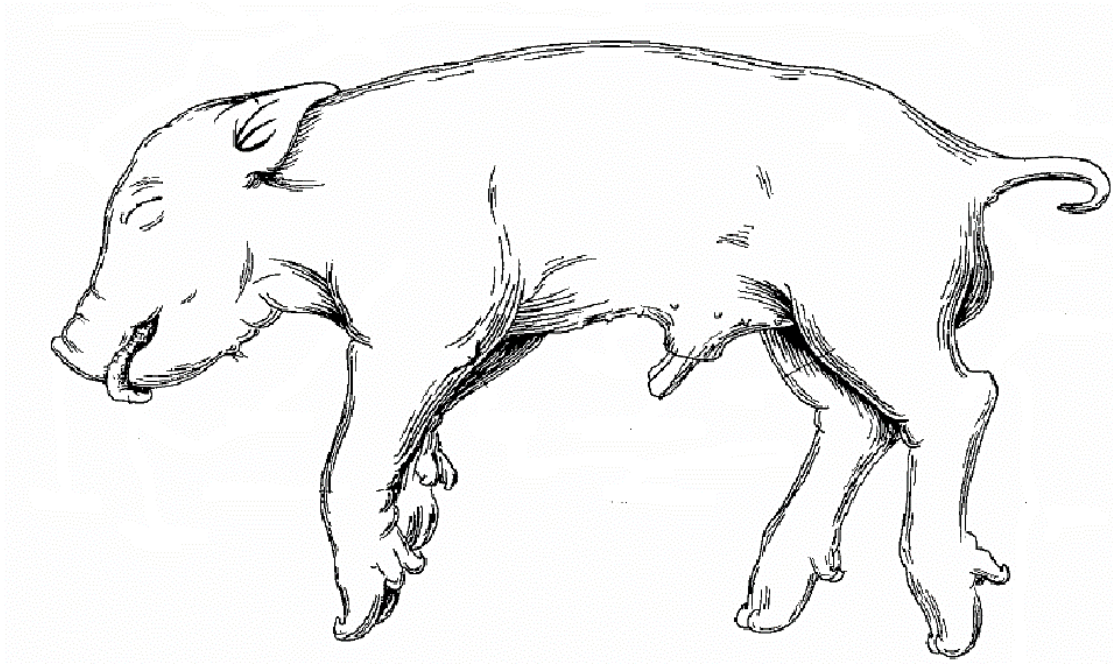


Image 6: Lateral View of Fetal Pig

Day 2: Muscular System

Introduction

In today's lab you are to locate and draw the *gastrocnemius* muscle of the pig. In man this is the large calf muscle which terminates in the large *Achilles tendon*. This tendon then inserts on the heel bone. In the pig the same thing occurs, however, you must be careful when locating the femur, the tibia, the fibula, and the calf muscle area on a pig. The *gastrocnemius* is covered by a thin sheet of muscle, the *biceps femoris*.

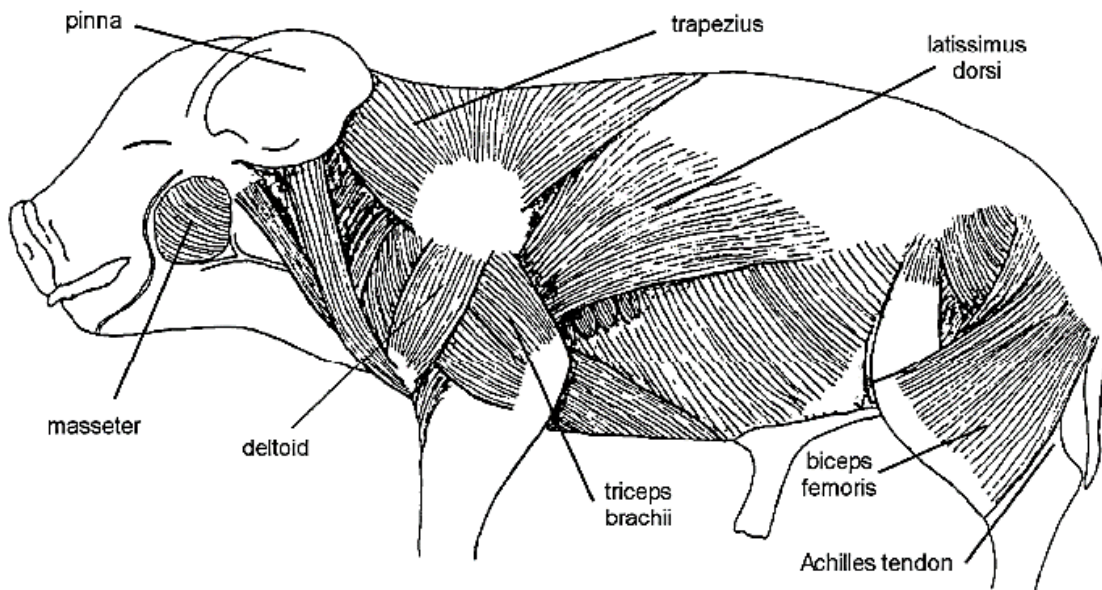


Image 7: Lateral View of Fetal Pig Muscles

Directions for Today's Dissection

1. Work on the left side of the animal. Preserve the right side for circulatory and nervous system dissection. Skin the left leg. Cut carefully through the skin. Make a circle cut around the upper leg where it blends into the trunk of the body. The cut should be about a one to two mm in depth. Cut from the top of the circle downward towards the foot. Now you should be able to remove the skin from the leg.
2. Clear away any *fascia* which covers the muscles of the shank. Fascia will appear solid sheet-like (no fibers) and will be from clear to white in color.
3. Refer to Figure 7. Notice the biceps femoris covers the origin of the gastrocnemius. The biceps femoris should be removed carefully. The key to success is that muscle tissue is fibrous and the direction the fibers run helps in identifying the muscle. Biceps femoris run obliquely; gastrocnemius fibers run parallel to the bone.
4. The gastrocnemius originates on the lower end of the femur. It inserts by the Achilles tendon on the calcaneus, the heel bone. This muscle extends the foot.
5. Isolate the muscle at the origin and insertion, include the tendon. Have your dissection okayed at this point. The only muscle fiber that can be cut is the biceps femoris. A good dissection will reveal a major nerve trunk running through the muscle in its upper one-third.
6. Make a drawing of the lower leg below, showing the foot, knee, and upper leg. Label the following parts in your drawing: body of the muscle, origin and insertion points of the gastrocnemius, Achilles tendon, femur, calcaneus, and nerve.

Analysis and Conclusion

1. Make a drawing of your dissection and label the parts.

2. Describe the difference between muscle and tendon as to function and structure. Include a visual description of the differences between size, color, and texture of each.
3. Is the gastrocnemius muscle considered a flexor or extensor? Explain your answer.
4. What can a person who has just broken his or her Achilles tendon unable to do? Why?

Day 3: Thoracic Cavity

1. Put paper towels under the dissecting tray. Place the pig in the dissecting tray on its back. *Remember: when observing structures from the ventral side, left and right will be reversed.* Slide a “body block” (sponge) under the back until it rests under its shoulders (front legs). The block causes the neck and arms (pig’s front legs) to fall back will elevating the chest so that the 1st incision of the trunk is easier to make.
2. For a better view of the abdomen, you can pull the legs farther apart by tying string around each leg and twisting the string around the spools in each corner of the tray (Image 8). You can also pull the string underneath the dissecting pan and tie it to the other leg. Don’t tie this too tight as you may want to adjust the ties as you open the chest cavity.

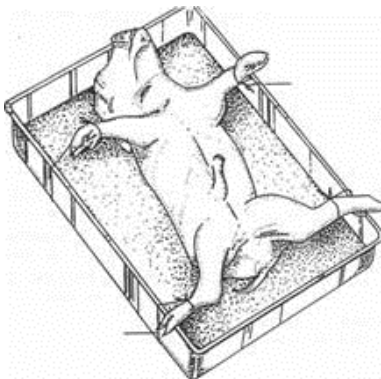


Image 8: Tying the Fetal Pig

3. With a *scalpel*, the diener makes a Y-shaped incision (Image 9). Use the figure below to guide you as to how to make the cuts and where to cut according to the gender of your pig. **Do not cut off pieces of skin!** You will need to sew the chest cavity back together once the autopsy is complete. The arms of the Y start from the top of each shoulder anterior to the front legs and come down to the sternum which is directly over the heart between the front legs. The incision should be just deep enough to cut through the muscular chest wall. Cut away the tissue from the underside of the flap of skin formed by the arms of the Y. Continue to cut the tissue as you pull the flap back toward the nose until the protruding larynx is exposed.

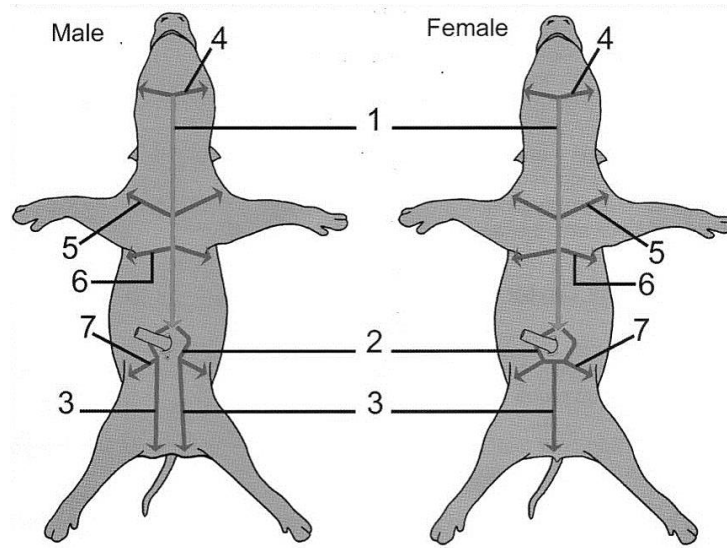


Image 9: Incision Guidelines

The organ systems that we will be exploring in depth during this dissection will be:

- The Respiratory System
- The Circulatory System
- The Digestive System
- The Excretory System
- The Reproductive System

Prior to exploring each system in the fetal pig, you may virtually dissect at the following website: <http://www.whitman.edu/biology/vpd/main.html>

Examination Procedures

1. Make a median longitudinal incision through the muscles in the neck in order to expose the *larynx* and *trachea*. Do not sever the blood vessels or nerves located on either side of the trachea. Use Image 3, 11 and 12 as a guide for identification of these structures.
 - a. The trachea contains rings of cartilage in its walls. Determine whether these rings are complete on the dorsal surface of the trachea.
2. Remove muscular tissue from the larynx. Make a longitudinal incision through the ventral wall of the larynx and locate the *vocal folds*, which are two small, shelf-like membranes. These are poorly developed in the fetal pig.

