

Biology Lab: Anatomy of the Fetal Pig

Background

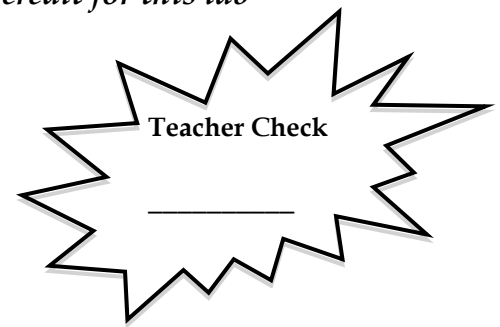
Pigs are placental mammals (just like humans) and exhibit very similar characteristics to us. In studying the anatomy of the fetal, or unborn, pig, you will see that its various organ systems are basically the same as those of humans. Dissecting the pig is a great educational model to culminate our study of the human body systems.

To see the organs and organ systems discussed in this lab and in class, you will have to do a very careful dissection. It is very easy to crush or remove structures that are important to observe so make sure that you are very careful and purposeful in your dissection. This can be avoided by reading over the instructions for each part of the lab. Use the diagrams provided to guide you through the dissection and **only use scissors and scalpel when instructed to do so**. Choose the forceps, probes and dissecting needles at all other times.

***** Whenever you see a box to the right side that says Teacher Check, you cannot move on to the next part of the lab without my initials or stamp. You will not receive full credit for this lab without these completed. *****

What are 3 ways you can be sure to have a successful dissection lab?

- 1.
- 2.
- 3.



Objectives

In this laboratory activity, you will:

1. Observe the external anatomy of the fetal pig.
2. Observe the organs and organ systems of the systems we have learned about in class.

Materials

Preserved fetal pig	Dissecting tray
Dissecting scissors	Scalpel
Probe	Forceps
Dissecting needles	Dissecting pins
Cord	Microscope
Slide	Cover slip
Metric ruler	Latex gloves

Procedures and Observations

Part 1. External Anatomy of the Fetal Pig

Gloves must be worn throughout this entire activity. Figure 1 shows the external anatomy of the fetal pig. Note that the back of the pig is the dorsal side and the belly is the ventral side. The head of the animal is anterior and the tail end of the pig is posterior. It is easy to remember that the top of the pig starts at the start of the alphabet (A for anterior) and the tail is towards the end of the alphabet. Any reference throughout the lab to the right or left side refers to the pig's right or left side.

How can you remember the difference between dorsal and ventral?

How can you remember the difference between anterior and posterior?

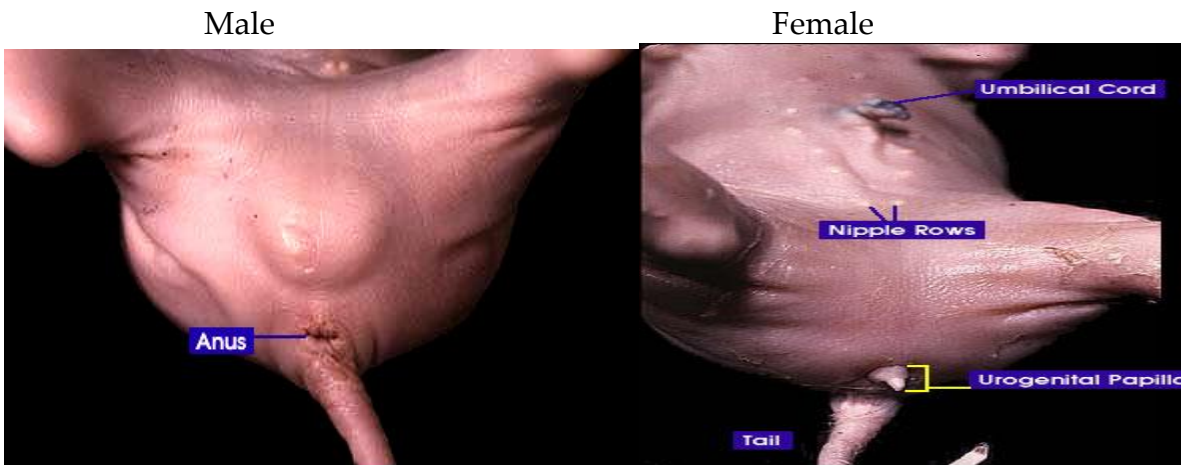
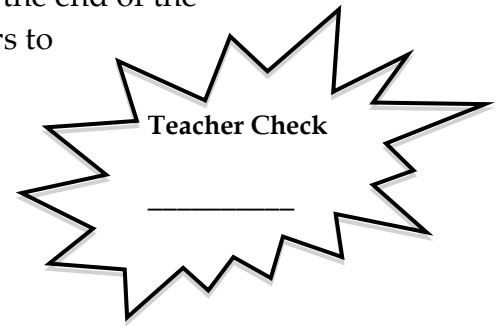


