

Accelerated Biology**Fetal Pig Dissection****Background**

Now that you have studied the physiology of several human organ systems, you will be able to look at the organs in the fetal pig. The anatomy of a fetal pig is very similar to human anatomy, so it is one of the best alternative specimens to study. A fetal pig's external features such as birth marks, hair, and skin, and internal features such as organ, systems, and tissues are very much like yours. You may wonder where these pigs come from. In each litter of piglets that a sow gives birth to, 10–20% of the piglets are stillborn. Basically, it is a recycling of material that would otherwise go to waste.

During this lab, you will be using this instruction sheet as well as helpful instructional videos on the iPad. These videos will be accessible from home at <https://sites.google.com/site/pigdissectionmaterials/>

The following websites will be helpful as well:

<http://www.esu7.org/~lweb/Lakeview/science/fetal.html>

<http://www.whitman.edu/content/virtualpig>

<http://students.ed.uiuc.edu/keder/Bio/Virtual%20Pig%20Dissection.htm>

In a lab group, you will assume one of four roles: Pig Dissector(s), Reader/Recorder, and the iPad operator. Please rotate these jobs each day so that everyone has a chance to act as the dissector. The reader must read aloud before the dissectors proceed with the next step. Also, the IPAD operator must show videos when asked to on the instructions.

As you conduct the investigation, you will remove all of the organs from the body cavity. This gives you a better view of all the organs in each system and how space is conserved through the folding and placement of the organs within the body cavity. If needed, refer to the glossary at the end of this guide for more information on terms used in this protocol.

You will conclude your investigation by placing all of the organs and connective tissue back into the body cavity each day.

This lab will be broken up into the following labs:

- #1 – External Anatomy**
- #2 – Oral Cavity**
- #3 – Removal of Body Block**
- #4 – Respiratory System**
- #5 – Circulatory System**
- #6 – Digestive System**
- #7 – Urinary System**
- #8 – Genital System**

All underlined or bolded words must be located on your pig and all numbered questions must be answered on each of your packets. Your teacher will check the questions as you work through the laboratories. Most cuts can be done with the scissors. Dissection is an art and you must be as careful as you can get hurt during this laboratory. **YOU MUST WEAR GOGGLES** at all times during this dissection. The best scientists have excellent observational skills. From your detailed observations, both externally and internally, try to determine the pig's characteristics, locomotion, diet, method of reproduction, etc.

Other questions to consider would be: what characteristics make it a mammal? Is it male or female? How would this animal defend itself?

Pig Lab #1 – External Anatomy

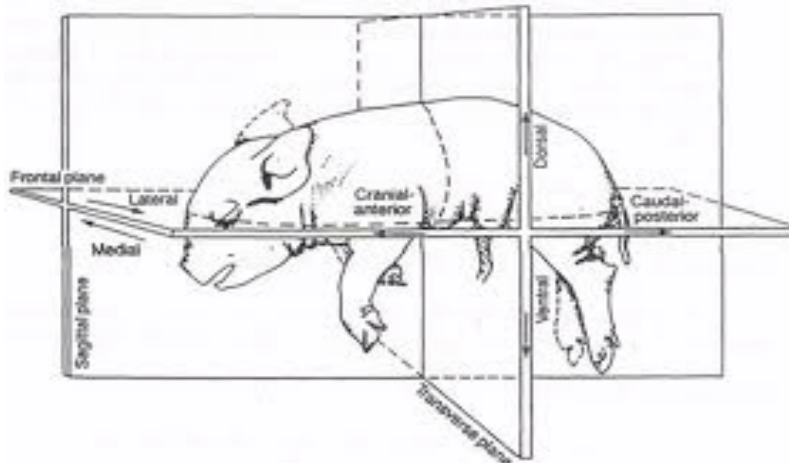
You will be examining several characteristics of an unborn mammal. The period of gestation for the pig is 112–115 days.

- ☐ The age of the fetus can be estimated by measuring the body length from the tip of the snout to the attachment of the tail. Compare this length to the data given on relative sizes of a fetal pig at different times during gestation or the time of development inside the uterus. (mm = millimeters)

| | |
|-----------------|-------------------|
| 21 days – 11 mm | 56 days – 40 mm |
| 35 days – 17 mm | 100 days – 220 mm |
| 49 days – 28 mm | 115 days – 300 mm |