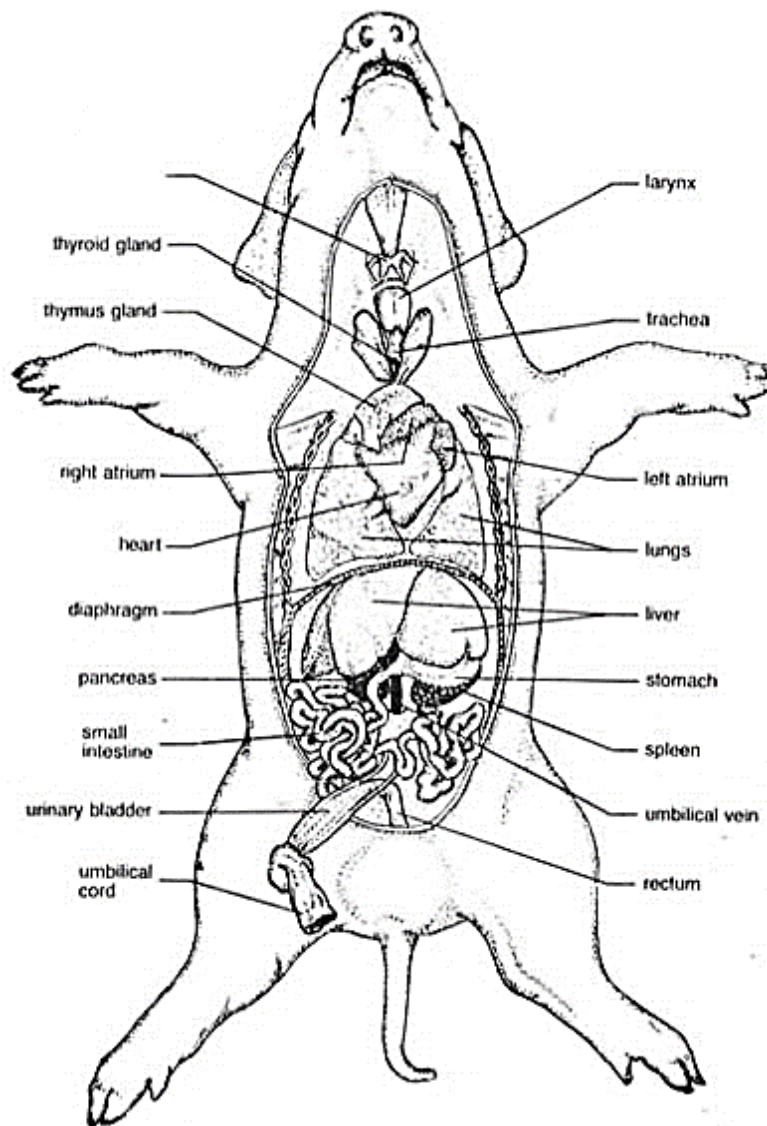


Image 10: Fetal Pig Internal Organs

- b. Locate the *hyoid bone* anterior to the larynx.
 - c. The *sublingual* and *submandibular* glands are now visible adjacent to the larynx.
3. Identify the *thymus* gland. the large gland ventral to the heart. This gland consists of two major lobes which extend anteriorly into the neck region on either side of the trachea. The thymus is relatively large in the fetus.
4. The ventral neck muscles and the cervical part of the thymus gland cover the *thyroid* gland, the small, dark gland which lies on the upper trachea. Part the muscles and thymus gland to expose this gland.
5. Observe the large right and left *common carotid arteries* and the *internal jugular veins* on each side of the trachea.
6. The *vagus nerve* is the conspicuous white band that is bound to the dorsal surface of the common carotid artery. This nerve connects many of the thoracic and abdominal organs as part of the autonomic nervous system.

7. Free the trachea, laterally, from the preceding blood vessels and nerves. Lying along the trachea, and attached to it, are the two slender inferior laryngeal nerves. These nerves which are essential for speech in humans originate from the vagus nerve and, although they are small and delicate, are easily seen against the trachea on either side.
8. Locate the *esophagus*, the muscular tube dorsal to the trachea.
9. Examine the interior of the thoracic cavity.
 - a. Note that the thoracic cavity is divided into two *lateral pleural cavities*. which contain the lungs. The *pericardial sac*, which contains the heart. is in the space (*mediastinum*) between the lungs.
 - b. The pleura is a double layered membrane which lines the thorax. That portion of the pleura lining the thoracic wall is called the *parietal pleura*; that which covers and adheres to the lungs is called the *visceral pleura*.
 - c. The *pericardium*, the membrane surrounding the heart, is also composed of two layers: the outer parietal layer and the inner visceral attached to the heart. Much of the parietal pleura forming the medial walls of the pleural cavities is tightly bound to the parietal pericardium.
9. Remove thymus tissue in the thoracic cavity in order to study the lungs.
 - a. Note that the lung is attached to other structures in the thorax only by the root. The root of the lung is formed by the *bronchus*, pulmonary artery and vein, bronchial arteries and veins, nerves, lymphatic vessels, and bronchial lymph nodes, all encircled by pleura.

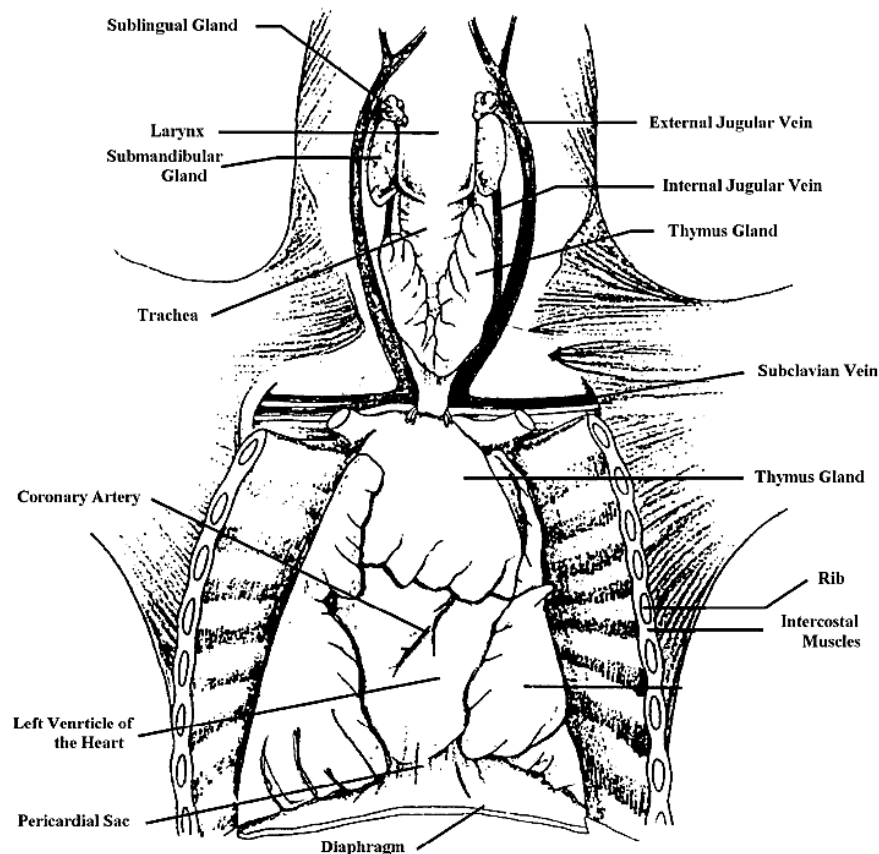


Image 11. Superficial View of the Thoracic Cavity with the Neck Dissected

- b. Determine the number of lobes in each lung. Each lung is divided into three major lobes: *apical*, *cardiac*, and *diaphragmatic*. The right lung has an *intermediate* lobe beneath the apex of the heart.
 - c. Cut off a small section of the left lung and note the density of the lung. The lungs have not yet filled with air, since they are nonfunctional before birth.
10. The trachea branches into a right and left *bronchus* dorsal to the heart. In order to locate the right bronchus, push the heart to the left side of the thoracic cavity; then locate the inferior end of the trachea dorsal to the heart and right pulmonary blood vessels. Try not to sever the pulmonary blood vessels.
11. Locate the apical bronchus which leaves the trachea anterior to its termination and supplies the right apical lobe. Note the right main (primary) bronchus which supplies the right cardiac and diaphragmatic lobes, and the small branch of the bronchus which supplies the intermediate lobe. Then scrape away the right cardiac lobe of the lung, bit by bit, noting the organization of the bronchial tree and blood vessels and locate a primary bronchus. Leave the vessels intact. The branches of the bronchi can be identified by the cartilage in the walls.
12. Locate the *phrenic nerve*. It is the conspicuous white line that passes along the pericardium to the diaphragm on either the right or left side of the heart.
13. Lift the left lung and remove some of the parietal pleura dorsal to the lung to locate the esophagus. Follow the esophagus to the diaphragm.
14. At this point, make sure your teacher has seen your work. She will provide directions for cleanup.