Figure 1: External Anatomy of the Fetal Pig

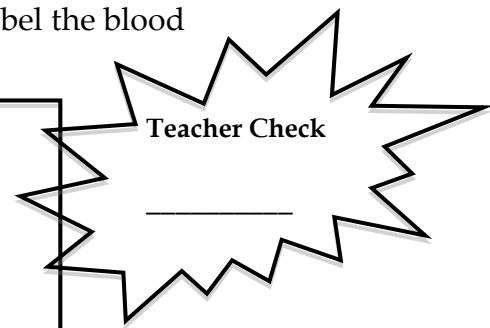
1. Pick up your pig and examine it. You can estimate the age of the pig from its length. Measure your pig from the tip of its snout to the base of its tail. Using the measurements given below, estimate the age of your pig.

Length of pig (mm)	Age estimation (weeks)
28 mm	7 weeks
40 mm	8 weeks
220 mm	15 weeks
300 mm	17 weeks

- a. What is the approximate age of your pig? _____
2. Determine the sex of your pig. The sex of a pig can be determined from the external structure. Both males and females have nipples on the ventral surface, so the presence of nipples cannot be used to determine sex. In both males and females the anus is located just beneath the tail. In

males, the scrotal sac, which contains the testes, is located beneath the anus. The urogenital opening of the male is just posterior to the umbilical cord on the ventral surface. In females, the urogenital opening is beneath the anus, in a spike-like genital papilla. Urogenital means an opening that is part of the excretory and reproductive systems.

- a. *What is the sex of your pig?* _____
3. Examine a pig of the opposite sex.
4. The umbilical cord contains blood vessels that connect the fetus to the placenta. In the pig, the umbilical cord extends from the midline of the ventral surface.
 - a. Examine the cut end of the umbilical cord. You should be able to see two arteries and a vein. The vein may be completely collapsed, which makes it difficult to find. If you cannot find the vein, use your scissors to make a fresh cut through the cord about 1 cm from the body wall, and examine the freshly cut end. (*Hint: The blood vessels have been injected with dye to show the difference between arteries and veins. The blood vessels that would have the most oxygen have been injected with red dye and those with less oxygen were injected with blue dye.*)
 - b. In the box below, draw a cross section of the umbilical cord and label the blood vessels.



5. Examine the feet of the pig.
 - a. *How many toes does the pig have?* _____

Part 2: Opening the Abdominal and Chest Cavities

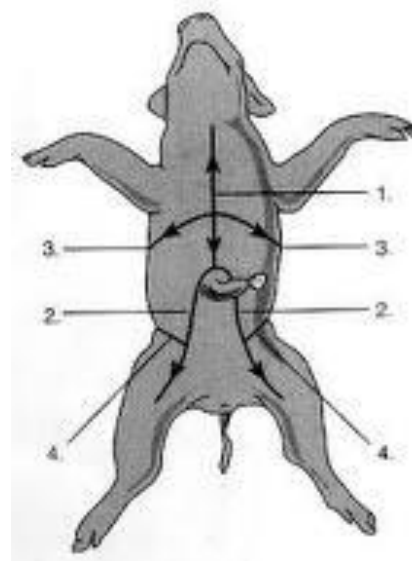
1. Place the pig on its back in the dissecting tray. Tie a piece of string around the “wrist” of one of its front legs. Run the cord under the width of the dissecting tray and tie it around the wrist of the other front leg. Pull the cord fairly tight so that the legs are spread apart. Secure the hind legs in the same manner. (See Figure 2 below)

Figure 2.
Positioning
the pig on
the
dissecting
tray.