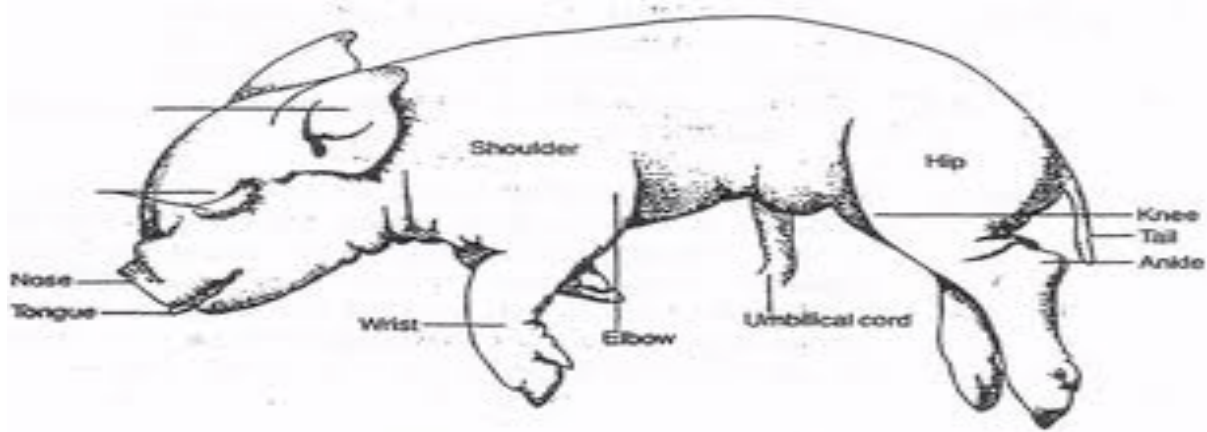
Generally speaking, orders of mammals are recognized rather easily by their external appearance. These external features which separate mammals into orders are traits such as the number of digits (toes or fingers) on the feet, method of walking or other locomotion and characteristics of the teeth.

- ☐ Examine the diagram below. Identify on your pig the dorsal, ventral, anterior, posterior ends. Also, identify the sagittal and transverse planes.



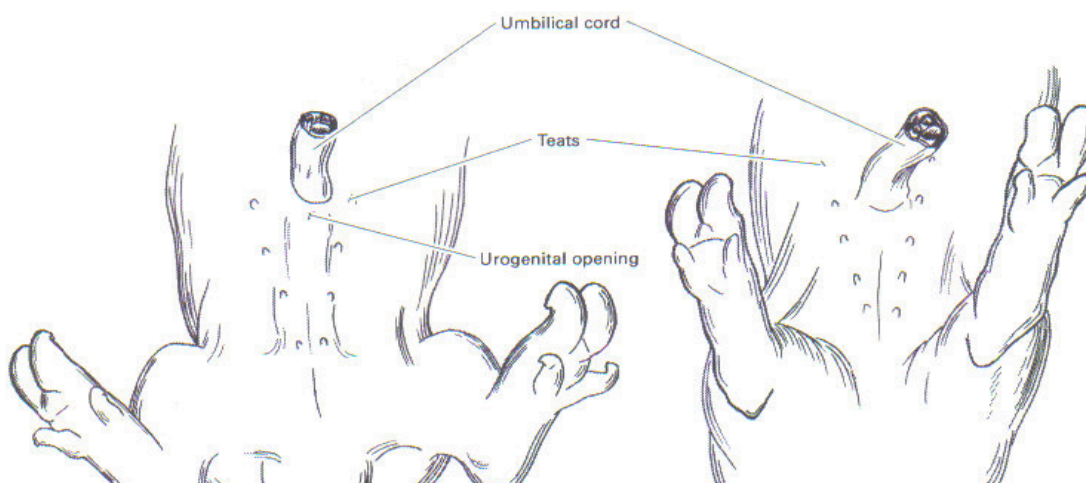
- ☐ Mammals have two unique external characteristics which distinguish them from all other vertebrates: (1) all mammals have hair at some time during their development, and (2) all female mammals possess mammary glands with external openings for nourishing the young. Your fetal pig probably does not have a lot of hair due to the fact that it is not fully developed yet. However, at maturity most pigs do have some strands of hair on their body.
- ☐ Examine the diagram on the next page to help you identify the external structures. The lips around the mouth are well developed and the upper lip is usually cleft in the center by a groove called the philtrum. Humans also have a philtrum. This is the indent underneath your nose.
- ☐ The external nares (nostrils) are found on the nose.
- ☐ Examine the ears. They have a flexible outer flap called the pinna. The pinna helps the pig hear by focusing the sound.

- ☐ Many mammals have sensory facial hairs called vibrissae; however, our pigs do not possess these yet. They are evident once a pig reaches maturity. They help organisms feel their way around in the dark. Examine the eyes. They have an upper and lower lid and a small mass of tissue in the upper corner known as the nictitating membrane. This helps keep the eye clean. Birds can moisten their eyes in flight using this membrane and not blinking; blinking could cause a collision with a branch or tree.
- ☐ Examine the feet. The pig is called unguligrade because it walks on its hooves. Humans are plantigrade because we walk on the entire soles of the foot. Dogs and cats are digitigrade because they walk on their digits. In pigs, the first digit of both the fore and hind limb is absent and the second and fifth are reduced in size but remain functional.
- ☐ The pig's trunk is divided into two regions: thorax (chest) and abdomen (stomach). Examine the umbilical cord. Observe that it contains three blood vessels: a large vein and two smaller arteries.
- ☐ Observe the paired row of nipples on the ventral surface of the abdomen in both sexes. The actual number of nipples varies from mammal to mammal. Animals that have litters tend to have more nipples.



Is it a Girl or a Boy?