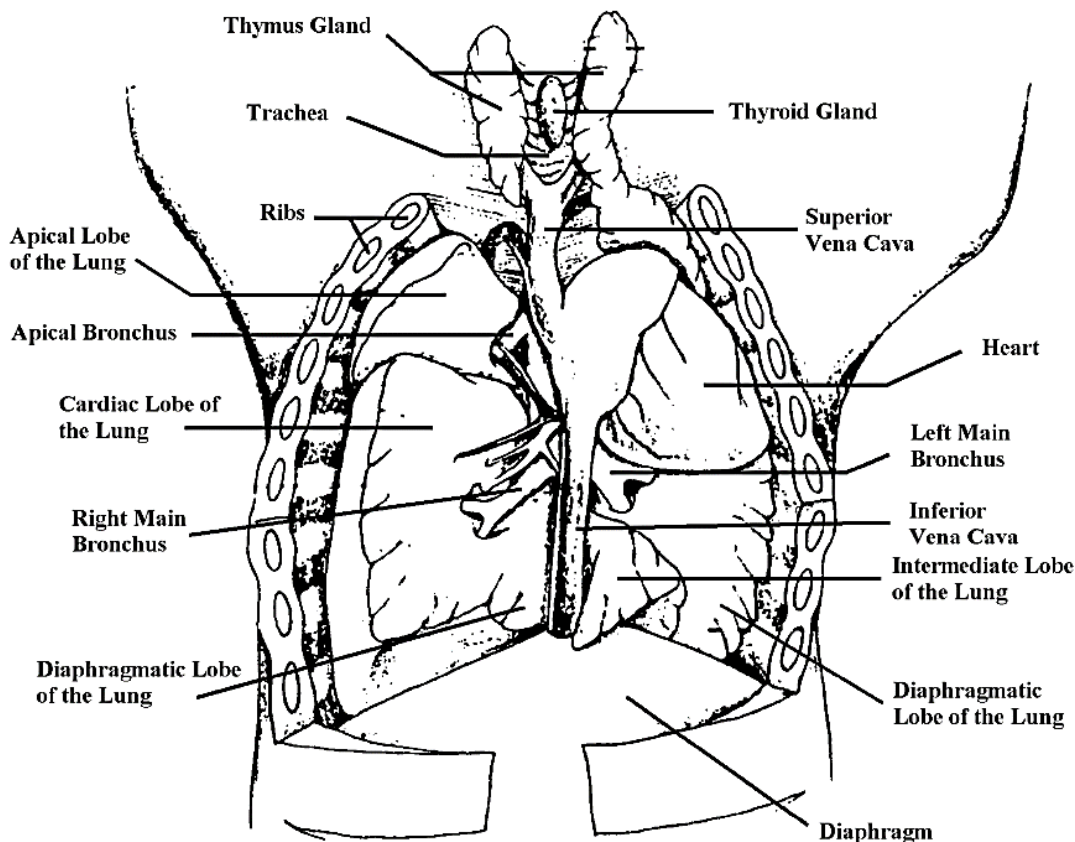


Image 12. Dissection of the Organs of the Thoracic Cavity of the Fetal Pig

Day 4: Abdominal Cavity

Examination Procedures

1. Expose the organs in the abdominal cavity by making the incisions through the body wall as shown in Figure 3. Arrows indicate the directions in which they should be made. First trace each incision by making a shallow cut with a scalpel through the skin, then continue the cut through the rest of the body wall with a pair of scissors. Lift the body wall toward you as you do this to avoid cutting internal organs.
2. Make a pair of cuts from just in front of the umbilical cord and extend them posteriorly to the mammary papillae (nipples). The midventral strip of tissue lying between this pair of incisions contains the umbilical arteries (injected with red latex), urinary bladder (the large sac situated between the two umbilical arteries), and, in the male, the penis. This strip of tissue can be turned back by cutting the umbilical vein that extends cranially from the umbilical cord to the liver. Cut the vein near the umbilical cord, leaving a long stump attached to the liver. You will need to find this vein again later.
3. Make a short cut that extends cranially from the umbilical cord to the posterior end of the sternum (breastbone), which you can feel. Look into the abdominal cavity and notice the muscular *diaphragm* that forms a border between the abdominal and thoracic cavities.
4. Make lateral incisions through the body wall (*incision 3*) just posterior to the attachment of the diaphragm, which you can feel with your fingers. These cuts should follow the attachment of the diaphragm all the way to the back muscles. You should now have the abdominal cavity exposed. If the body cavity is filled with a dark fluid, flush it out with water; be careful not to damage any organs.

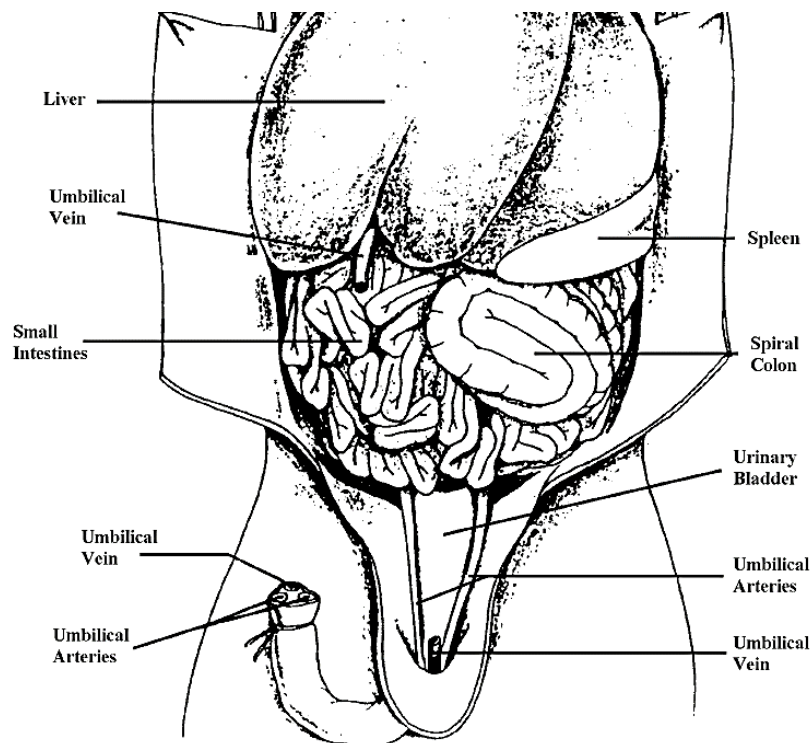


Image 13. Superficial View of the Digestive Organs of the Fetal Pig

5. Use Images 13 and 14 to assist you in locating the following organs:
- Locate the large, reddish-brown colored *liver*, posterior to the diaphragm. Note that the superior surface of the liver is convex to match the concavity of the diaphragm. The liver produces bile, which is emptied into the duodenum and serves to break up fats.
 - Count the number of lobes in the liver. The pig liver is divided into five lobes: the right lateral, right central, left central, left lateral, and a small caudate lobe. The caudate lobe is posterior to the right lateral lobe.
 - Lift the right lobe of the liver and locate the *gall bladder*, the small, pear-shaped sac embedded in the right central lobe. The gall bladder stores bile produced by the liver.
 - The *umbilical vein* can be found entering the liver to the left of the gall bladder.
 - The *cystic duct* from the gall bladder and the *hepatic duct* from the liver unite to form the *common bile duct* which empties into the duodenum (see Figure 5). In order to locate these structures, gently tease away the connective tissue between the stomach and the liver. First locate the cystic duct from the gall bladder and the common bile duct. The cystic duct may be stained green due to the presence of bile. To locate the hepatic duct, trace the common bile duct upward to the point where the cystic duct enters it. The duct branching to the left is the hepatic duct. It is necessary to dissect carefully to avoid destroying these structures.

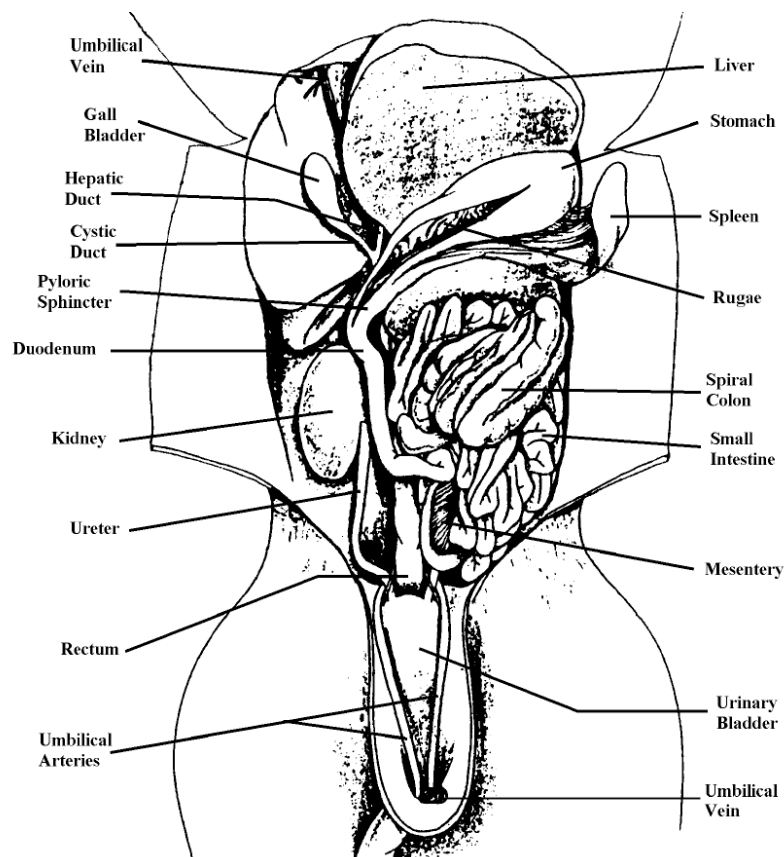


Image 14. Digestive Organs with the Liver and Spleen Pulled Back

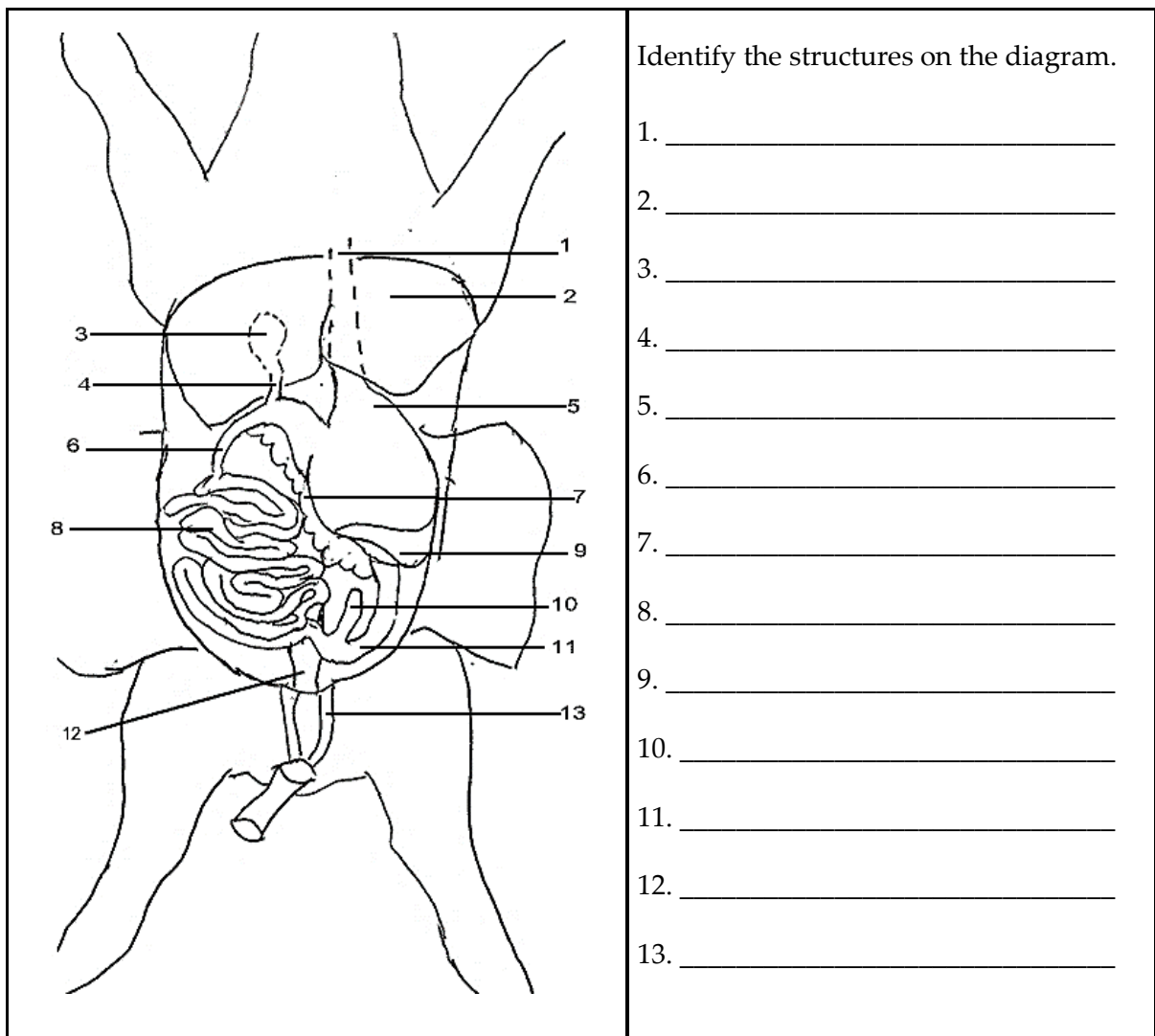
6. Lift the liver to expose the stomach, the large, somewhat J-shaped organ located on the left side of the abdominal cavity.
 - a. Locate the entrance of the esophagus into the *stomach*. The stomach is the site of mechanical digestion and, through actions by the enzyme pepsin, the initial site of protein digestion.
 - b. Identify the following regions of the stomach: the *greater curvature*, the side to which the spleen is attached; the *cardiac region* where the esophagus joins the stomach; and the *pyloric region*, the region opening into the duodenum.
 - c. Use a longitudinal incision from the cardiac region to the pyloric region to cut open the stomach. The green debris found here and elsewhere in the digestive tract is called meconium. It consists of a bile-stained mucus, epithelial cells sloughed off from the skin and lining of the digestive tract, and amniotic fluid swallowed by the fetus. It is discharged in the first bowel movements of the newborn. Wash the meconium out of the stomach.
 - d. Observe the gastric mucosa lining the stomach and the *rugae*, the longitudinal folds visible in the interior of the stomach.
 - e. Locate the *cardiac sphincter*, a circular ring of smooth muscle surrounding the opening of the esophagus into the stomach. Note that the sphincter is tightly closed. This sphincter allows food into the stomach and prevents food from backing up into the esophagus.
 - f. Continue the same longitudinal incision through the *pyloric sphincter*. This sphincter valve keeps food in the stomach until it is sufficiently broken down to be handled by the duodenum.
7. Locate the small intestine beginning at the posterior end of the stomach. The small intestine is a long, coiled tube, divided into three regions: the *duodenum*, the *jejunum*, and the *ileum*.
 - a. The anterior curved portion of the small intestine leaving the stomach is the *duodenum*. This portion is approximately 1 cm long. The common bile duct from the liver and gall bladder can be seen entering the duodenum. Pancreatic enzymes enter the duodenum and serve as the primary digestive agents in this site of most chemical digestion.
 - b. Open the duodenum by continuing the longitudinal incision through its wall from the pyloric sphincter, on the side away from the opening of the common bile duct.
 - c. The two remaining portions of the small intestine, the *jejunum* and the *ileum*, are approximately equal in length and have no readily distinguishable boundary. The jejunum is the middle portion of the small intestine, and the ileum is the latter half that enters the large intestine. These two sections of the intestine represent the location of the greatest amount of absorption by the digestive tract. Cut open a section of the small intestine and observe the velvet-like texture of the interior of the small intestine. This texture is due to small finger-like projections called villi that greatly increase the absorptive surface of the small intestine.