2. Figure 3 shows where your incisions should be made. **In making incisions use only the tip of your scalpel to push the skin up. Then use the dissection scissors to continue the cut. This will cut down on the chance of damaging the internal organs. CAUTION: Use the scalpel and dissection scissors with care throughout this lab activity.** Be particularly careful in the incision over the chest area. Begin the incision at the spot marked by the dot on line 1. Then make the incision shown by line 2 and continue to follow the numbering when you make the cut. See Figure 3 below for examples and the diagram.

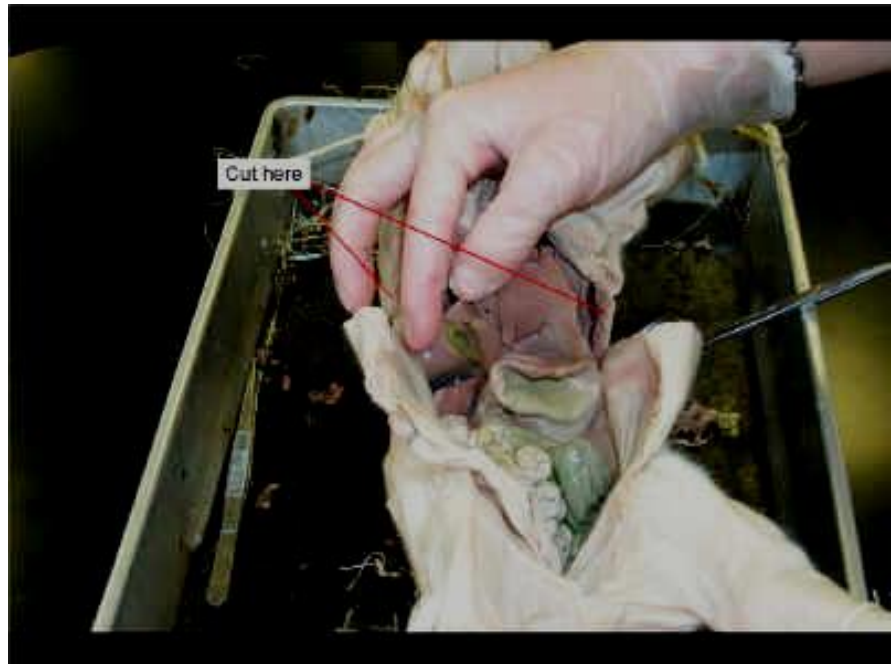
Figure 3: Using the dissecting scissors and the numbering to follow for your first incisions.



The ends of the diaphragm, the muscle that separates the abdominal and chest cavities, are attached to the body wall right around incision 3.

3. Gently pull apart the flaps of the body wall along the long incisions between the front and hind legs (*Incisions 2 and 3*). Do not lift the flap with the umbilical cord. As you separate the flaps under the front legs, use your scissors or scalpel to carefully cut the ends of the diaphragm at the body wall so that the flap can be pinned down. Pin the flaps down under the front legs and above the hind legs. You should have four pins total (two pins on each side).
4. Carefully pull up the flap with the umbilical cord very slightly. You will see the umbilical vein extending from the inside of the umbilical cord up through the liver, toward the head. In order to pull up this flap, use your scissors to cut the umbilical vein. Do not cut off the flap. After cutting the vein, just leave the flap extending backward between the hind legs of the pig. See Figure 4 for assistance.

Figure 4. Removing the skin from the abdominal cavity.



Part 1-4 Analysis and Interpretation Questions

1. What is the function of the umbilical cord in the fetal pig?
2. What two body cavities does the diaphragm separate? What is the function of the diaphragm in the body?
3. What type of muscle is the diaphragm?
4. Would you expect to find food in the stomach of your fetal pig? Explain.



Part 5: The Chest Cavity – Heart and Lungs

The chest cavity contains the heart and lungs and a different membrane covers _____ each organ. The pleural membrane covers the chest wall and lungs while the heart is covered by the pericardium.