- ☐ Determine the gender of your pig by using Figure 1. If your pig is male you will see the urogenital opening posterior to the umbilical chord. It serves as a passageway for urine and semen. Depending on the age you may or may not see scrotum. The penis is not visible but you can feel it by pressing the skin between the urogenital opening and the scrotum. The males' nipples will never develop but in females they will develop into teats during pregnancy. For both male and female, you will see the anal opening under the tail. If your pig is female, you will also see the genital papillae (a triangular protrusion) under the tail. This is the opening to the reproductive system.
- ☐ Be sure to observe another group's pig of the opposite gender.



Internal Anatomy – General Directions:

In the dissection and observations of the internal organs, you will proceed by systems and **remove organs only when directed to do so**. Study and use the accompanying diagrams to aid in your observations of the internal organs. As you dissect, keep in mind the interrelationships of systems. While concentrating on a single system, use care not to damage other systems. Again, most cuts can be done with the scissors. Occasionally, the scalpel must be used.

Dissection is an art and you must be as careful as you can get hurt during this laboratory. Do not carry any of the sharp dissection tools around the room.

Pig Lab #2 – Oral Cavity

- ☐ You will now study the oral cavity (mouth) of the pig. With a pair of scissors cut deeply into both corners of the mouth (see figure 2). **This may be difficult as you must cut through both tissue and bone.** Open the mouth. Be sure to follow the curvature of the throat and do not cut straight back into the neck tissue.
- ☐ Examine the oral cavity containing the tongue and teeth. Notice the ridged roof of the mouth called the hard palate. The soft palate is the fleshy portion of the roof of the mouth and lies caudal to the hard palate. Locate the tongue with all its taste buds. Mammals have two types of teeth – incisors, located in the very front of the oral cavity and cheek teeth located toward the back of the oral cavity.
- ☐ To find the next few structures, you will have to cut through the bone of the jaw, and then apply gentle pressure to force the mouth open.
- ☐ Far back in the oral cavity is the pharynx, a common passage for food going to the esophagus and air going to the lungs. Locate the tear-shaped epiglottis, a flap like structure at the top of the trachea. The esophageal opening, which is the entrance to the esophagus (food tube) can also be found in the back of the throat. The esophagus is located behind the trachea.

Figure #2

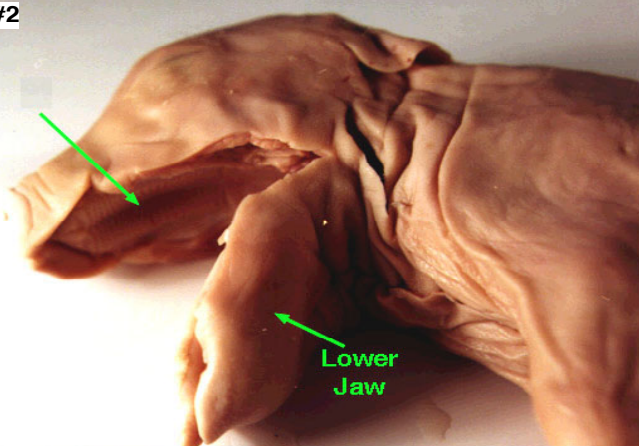


Figure # 4

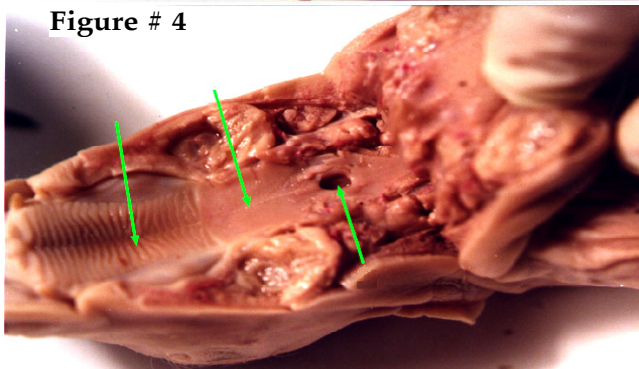
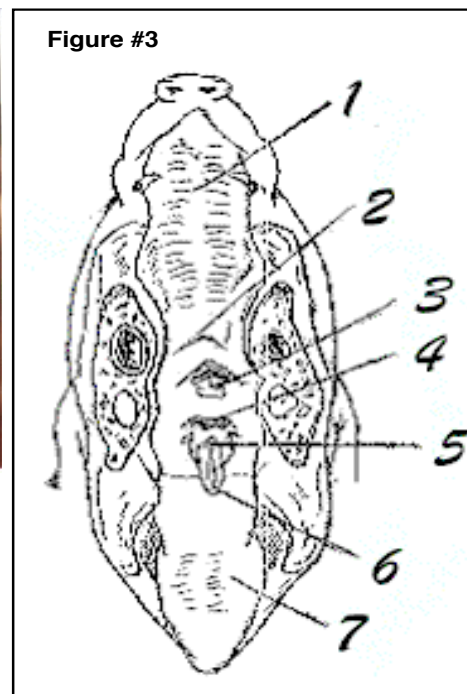