8. Locate the *spleen* the long, dark organ to the left of the stomach. It is attached to the greater curvature of the stomach by means of the *greater omentum*, a specialized fold of the peritoneum. The spleen functions in the destruction of worn out red blood cells and the production of some lymphocytes.
9. The *pancreas* lies in the angle between the curve of the stomach and the duodenum. The greater part of the gland is located dorsal to the stomach. The pancreas secretes enzymes that act upon all major categories of food (carbohydrates, lipids, proteins, and nucleic acids); it also contains endocrine patches (the islets of Langerhans) that produce insulin and glucagon, hormones essential for normal glucose metabolism. The pancreas is connected to the duodenum by the *pancreatic duct*. This duct is small and need not be dissected out.
10. Locate the *peritoneum*, the double membrane lining the abdominal cavity.
 - a. The *parietal* layer of the peritoneum lines the body wall; the *visceral* layer covers the abdominal organs.
 - b. Locate the *mesentery*, the double layer of the peritoneum extending from the dorsal wall of the abdominal cavity to the small intestine. The mesentery contains blood vessels, lymph vessels and nerves (see Figure 5). Nutrients are absorbed into the bloodstream by the mesentery and then sent to the liver.
11. Unravel and string out the small and large intestines by carefully cutting the mesentery that hold the intestines in a tight ball. Do not dissect out these organs and be as careful as possible. If successful, you will find a continuous tube starting from the pyloric sphincter and ending at the rectum of the large intestine.
12. Trace the ileum to its point of attachment with the large intestine.
 - a. The ileum opens into the side of the colon, forming a blind pouch, the *cecum*, at the beginning of the colon. The cecum contains bacteria that serve to break down much of the cellulose that is present in the diet of herbivores. In man, the vermiform appendix is located inferior to the cecum. This is not present in the pig.
 - b. Cut into the cecum, wash out the contents, and observe the *ileocecal sphincter*, which is found at the entrance to the small intestine and prevents material in the colon from backing up into the small intestine.
 - c. The first part of the large intestine in the fetal pig is called the *spiral colon*. It is visible as a compact coiled mass on the left side of the abdominal cavity. This structure is characteristic of the pig and is not found in humans.
 - d. The posterior portion of the large intestine is the *rectum*. Locate this structure passing from the spiral colon as a straight tube into the pelvic region. The external opening of the rectum is the *anus*.
13. At this point, make sure your teacher has seen your work. She will provide directions for cleanup.

Analysis and Conclusion

Be sure you have located each of the following organs on the following page, check the box when you have located the structure.

1. **Diaphragm.** This muscle divides the thoracic and abdominal cavity and is located near the ribcage. The diaphragm aids in breathing. ☐
2. **Liver.** This structure is lobed and is the largest organ in the body. The liver is responsible for making bile for digestion. ☐
3. **Gall bladder.** This greenish organ is located underneath the liver, the **bile duct** attaches the gall bladder to the duodenum. The gall bladder stores bile and sends it to the duodenum, via the bile duct. This will be attached to the liver and will need to be "teased" free. ☐
4. **Stomach.** A "J-shaped" or "pouch shaped" organ that rests just underneath and to the pig's left. At the top of the stomach, you'll find the **esophagus**. The stomach is responsible for churning and breaking down food. The stomach is where mechanical digestion takes place. ☐
5. The stomach leads to the **small intestine**, which is composed of the **duodenum** (straight portion just after the stomach) and the **ileum** (curly part). The ileum is held together by **mesentery**. In the small intestine, further digestion occurs and nutrients are absorbed through the arteries in the mesentery. Chemical digestion takes place in the small intestine. ☐
6. **Pancreas:** a bumpy organ located along the underside of the stomach, a **pancreatic duct** leads to the duodenum. The pancreas makes insulin, which is necessary for the proper uptake of sugars from the blood. It is part of both the digestive and **Endocrine Systems**. ☐
7. **Spleen:** a flattened organ that lies across the stomach and toward the extreme left side of the pig. The spleen stores white blood cells and is part of the **Lymphatic System**. ☐
8. At the end of the ileum, where it widens to become the large intestine, a "dead-end" branch is visible. This is the **cecum**. The cecum helps the pig digest plant material. ☐
9. The **large intestine** can be traced to the **rectum**. The rectum lies toward the back of the pig and will not be moveable. The rectum opens to the outside of the pig, or the **anus**. The large intestine reabsorbs water from the digested food, any undigested food is stored in the rectum as feces. ☐
10. Lying on either side of the spine are two bean shaped organs: the **kidneys**. The kidneys are responsible for removing harmful substances from the blood, these substances are excreted as urine. Do not remove them yet! (more on this later when we discuss the Excretory System) ☐
11. Two **umbilical vessels** can be seen in the umbilical cord, and the flattened **urinary bladder** lies between them. ☐



Day 5: Heart, Arteries and Veins

Background

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.

Examination 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. I have provided 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 in these grooves.

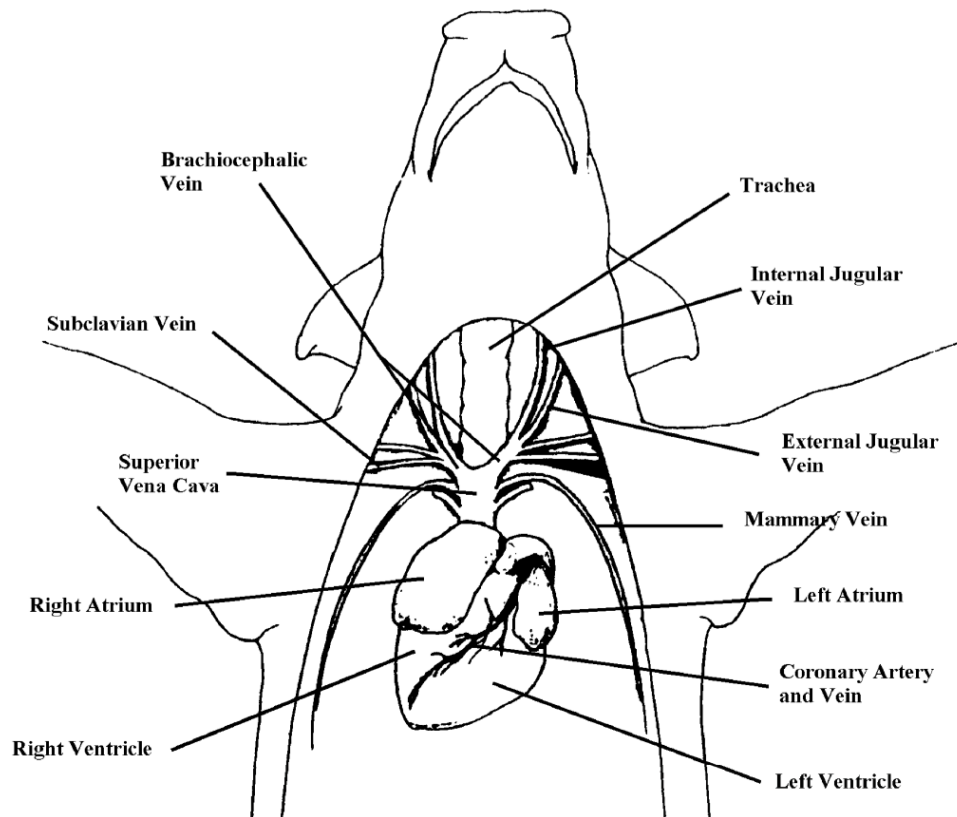


Image 15. Veins of the Thorax and Neck Region

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).
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.
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 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

14. 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 16).
15. 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.
16. 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.