1. Gently pull apart the body wall of the chest along the incision made previously. Pin down the two flaps. See Figure 7. Carefully remove any of the pleural membrane that has not been pulled away with the body wall. *Note how the diaphragm forms a muscular floor for the chest cavity.*

2. Examine the lungs.

a. How many lobes does the left lung have? _____

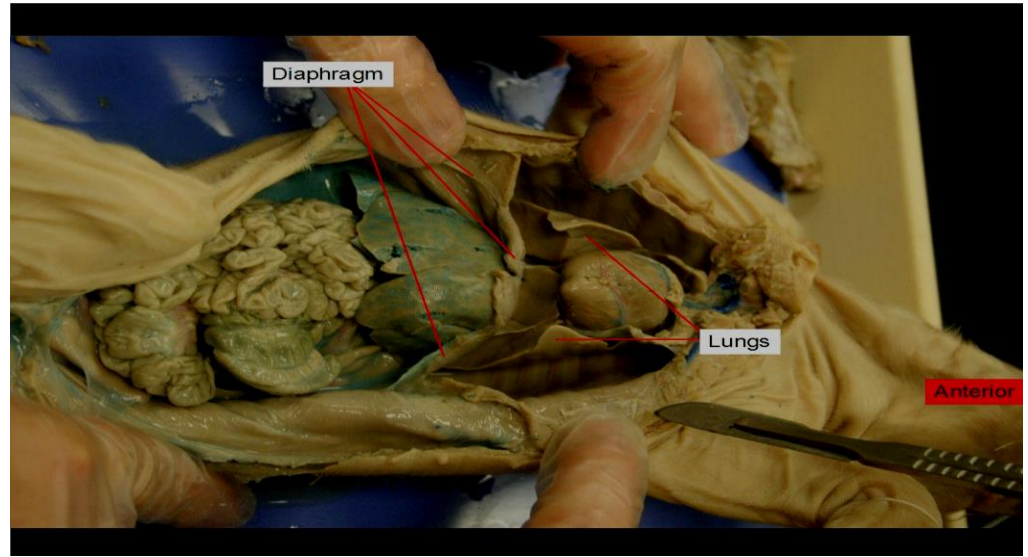
b. How many does the right lung have? _____

c. Do you think the lungs of the fetus are functional? _____

d. Justify your answer. _____



Figure 7:
Lungs and
Diaphragm



3. Lift the lungs out of the way and examine the heart, which is enclosed by the pericardium. See Figure 8. The anterior end of the heart is partly covered by the thymus gland. Remove the thymus and cut away the pericardium.

a. Identify all of the labeled parts in the picture below. **When you have identified them, highlight them in the diagram below.**