Figure #3



Pig Lab #3 – Removal of the Body Block

- ☐ Place the pig in the dissecting tray on its back. ***Remember: when observing structures from the ventral side, left and right will be reversed. The Dissector slides a “body block” (sponge) under the back until it rests under its shoulders (front legs). As in human autopsies, the block causes the neck and arms (pig’s front legs) to fall back, elevating the chest so that the 1st incision of the trunk is easier to make.
- ☐ 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. 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. ***If you are having problems go to the website and navigate to the ‘**Tying Pig**’ page.***

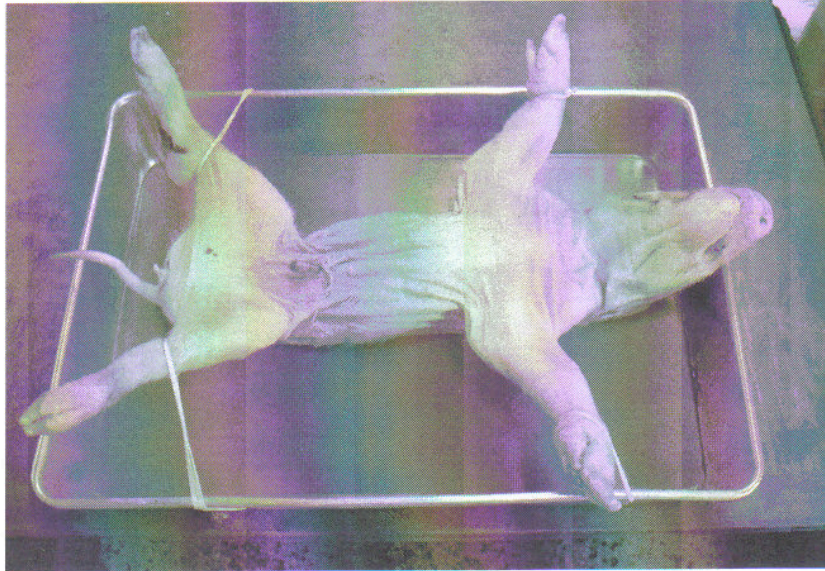
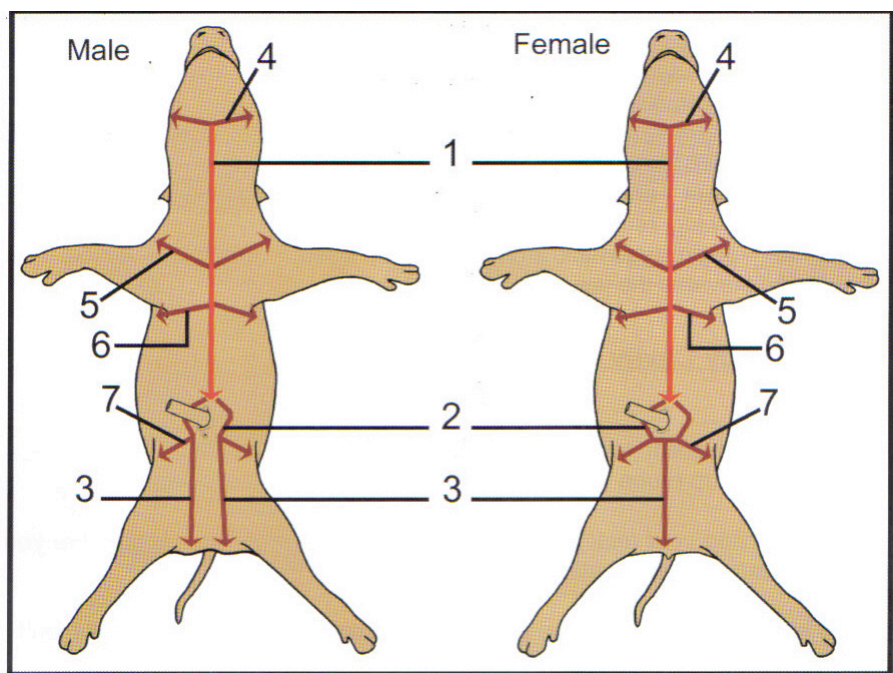


Figure 2. Pig in a dissecting tray

You will now be cutting open the fetal pig. Please read through page 5 and page 6. If you are having any difficulties understanding what to do PLEASE look at the web site and navigate to ‘**Removal of Body Block.**’

- ☐ With a scalpel, one dissector makes a Y-shaped incision. Use the figure below to guide you as to how to make the cuts with scissors and where to cut according to the gender of your pig. ***Do not cut off pieces of skin! 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.