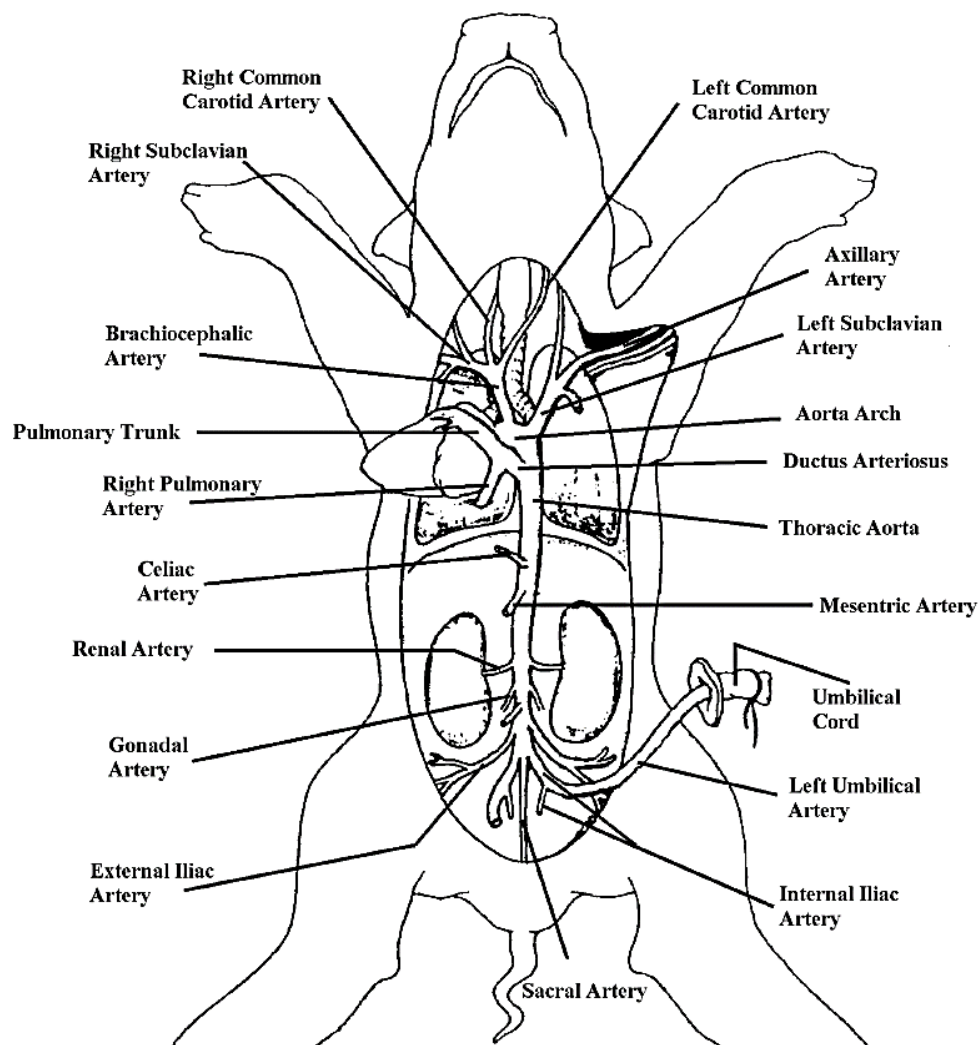


Image 16. Major Arteries of the Fetal Pig (Heart Pulled to the right)

17. 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*.
18. To enable you to see the arteries branching off the aortic arch, free the anterior vena cava from the arteries beneath.
19. 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 fingertips along the side of your trachea, you may feel your pulse. You are detecting the blood being pushed through your carotid artery.
20. 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.
21. 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.
22. The *subclavian* artery becomes the *axillary* artery as it crosses the axillary space, and then the *brachial* artery on the upper arm.

23. 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.
24. Note the *intercostal* arteries emerging from the thoracic aorta. These supply the intercostal muscles.
25. Trace the descending aorta through the diaphragm. The first major branch from the abdominal aorta is the *celiac* artery (see Figure 16). 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.
26. 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.
27. Locate the *renal* arteries (which supply the kidney) below the mesenteric artery.
28. 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.
29. 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.
30. Locate the *internal iliac* arteries below the point at which the *external iliac* arise from the aorta. These give rise to the large umbilical arteries, which pass lateral to the bladder.
31. The small *median sacral* artery can be seen emerging from the base of the aorta between the two internal iliac arteries.
32. 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. Currently 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.

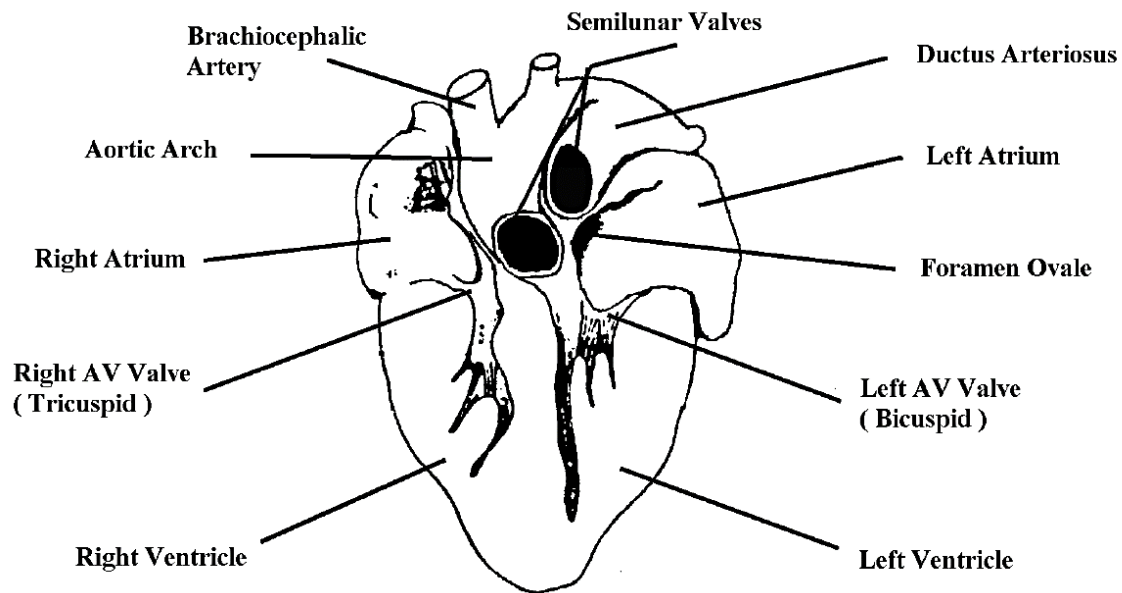


Image 17. Longitudinal Section Through the Fetal Pig Heart

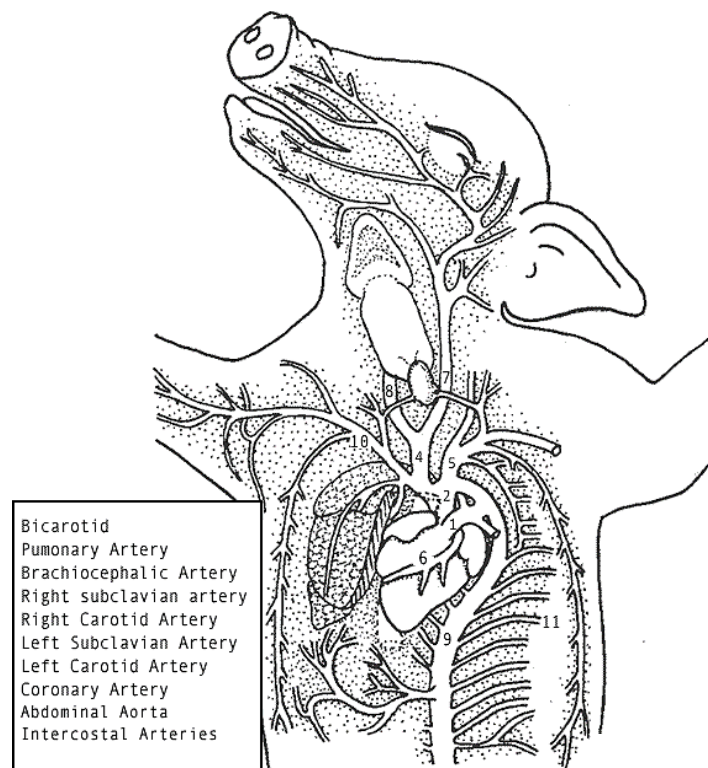
Analysis and Conclusion

Locate each of the following organs below, check the box when you have located them.

1. Once the chest cavity is opened, we will start with the center of the **Circulatory System**, the heart. Right above the heart is the **thymus**, which is a critical structure for the **Lymphatic System**. ☐
2. Remove the **pericardium**, which is a membrane that surrounds the heart. This membrane is also located over many of the organs and can get in the way of your view. ☐
3. The structures visible on the heart are the two **atria**, the **ventricle** (which has two chambers, but the separation is not visible from the outside), and the large **Aorta** - a vessel which leaves the heart. ☐
4. Observe the **coronary vessels** on the outside of the heart - these vessels supply blood to the muscle of the heart. These are the blood vessels that, when blocked, can lead to a heart attack. ☐
5. The largest most visible vessel is the **aorta**, it arches from the heart and branches toward the head and curves around to go to the lower part of the body - where it is called the **abdominal aorta**. The aorta supplies the body with fresh blood. ☐
6. Underneath the aorta is the **pulmonary artery**, which takes blood to the lungs, in a fetal pig this vessel is unused (the fetus doesn't yet breathe to get oxygen) and a shunt called the **ductus arteriosus** allows fetal blood to bypass the pulmonary vessels and go straight to the aorta. ☐

7. Lift the heart to look on its dorsal side (toward the back), you should be able to see the **anterior and posterior vena cava** (singular **vena cava**), which brings blood from the body back to the heart. ☐
8. Follow the aorta to where it arches (appropriately called the "aortic arch", if you carefully pick away the surrounding tissue, you will find three main branches from the aortic arch. ☐
9. Toward the pig's right, two branches move to the arm and to the neck. The rightmost branch is the **right subclavian artery** and it supplies blood to the pig's arm and shoulder. ☐
10. Next to the right subclavian and heading directly toward the pig's head is the **bi-carotid**, which will divide (in a Y shape) to form the **left and right carotid arteries**, which supply blood to the head and neck. ☐
11. Toward the pig's left, you'll find the **left subclavian artery** which provides blood to the left shoulder and arm. ☐
12. Also note the arteries that run along the ribs of the pig, these are the **intercostal arteries**. ☐

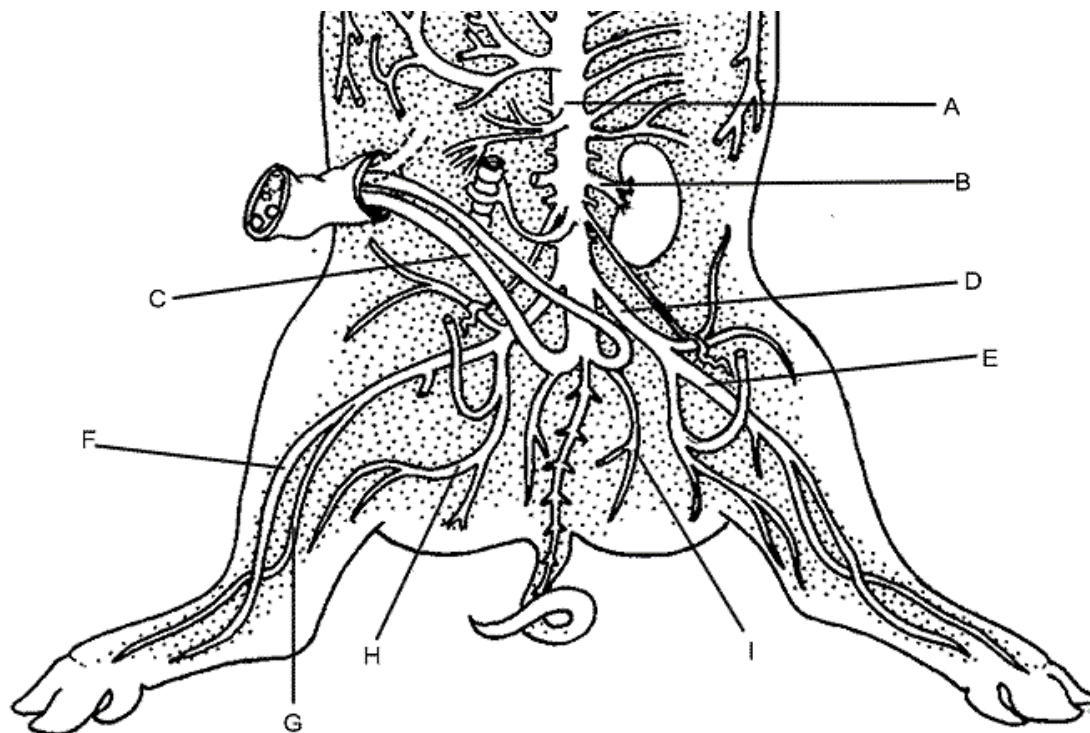
Match the numbers to the names on the diagram below.