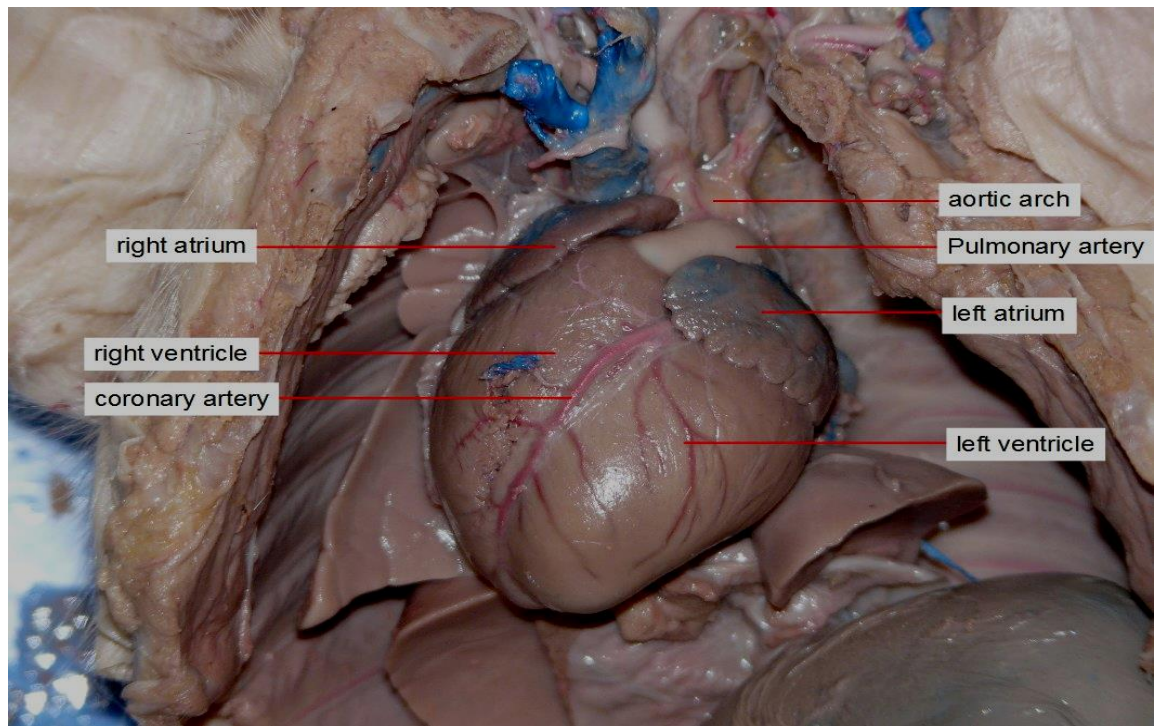


Figure 8:
Fetal Pig
Heart

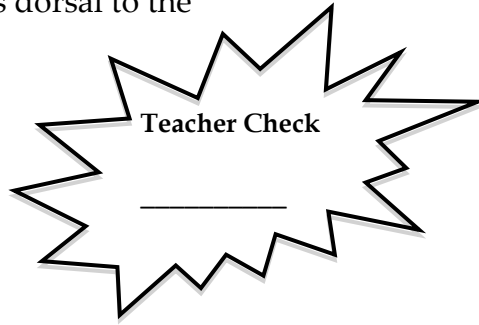
- Lift up the bottom of the heart and identify the inferior and superior vena cava which enter the right atrium. Identify the pulmonary artery leaving the right ventricle. This large artery divides to form the two pulmonary arteries to the lungs a short distance after leaving the heart. Try to trace these vessels. Put the heart back in place and identify the aorta, which comes from the left ventricle.

In pigs (and in humans) there is a vessel called the *ductus arteriosus* that serves as a shunt between the pulmonary artery and the aorta prior to birth. In the fetus, where the lungs are not functioning in respiration, much of the blood bypasses the lungs. It passes from the right ventricle into the pulmonary artery and then through the ductus arteriosus to the aorta. At birth, the ductus arteriosus normally closes up, and all the blood from the right ventricle goes to the lungs.

- You will now remove the heart very carefully. Use scissors to very carefully cut the blood vessels around the heart. **Do not cut them at the surface of the heart; cut at a short distance away. Leave enough of the vessels so that you can study their positions and relationships. CAUTION: Use care in handling the dissection scissors and scalpel throughout this lab activity.**
- Examine the dorsal side of the heart. Identify the ductus arteriosus.
- Carefully cut through the heart lengthwise. Cut as if you were cutting between the left and right sides of the heart. Examine the different chambers of the heart and the relative thicknesses.
 - Does the inside of the heart look like you would expect it to? Explain.

8. With the heart removed, identify the trachea by its cartilage ring structure. Find where it divides into two bronchi and enters the lungs. Identify the esophagus, which is dorsal to the trachea.