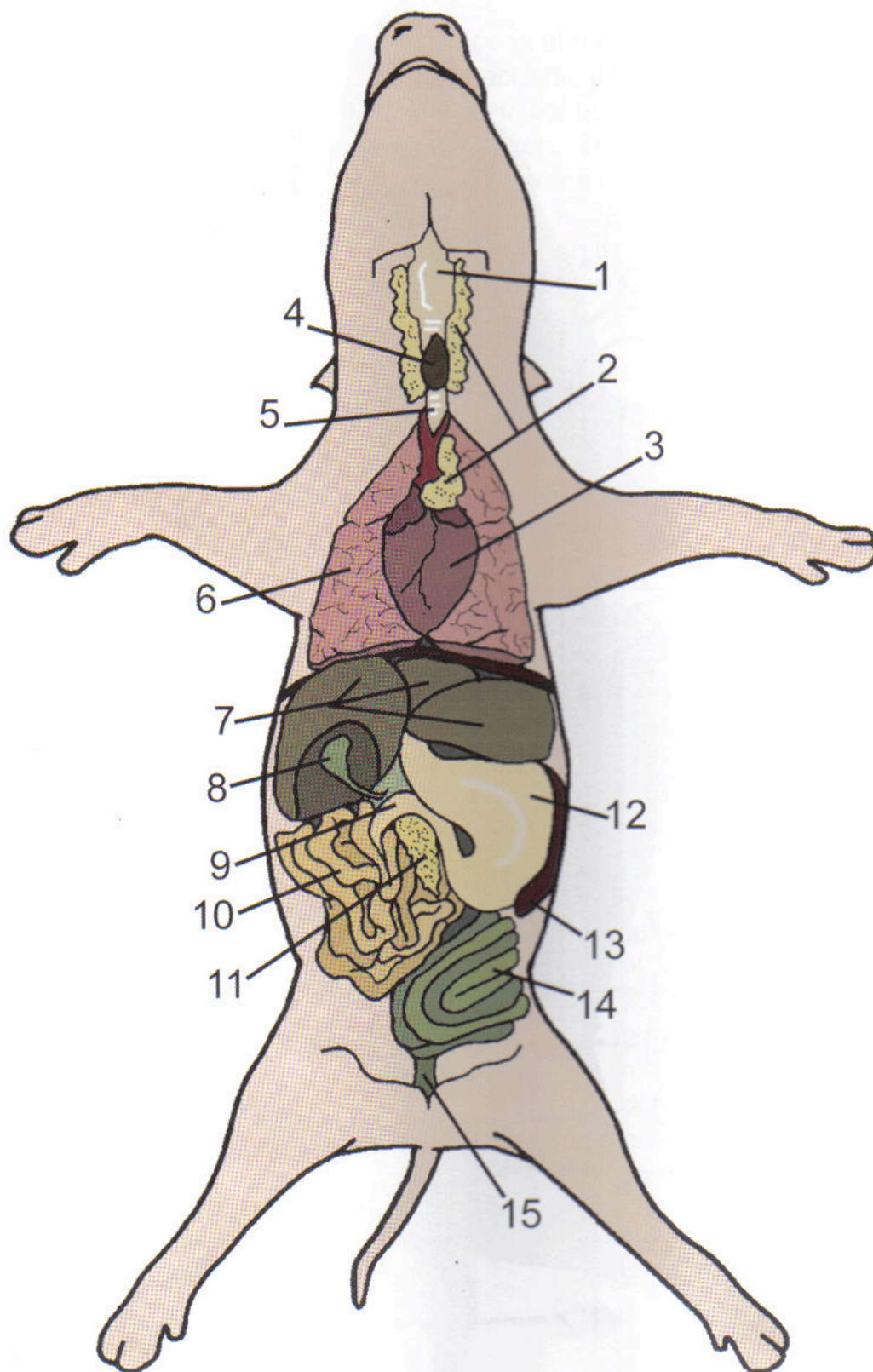
Continue cutting the tail of the Y down the middle of the abdomen to the top of the umbilical chord. If the pig is male, cut a semicircle around the anterior portion of the umbilical chord, then cut straight down on each side of the abdomen just outside the left and the right rows of mammary papillae. If the pig is female, the incision should encircle the entire umbilical chord, then with a single cut, continue straight down to the genitalia. Notice how the umbilical chord vein is anchored to the liver. Cut this so you can have full access to the abdomen.