13. Trace the abdominal aorta to the lower part of the body, careful teasing of the tissue will reveal several places where it branches, though some of the arteries may have been cut when you removed organs of the digestive system. ☐

14. The **hepatic artery** leads to the liver. (may not be visible) ☐
15. The **splenic artery** leads to the spleen (may not be visible) ☐
16. The **renal arteries** lead to the kidney. ☐
17. The **mesenteric artery** leads to the mesentery and branches into many smaller vessels. (You cut the mesentery in the first part of the lab, so these arteries may not be visible) ☐
18. Trace the abdominal aorta and note where it joins the umbilical arteries. You will need to cut the muscle in the leg to trace the next vessels. Use a pin to carefully tease away the surrounding muscle and tissue. ☐
19. The abdominal aorta splits into two large vessels that lead to each leg - the **external iliac** arteries will turn into the femoral arteries as they enter the leg. ☐
20. Follow the umbilical artery toward the pig, you'll find that it branches, and a small artery stretches toward the posterior of the pig - this is the **ilio-lumbar artery**. ☐
21. Follow the external iliac into the leg (carefully tease away muscle), it will branch into two arteries: the **femoral** (toward the outside of the leg) and the **deep femoral** (toward the inside of the leg) ☐
22. Follow the femoral to the lower leg where it branches into the **anterior tibial artery** and the **posterior tibial artery**. ☐

Label the lower abdominal arteries on the pig.



23. Find the **diaphragm** again. Remember that the diaphragm separates the abdominal cavity from the thoracic cavity, and it aids in breathing. ☐

24. Find the heart again and push it to the side to locate two spongy **lungs** located to the left and right side. The lungs are connected to **bronchial tubes** which connect to the **trachea** (forming a Y). ☐

25. The **trachea** is easy to identify due to the **cartilaginous rings**, which help keep it from collapsing as the animal inhales and exhales. The trachea should be located behind the heart and liver and near the esophagus but note that the esophagus and trachea are separate tubes. ☐

26. Lying ventral to the trachea, locate the pinkish-brown, V shaped structure called the **thyroid gland**. This gland secretes hormones that control growth and metabolism and is part of the Endocrine System. ☐

2. At the anterior (toward head) of the trachea, you can find the hard-light colored **larynx** (or voice box). The larynx allows the pig to produce sounds - grunts and oinks. ☐

In the space below, sketch the thoracic cavity of the fetal pig and label the trachea, heart, lungs, bronchial tubes, thyroid gland, and larynx.

Fetal Pig Heart versus Adult Pig Heart

1. Compare the external halves of your fetal pig heart with the external halves of the heart dissected by your teacher. Note the similarities as well as the differences between the two different hearts, such as the sizes of the chambers, valves, vessels, and muscle thickness, etc. Record your observations on your autopsy report.
2. Compare the internal halves of your fetal pig heart with the internal halves of the heart dissected by your teacher. Note the similarities as well as the differences between the two different hearts and record these on your autopsy report.

Day 6: Urinary and Reproductive Systems

Urinary System Background

The organs in the urinary system of the fetal pig are very similar to those in the human. As you dissect the organs, be prepared to trace the path of urine from its site of production to the point at which it passes to the outside. The pig kidney will be sectioned in order to study its internal structure, since it provides a good example of a typical mammalian kidney.

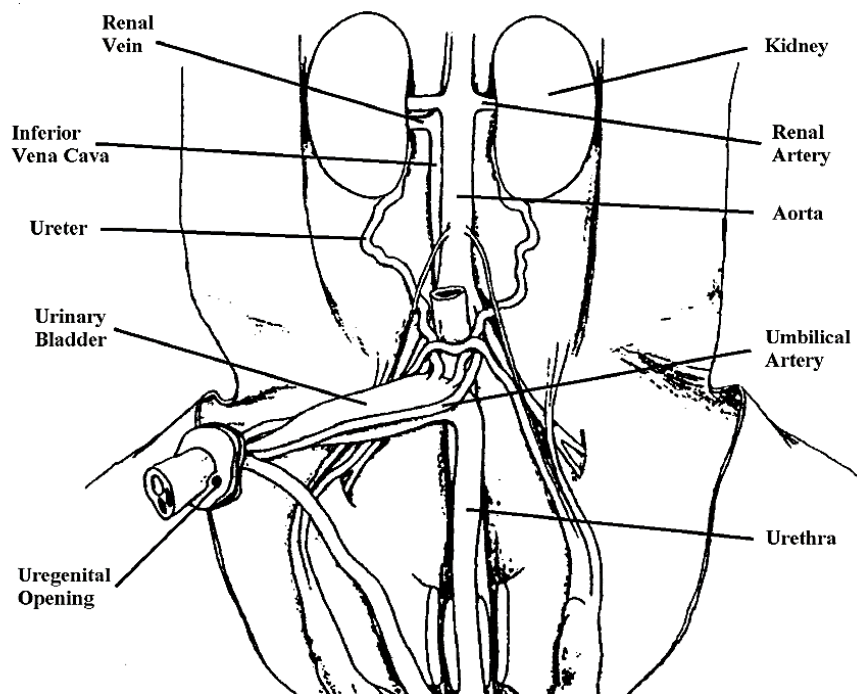


Figure 18 Urinary System of a Male Fetal Pig

Examination Procedure

1. Observe the paired kidneys on the dorsal body wall of the pig. Use Image 18 as a guide.
2. Remove the peritoneum, which covers only the ventral surface, from both kidneys. Since the kidneys are separated from the abdominal organs by a layer of peritoneum, their location is described as *retroperitoneal*.
3. Identify the renal artery and renal vein, which carry blood to and from the kidney. Which vessel carries the cleansed blood?

4. Locate the **adrenal gland**, a narrow band immediately above each kidney.
5. Observe the **ureter**, the narrow, white convoluted tube which drains the urine from each kidney. Trace the ureter from the **hilum**, the opening on the medial border of each kidney, to the **urinary bladder**, freeing it from the peritoneum. The urinary bladder is attached to the reflected ventral strip of the abdominal wall.
6. Observe the **umbilical arteries** which lie lateral to the urinary bladder.
7. Locate the urethra, the duct which conducts urine from the posterior end of the bladder to the outside. The remainder of the urethra will be freed when the reproductive system is dissected. Remove one kidney. Make a longitudinal section through the kidney.
 - a. The **renal capsule** the thin layer of connective tissue around the outside of the kidney.
 - b. The **renal cortex** is the outer light brown layer of the kidney immediately beneath the capsule. This layer contains most of the filtration units called nephrons. The loop of Henle will extend into the renal medulla.
 - c. The next layer of the kidney, the renal medulla, contains the **pyramids**.
 - d. Locate the **renal pelvis**, the funnel-shaped expansion of the ureter. It is the hollow interior of the kidney.
8. Compare the preceding structures with Images 19 and 20 of the human kidneys.

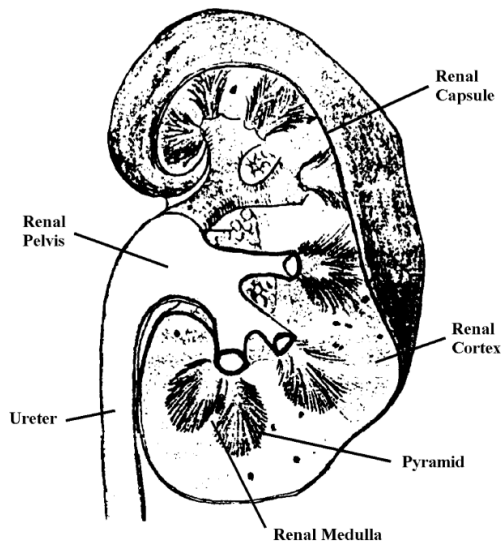


Image 19.

Longitudinal Section through Kidney

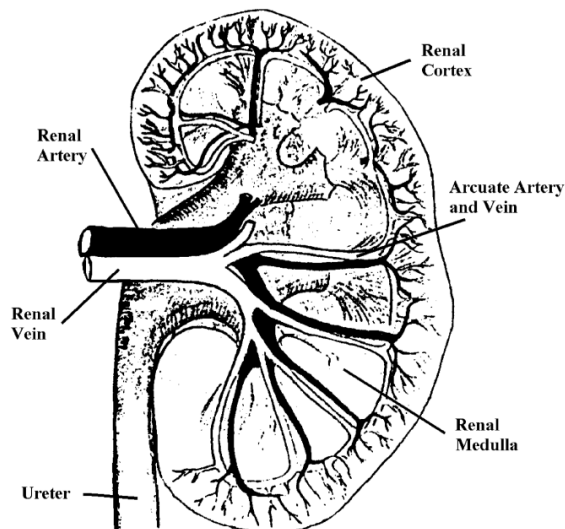


Image 20.

Renal Blood Supply

Reproductive System Background

The reproductive organs of the fetal pig are similar to those of the human. Note, however, the difference in the structure of the uterus of the female. Although you will dissect the reproductive system of only one sex, you are responsible for that of both sexes. Therefore, carefully study the reproductive structures on a fetal pig of the opposite sex.