a. *How do the esophagus and trachea differ in structure and in appearance?*



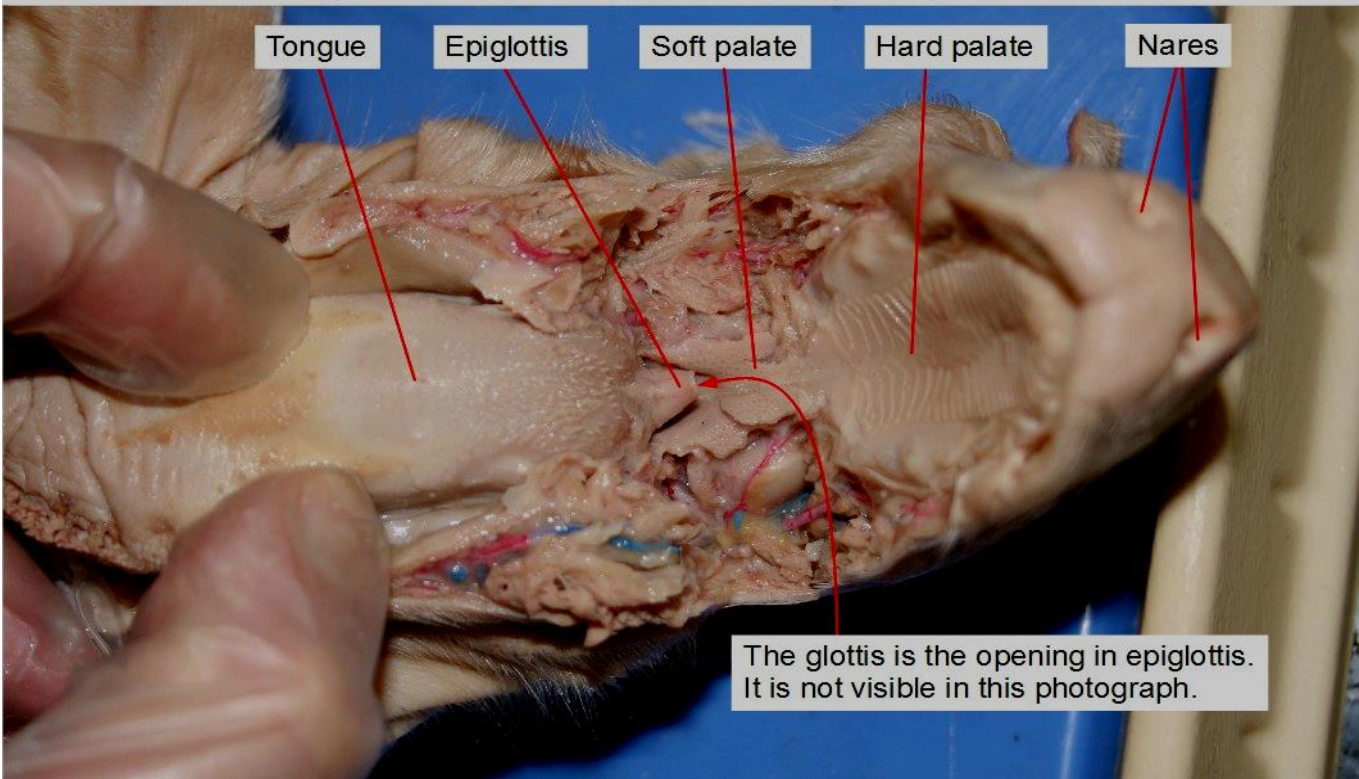
9. Follow the trachea upward toward the head. Locate the thyroid gland, which lies ventral to the trachea. It is reddish-brown and has two lobes. Find the larynx, which is at the top of the trachea.

Part 6: The Head

1. Examine the head of the pig. Open the mouth and examine the tongue, any teeth that are visible and the back of the throat. If the teeth are not visible, you will probably be able to feel them in the gums. To view the epiglottis, glottis and opening to the esophagus, use your scalpel to slit the corners of the mouth on both sides. See Figure 9. Also, note the hard and soft palate.

Figure 9: The Mouth and the Larynx

The jaw is opened wide enough so that the glottis and epiglottis are exposed. The epiglottis projects up through the soft palate into a region called the nasopharynx. The hard palate and soft palate separate the nasal and oral cavities. When breathing, air passes through the nasal passages to the pharynx. The pharynx is the space in the posterior portion of the mouth that both food and air pass through. From the pharynx, it passes through the glottis to the trachea.



a) What is the function of the epiglottis?

2) Cut open the throat and identify the Trachea, Larynx, Pharynx, Bronchi and Bronchioles.



Parts 5 - 7 Analysis and Interpretation Questions

1. Arteries take blood away from the heart, while veins carry blood toward the heart. List the major arteries and veins you found around the pig heart.
2. Explain how the structure and function of the trachea differs from that of the esophagus (the tube leading to your stomach).
3. Why did we dissect a fetal pig instead of a frog? Support your answer with details.

EXTRA IF YOU HAVE TIME!!!!

The nervous system of the pig is very similar to that of humans. There is the central nervous system consisting of the brain and spinal cord, and the peripheral nervous system consisting of cranial and spinal nerves and their branches.

1. Using your scalpel, make incisions through the skin of the head as shown in Figure 10. Start with a line that goes across the head just above the ears and make a rectangle that continues down each side and then have a parallel line that is just below the ears. Peel off the skin. Look for lines in the skull, which indicate where the bones meet. Carefully insert the pointed end of your scissors between the bones. Then use the tips of your forceps to pull or break off pieces of the skull until you have opened up most of the skinned area.

2. The brain and spinal cord are both covered by three membranes. The first membrane, the *dura mater*, is the thickest. The second membrane covered the surface of the brain and is called the *pia mater*. The third membrane, called the *arachnoid membrane*, is found between the *dura mater* and the *pia mater*. In living animals, cerebrospinal fluid fills the space between the second and third membranes but once animals are preserved, these two membranes fuse together.

Figure 10:
The Fetal Pig
Brain