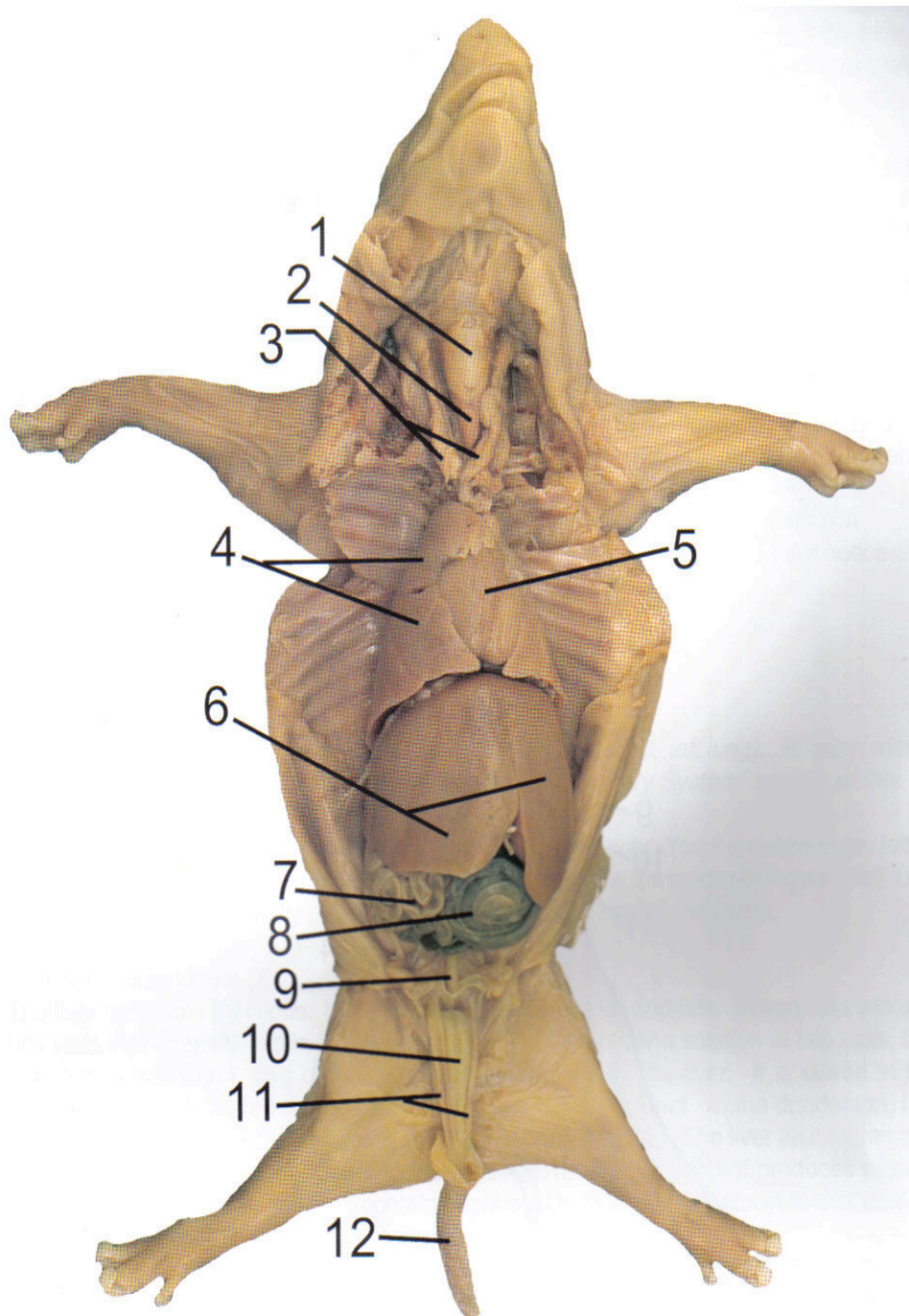
- ☐ Using dissecting scissors, start at the bottom of the ribcage and cut through the ribs going up the right and left sides of the sternum.
- ☐ The chest plate can now be opened to the sides (like a jacket) exposing the heart, lungs, and liver.
- ☐ All of the organs of the trunk can now be removed in “one block.” Use the diagrams on the next two pages to help you locate particular organs. Just above the liver you will find the diaphragm. Cut it away from the body cavity moving to free the abdominal organs from the cavity. Be careful not to cut into/off the kidneys, which will be anchored, to the dorsal side of the cavity. If there is a lot of fluid in the pig, carefully hold the pig by the neck to prevent it from slipping and tip the tray into the sink. **YOU MUST CLEAN UP ALL DRIPS AND SPLASHES.** You will need to cut through the end of the colon to free the bottom portion of the organs.

Please refer to the clip in the Removal of Body Block web site page if you are having difficulties removing the body block with the kidneys in tact. In addition to the clip for the kidneys there is also a clip to show how to cut the trachea and identify the larynx.

- ☐ Use the scissors to cut free the larynx and esophagus and continue to cut through the connective tissue. The larynx is referred to as the “voice box” and lies between the epiglottis and the trachea. The epiglottis helps direct food down the esophagus and air into the trachea. The trachea has a ribbed appearance and is composed of cartilage. Make a cut just below the larynx and pull the attached trachea downward. Detach the chest organs from the spine with the scalpel.
- ☐ The only remaining attachments to the organs are pelvic ligaments, the bladder, and the rectum. These can be severed with a scalpel or scissors, then all the organs can be removed in one block. Notice how all the organs are connected and how their symmetry allows for perfect fit in the body.



1-larynx; 2-thymus; 3-heart; 4-thyroid; 5-trachea; 6-right lung;
 7-lobes of the liver; 8-gall bladder; 9-duodenum; 10-small intestine;
 11-pancreas; 12-stomach; 13-spleen; 14-large intestine; 15-rectum



1-larynx; 2-thyroid; 3-thymus; 4-lobes of the lung;
5-heart; 6-lobes of the liver; 7-small intestine;
8-large intestine / colon; 9-rectum; 10-bladder;
11-umbilical arteries; 12-umbilical cord

Pig Lab #4 – Respiratory System

If you need any additional help please refer to the web site and navigate to the page titled “Respiratory System.”