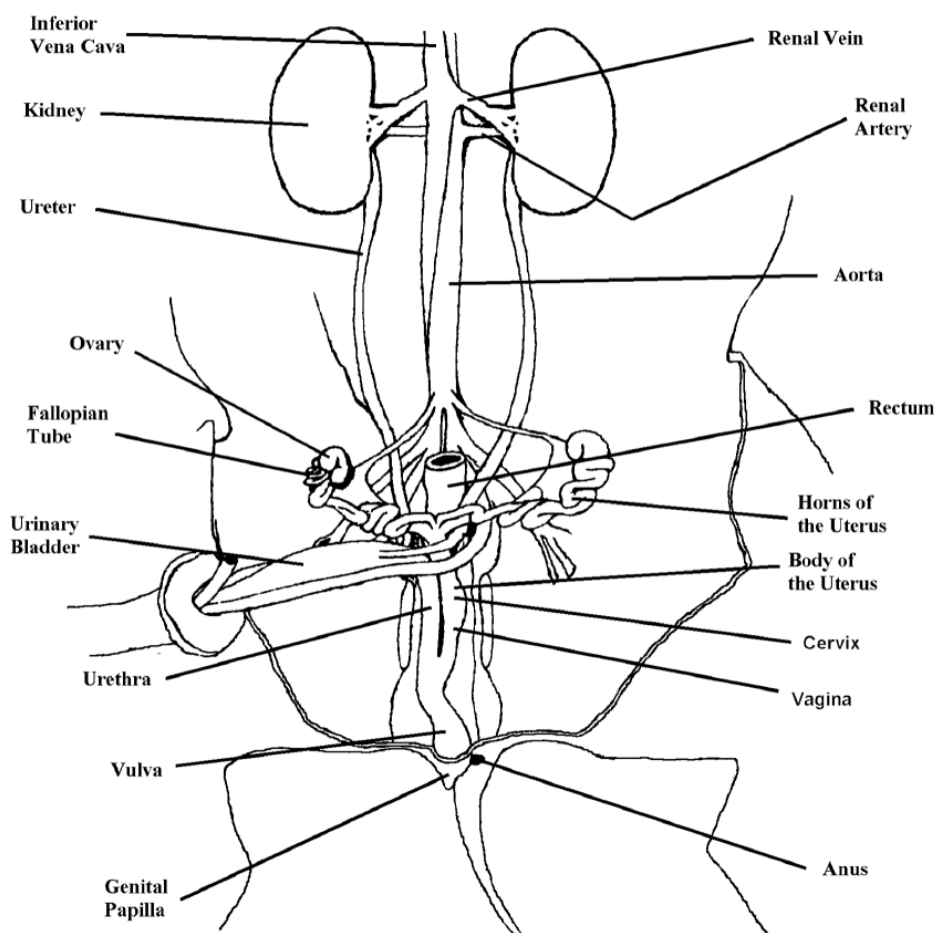


Image 21. Reproductive Organs of the Female Pig

Examination Procedure

Part 1. The Female Reproductive System

1. Use Image 21 as a guide in your dissection. Identify the ovaries, a pair of small light-colored oval bodies located posterior to the kidneys.
2. The **uterine tubes** (Fallopian tubes) are very small, highly convoluted tubes lying on the dorsal surface of the ovaries. The expanded end of the Fallopian tube, which partially covers the ovary and picks up the eggs from the ovary, is called the **ostium**.
3. Trace the Fallopian tube until reaching a larger tube next to each ovary. These tubes, the **uterine horns** or horns of the uterus, are the beginning of the uterus. The eggs are carried through the Fallopian tubes to the uterine horns where, if fertilized, they develop. The fetuses tend to be equally spaced throughout the two horns.
4. The two horns unite in the midline to form the **body** of the **uterus** which lies dorsal to the urethra. The broad ligament can be seen running laterally from the body of the uterus to the uterine horns.
5. To dissect the rest of the female reproductive system, the pelvic cavity must be exposed. Remove the skin from the ventral pelvis and cut through the pelvic muscles and the pubic symphysis in the midventral line. Cut with care since the urethra lies immediately beneath the pubic area.
6. Locate the urethra, the tube carrying urine from the urinary bladder.

7. Dorsal to the urethra, identify the vagina, the tube leading from the posterior end of the uterus.
8. Separate the urethra from the *vagina*. Toward the posterior end, the vagina and urethra unite to form a common passage called the urogenital sinus or vulva which opens to the outside. An *external genital papilla* is located on the external surface at the opening of the vulva.
9. The lateral boundaries of the urogenital sinus are folds called the *labia*. These unite ventrally to form the genital papilla.
10. Locate the rectum, the continuation of the large intestine, dorsal to the vagina.

Part 2. The Male Reproductive System

1. Use Image 22 to identify the male reproductive parts. Locate the *scrotum*, the sac visible under the skin ventral to the anus. Early in fetal development the *testes* are located below the kidneys; however, they migrate before birth through the inguinal canal into the scrotum.
2. Locate the inguinal canals, two openings in the abdominal wall, by tracing the internal testicular arteries posteriorly until they pass through the canals.
3. To expose the remainder of the male reproductive organs, cut through the skin in the midventral line ventral to the pubic symphysis. Cut through the scrotum carefully, to avoid damaging the structures contained within.
4. Using Image 22 as a guide, locate both the left and right *processus vaginalis*, large white sacs on each side which contain the testes. This structure is an evagination of the peritoneum that precedes the descent of the testes and surrounds them.
5. Pass a probe from the abdominal cavity through the inguinal canal and note that this emerges inside the processus vaginalis.
6. Cut open one of the sacs to expose the testis. The epididymis should be located along the medial side of the testis. This begins at the cranial end of the testis and extends to its caudal end. Identify the *gubernaculum*, the band of tissue which extends from the posterior end of the epididymis to the scrotal wall. This helps pull the testis posteriorly from the body cavity, through the inguinal canal, and into the scrotal sac.
7. The *vas deferens* carries the sperm from the epididymis through the inguinal canal to empty into the urethra. Trace the vas deferens through the inguinal canal to the urethra, noting how it loops over the ureter and enters the dorsal surface of the urethra.
8. Locate the *penis*, the long muscular tube lying just under the skin immediately posterior to the umbilical cord and the urogenital opening in the midventral strip of the abdominal wall. Remove the overlying skin so that the penis is exposed.
9. Now move the penis to one side of the midventral line and cut through the midventral portion of the pelvic muscles and the pubic symphysis. Spread the legs apart to expose the pelvic cavity. The urethra should now be visible emerging from the urinary bladder.
10. Separate the rectum from the urethra and trace both tubes to the outside.

11. Identify the large pair of *bulbourethral* or Cowper's glands, each of which is located at one side of the urethra near the anus.
12. Locate the *seminal vesicles* and *prostate glands* at the beginning of the urethra. They can be found on the dorsal side of the urethra and ventrally to the rectum. These glands, along with the Cowper's glands, will produce seminal fluid that nourishes and protects the sperm cells.

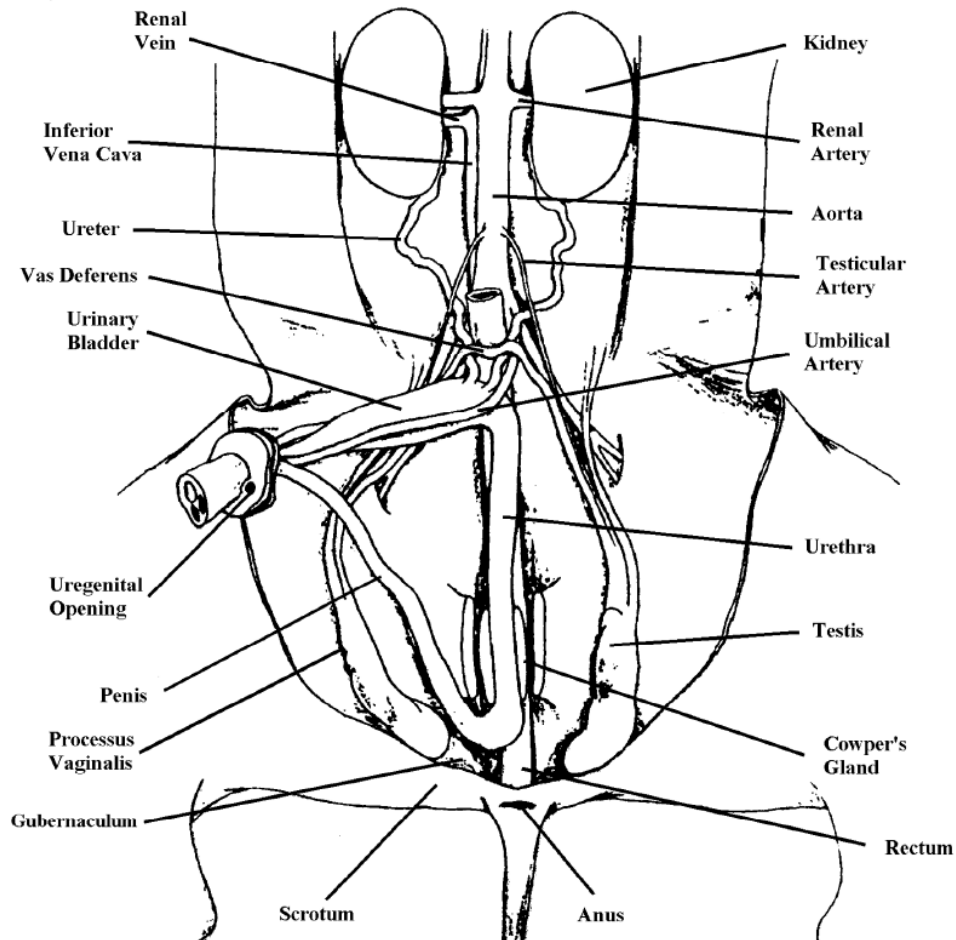


Image 22. Ventral View of the Male Reproductive Organs of the Fetal Pig

Analysis and Conclusion

Locate each of the structures below and check the box when you have found them. Make sure to view both the male and female pig.

1. Locate the **kidneys**, the tubes leading from the kidneys that carry urine are the **ureters**. The ureters carry urine to the **urinary bladder** - located between the umbilical vessels. ☐
2. Look for the tissue resting anterior/medial edge of the kidneys, these are the **adrenal glands**. They are important members of the Endocrine System, in that they produce a variety of hormones and neurotransmitters. The adrenal glands produce adrenaline, cortisol, and androgens to name a few. ☐