- ☐ Locate the larynx and follow the ribbed trachea until it branches into two bronchi that each lead to a lung. The right lung should have four lobes and the left lung should have three lobes. Note that the lungs are quite small as compared to the rest of the abdominal organs. Why?
- ☐ Call your teacher over to insert a drinking straw into the opening of the larynx and blow into it. Observe what happens to the lungs. If the teacher is unavailable, please refer to the video clip located on the ‘Respiratory System’ web site.
- ☐ Locate the esophagus (dorsal to the trachea), which is flat when it does not contain food, and separate it from the rest of the chest organs using a blunt probe.
- ☐ The diaphragm is located just above the liver. This curved muscle separates the thorax from the abdomen and is responsible for breathing. As it contracts and moves downwards the chest cavity expands and the lungs fill with air. As it relaxes and moves up, it forces air out of the lungs.
- ☐ With a scalpel, make 0.5cm cross section of one of the lung lobes like you would slice a loaf of bread. See if you can observe the secondary bronchi with a magnifying glass.

Pig Lab #5 – Circulatory System

If you need any additional help please refer to the web site and navigate to the page titled “Circulatory System.”

- ☐ Cut away the pericardial sac surrounding the heart and cut the pulmonary artery (adjacent to the aorta on the left side) where it exits the heart.
- ☐ Locate the coronary artery and the coronary vein in the groove between the two ventricles. These blood vessels supply and drain the cardiac muscle tissue of the heart. If the coronary arteries have a blockage, a heart attack can occur. These blocked arteries in humans are the ones that are bypassed during “bypass surgery,” often using veins from the patient’s leg. Locate the five main vessels for blood flow into and out of the pig’s heart (anterior vena cava, posterior vena cava, pulmonary artery, pulmonary vein, and aorta).
- ☐ Cut all the arteries and veins surrounding the heart and remove it.
- ☐ Orient the heart as shown in the video. Carefully make a longitudinal section by starting at the anterior end near the aorta and cutting downward with your scissors to expose the four chambers (left and right atria, and left and right ventricles).
- ☐ Try visualizing how blood flows through the heart. The right side of the heart receives deoxygenated blood into the right atrium. After passing through the tricuspid valve and into the right ventricle, the blood is pumped through the pulmonary valve and into the pulmonary artery going to the lungs. The left atrium receives the oxygenated blood from the lungs, and out to the body.

Pig Lab #6- Digestive system

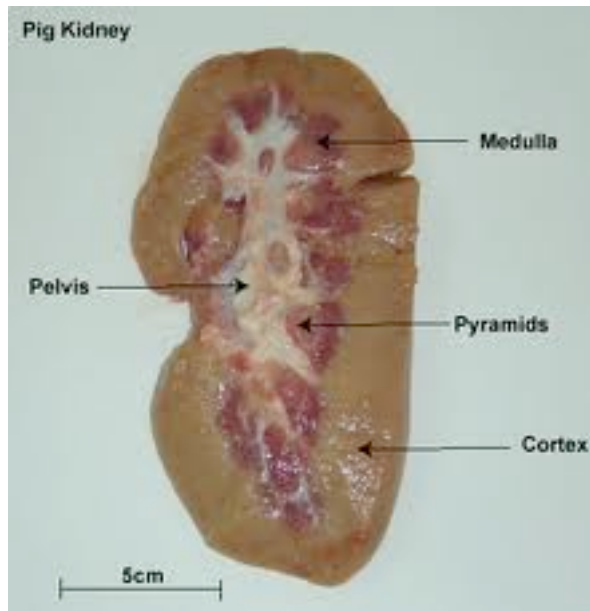
If you need any additional help please refer to the web site and navigate to the page titled "Digestive System."

- ☐ Just below the diaphragm is the liver, located at the top of the abdominal cavity. This liver has five lobes. The liver breaks down ingested toxins and drugs as well as the waste byproducts of protein metabolism. It is also a storage site for vitamins, iron and glycogen.
- ☐ Dorsal to the right medial lobe is a small, green sac like structure called the gall bladder. This structure stores bile produced by the liver. Bile is secreted into the small intestine to emulsify fat. Note the umbilical vein connected to the liver.
- ☐ Lift up the liver to expose the stomach and spleen. The spleen is a long, brown, flat structure lying dorsal to the stomach. Part of the lymphatic system, the spleen filters the blood for old red blood cells, makes new red and white cells, and produces antibodies.
- ☐ Locate the stomach on the upper left side of the abdominal cavity. It is underneath the liver. The stomach resembles a pouch in appearance and is connected to the esophagus at its anterior end. Slit open the stomach longitudinally. The longitudinal ridges that line the stomach are called rugae.
- ☐ Locate the pancreas which is a large white granular organ located below the stomach. The pancreas makes a variety of digestive enzymes that travel to the small intestine.
- ☐ The constricted caudal portion of the stomach leads to the small intestine. Observe that the small intestine is not loose in the abdominal cavity but is held in place by the mesentery. Check and look for veins and arteries in the clear mesentery that carry absorbed nutrients to the liver through the hepatic-portal vein.
- ☐ The large intestine appears as a compact coil and is larger in diameter than the small intestine. Locate the junction of the large and small intestine. Below this junction may be found a small pouch-like structure called the caecum.
- ☐ Follow the large intestine (colon) to the rectum. This lies in the dorsal wall of the abdominal cavity and is the straight end portion of the large intestine. Water is absorbed by the body in the large intestine. Waste material stored in the rectum leaves the body through the anus.