3. Lift the bladder to locate the **urethra**, the tube that carries urine out of the body. ☐

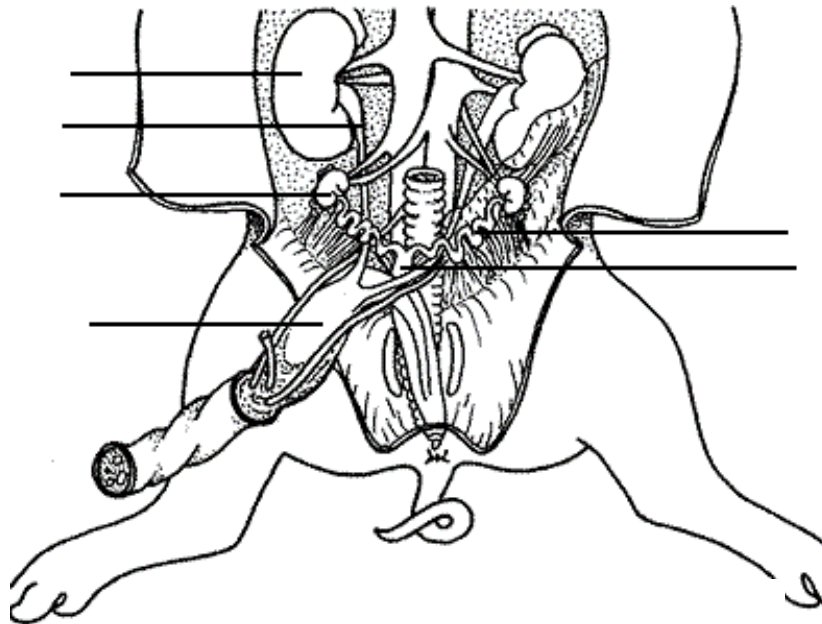
Male

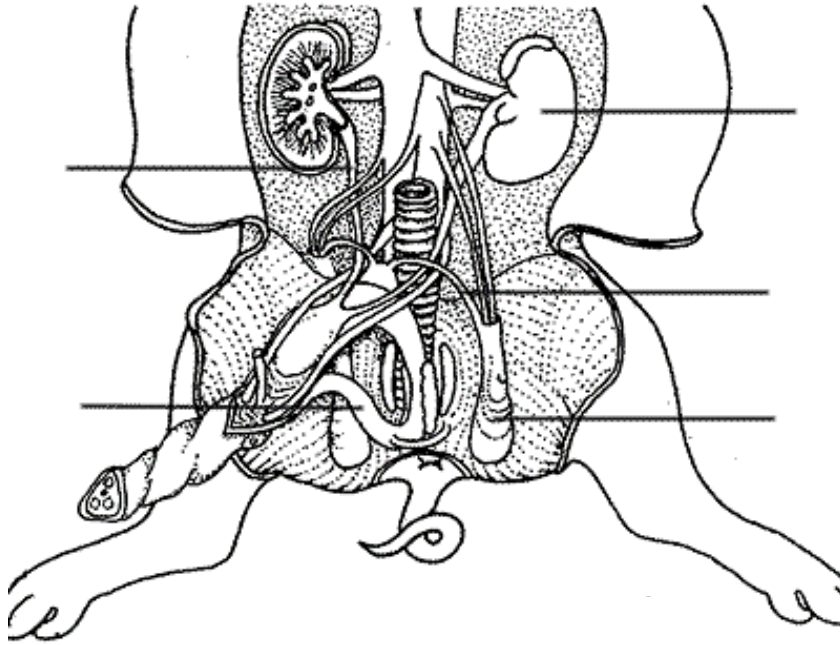
1. Find the **scrotal sacs** at the posterior end of the pig, **testis** is located in each sac. Open the scrotal sac to locate the testis. ☐
2. On each testis, find the coiled **epididymis**. Sperm cells produces in the testis pass through the epididymis, where they mature, and into a tube called the **vas deferens** (in humans, a vasectomy involves cutting this tube). ☐
3. The vas deference crosses over the ureter and enters the **urethra**, which leads to the **penis**. The penis will be in the flap that has the umbilical cord. Cut away the skin to reveal the penis. ☐

Female

4. In the female pig, locate two bean shaped **ovaries** located just posterior to the kidneys. ☐
5. The ovaries are connected to the **fallopian tubes**, which carry eggs from the ovaries to the **uterus**. The uterus is dorsal to the urinary bladder. ☐
6. Trace the uterus to the **vagina**. The vagina will actually appear as a continuation of the uterus. The vagina and urethra open into a common area called the **urogenital sinus**. ☐

Label the diagrams with the vocabulary words in bold.





Day 7: BRAIN & SPINAL CORD

Follow the directions below and locate each of the structures. Check the box when you have found them.

1. Rotate the pig so the skull is up. Using scissors cut away the skin on the head to explore the skull. The bone is not yet completely calcified, and the skull is largely cartilaginous. Use scissors to carefully cut a circle in the top of the skull. Remove the disk you have cut. You have revealed the two hemispheres of the **cerebrum**. The cerebrum controls thinking, senses, etc. ☐
2. Use your scissors to expose the rest of the brain. Locate the longitudinal fissure or indentation that runs laterally between the right and left cerebral hemispheres. The **olfactory lobes** that control smell are at the front of the cerebrum. ☐
3. Posterior to the cerebrum is the cerebellum. Locate the **cerebellum** and the transverse fissure that separates it from the cerebrum. The cerebellum consists of 2 lateral hemispheres and is involved with the control of muscles and coordination. ☐
4. Carefully cut posteriorly from the skull to the vertebral column in order to locate the hind section of the brain known as the **medulla oblongata** and the spinal cord. The medulla is on the ventral side of the cerebellum, so you may need to look under the cerebellum to find it. The medulla connects the brain to the spinal cord and controls all vital functions of the body such as heart beat and breathing. Try to expose where the spinal cord attaches to the medulla oblongata. ☐

5. With forceps and a razor remove the muscle from the mid-dorsal line of the back of the body in a strip about 5 cm long and 2 cm wide. Carefully use the razor to make a series of 'slices' through the **vertebrae** to expose the thick, whitish **spinal cord**.



The Final Steps

1. The final steps of a human autopsy include the placement of all the organs back into the body cavity, not necessarily in their original locations, or to incinerate the organs and pack the body cavity with filler material. The idea is to give the body cavity a normal shape for viewing at a mortuary.
2. You will follow the protocol of placing all the organs back into the body cavity (thorax and abdomen), arranging them to approximate the original body shape, suturing the "Y" incision, editing and filing your autopsy report, and disposing of the specimen.
3. (*Optional*) Thread your suture needle (caution, sharp tip) with 5 feet of black nylon (provided). Divide the line into two equal portions and tie a knot at the open ends. Starting at the bottom of the Y incision, insert the needle into either side of the incision and start a "running stitch" with over and under stitches on both sides, like baseball stitches. Pull the incision closed as you work along the opening. At the end of the incision pull the string taut and tie another knot. Cut off any remaining string.
4. Once you have completed the forensic dissection activity, edit your autopsy report with all the members of your group and turn it in to your teacher, along with any digital photos of the examination.
5. Follow your teacher's instructions regarding disposal of your pig.

Some Vocabulary to Know

External Features

1. Nares
2. Pinna
3. Abdomen
4. Thorax
5. Eye
6. Anus
7. Digit
8. Wrist
9. Ankle
10. Mammary papillae
11. Head
12. Neck
13. Trunk
14. Tail
15. Umbilical chord
16. Urogenital opening

Mouth:

17. Esophagus
18. Nasopharynx
19. Hard palate
20. Soft palate
21. Sensory papillae
22. Teeth
23. Epiglottis
24. Glottis
25. Tongue

Muscles:

26. Gastrocnemius
27. Abdominal
28. Oblique
29. Pectoral
30. Trapezius

Respiratory/endocrine:

31. Lungs
32. Trachea
33. Larynx
34. Diaphragm
35. Thyroid
36. Thymus

Cardiovascular:

37. Atrium
38. Ventricle
39. Coronary
40. Carotid artery
41. Pulmonary artery
42. Pulmonary vein
43. Aorta
44. Aortic arch
45. Jugular
46. Femoral
47. Superior/inferior
48. Vena Cava
49. Pericardium
50. Umbilical artery
51. Umbilical vein

Digestive/Endocrine:

52. Esophagus
53. Liver
54. Gallbladder
55. Stomach
56. Cardiac sphincter
57. Pyloric sphincter
58. Duodenum
59. Esophagus
60. Small intestine
61. Ileum
62. Jejunum
63. Pancreas
64. Spleen
65. Mesentery
66. Cecum
67. Colon
68. Rectum

Urogenital:

69. Renal vessels
70. Kidneys
71. Urinary bladder
72. Urethra
73. Ureters

Reproductive

74. Testes
75. Ovary
76. Oviducts
77. Uterus
78. Vagina
79. Vas deferens
80. Seminal vesicle
81. Scrotal sac
82. Epididymis
83. Penis

Pre-Lab Questions

Phylum:

1. What two features characterize the pig as a mammal?
2. Discuss how mammals care for their young. How is this an advantage for them?
3. List and discuss the three types of ways embryos can develop in mammals.

Lab Questions:

1. Compare circulation of the blood in a fetal and an adult pig.
2. The lungs do not function in a fetal pig. What takes over their function? Explain how.

3. Your dog just ate your homework. Discuss the path of your homework through your dog's digestive tract. Remember your dog is a mammal – so his digestive tract is like the fetal pig's and like yours.
4. You are a red blood cell in a mammal. Discuss the path you follow in the mammalian circulation. Start your journey in the right atrium follow the path around the body - end your journey in the right atrium (include the lungs, arteries, veins, etc).
5. The pig is classified as a *placental mammal*, an *ungulate*, and an *artiodactyl*. Research what these words mean and describe why a pig is classified in these ways.

Lab Report Guide

1. Following the instructions given, prepare a complete report on this lab experience. Be sure to include all observations and discoveries. This report should be between 5 and 8 pages long.
2. Even though you have worked as a team for the dissection, *EACH* member of the team must prepare an independent report of their findings. Each report must not plagiarize the other members' reports.
3. *Investigative Question:* How do the different organs and organ systems work interdependently to sustain health of a living organism?
4. *Use APA format throughout.*
5. The lab report is due _____.
6. Here is the grading rubric:

Title Page: (5 pts)

- Title – subject of the report
- Your name
- Group number & member names
- Class period
- Date

Introduction: (2 full paragraphs, 10 pts)

- Why do we are using the fetal pig to study human anatomy?
- What is significance of the investigative question?
- How is this experiment important?

Hypothesis: (1 paragraph, 5 points)

- What were your initial thoughts about the answer to the investigative question?

Methods and Procedures: (10 pts)

- List of materials used
- Procedure should clearly describe the experiment. Should be a numbered list of discrete steps that someone could easily follow.
- What types of observations did you look at?
- How were the incisions performed?
- What were some of the mini-experiments you conducted?

Illustrations: (30 pts)

- Clearly and neatly drawn, not copies from the internet.
- Clearly and accurately labeled.
- Enhance the overall quality of the report.
- Correct cited within the text of the report.

Discussion & Conclusion: (40 pts)

- Review and discuss the purpose and importance of the autopsy.
- Compare the interrelationships of organ systems to each other & to the body as a whole
- 11 body systems– circulatory, digestive, respiratory, excretory, nervous, immune, endocrine, reproductive, integumentary, skeletal, and muscular.
- Explain in detail how the systems work together. Give at least five specific examples of systems working together. You may use more than

two systems for an example. (You may need to do some independent research if we have not yet covered a system in class.)

Example: The circulatory system and respiratory system work together to get oxygen to the cells of the body. The interacting site is at the alveoli, which are surrounded by capillaries. The gas exchange of oxygen and carbon dioxide occur in the alveoli. The oxygen is picked up by the blood cells and carried to the body cells. Oxygen is deposited in the body cells and carbon dioxide is picked up. The blood cells carry carbon dioxide back to the lungs and deposit the carbon dioxide into the alveoli. The lungs then exhale, removing the carbon dioxide and inhale to bring in more oxygen.

- Explain how the systems make the body function.
- Relate the body and organ systems of the pig to that of humans.
- How is the pig anatomy like the human?
- How is the pig anatomy different from the human?
- What was your favorite part of the dissection? What did you learn from the dissection?