Pig Lab #7 – Urinary System

If you need any additional help please refer to the web site and navigate to the page titled "Urinary System."

- ☐ You should now be able to see the kidneys that normally lie on the dorsal wall on both sides of the spine. They are part of the body block.
- ☐ Locate the ureter originating from the concave side of the kidney. Follow the ureter posteriorly until it joins the urinary bladder. Do not remove any of these organs.
- ☐ Remove one kidney and dissect it horizontally into 2 halves. Locate the cortex (outer part) and the medulla (inner part) on one half of the kidney. See the diagram on the next page.



Pig Lab #8 – Reproductive System

If you need any additional help please refer to the web site and navigate to the page titled “Reproductive System.”

- ☐ Prepare for the observation of the reproductive organs of the male or female by pulling the hind legs apart. With scissors, cut anteriorly a little to one side of the mid-ventral line to avoid cutting the penis on the male. This is part of the pelvic girdle. Continue the incision anteriorly and cut through the pubic symphysis. Expose the urethra. This tube leads from the bladder to the outside world.

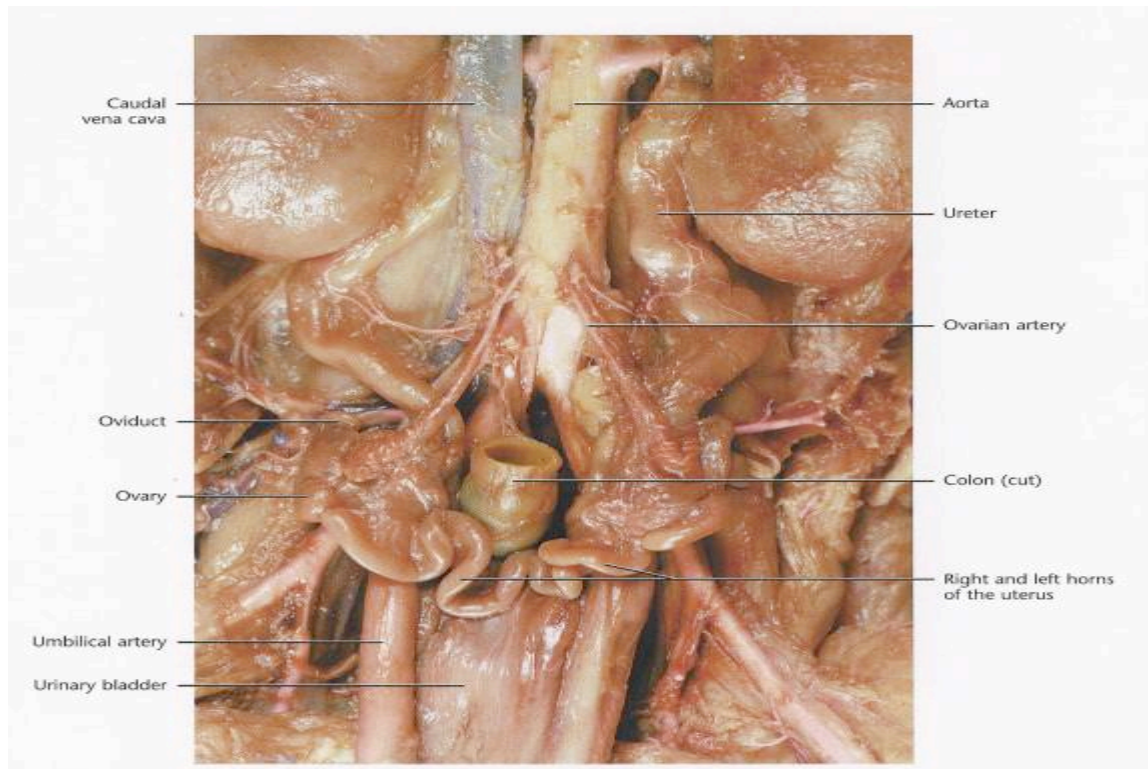
Male Reproductive System

- ☐ Examine the scrotal sac (scrotum) at the posterior end of the male pig. Open one sac and determine the presence of a testis. The testes descend just before birth to the outside of the body proper. This procedure is very important, as the ordinary temperature of the human body (98.6°) would kill sperm. The 3–4 degree lower temperature of the testes outside the body keeps the sperm viable or alive. If your specimen is advanced in fetal development, the testes may have already descended into the scrotal sacs. In either case, locate one of the testes and note the coiled tubule making up the epididymis. Follow this tube forward to the vas deferens. Follow the vas deferens. At this point, as in humans, the urethra becomes a urogenital duct.

Female Reproductive System

- ☐ Spread the legs to female reproductive system. Locate the oval-shaped ovaries which are found caudal to the kidneys. Leading from the ovaries are the twisted oviducts or Fallopian tubes. Further on, the oviducts join to form the uterus.
- ☐ Be sure to view the organs of a pig of the opposite sex of yours – you need to be able to locate the structures on both sexes!

Female Reproductive System and Urinary System



Male Reproductive System and Urinary System

