

Introduction

In this lab, you will study the external and internal anatomy of a fetal pig, relate its structures to those of other mammals, and determine differences between a fetal pig and an adult pig. Dissection will help you to get a 3-dimensional picture of how all the systems fit together. You've seen separate diagrams of many of the major systems. Now you'll get to see how they are arranged spatially within the specimen. You'll also get a better idea of the texture of many organs that make up the pig's system.

The body shape of the pig is closely related to its method of locomotion. It has **bilateral symmetry**. Its body is composed of four regions—a head, neck, trunk, and tail. The trunk, which has two pairs of **appendages**, can be subdivided into the thorax and the abdomen.

This lab will be broken up into the following labs:

- #1- External Anatomy
- #2- Oral Cavity
- #3- Digestive System
- #4- Circulatory System
- #5- Respiratory System
- #6- Urogenital System
- #7- Nervous System

Materials

preserved fetal pig, dissecting pan, scissors, scalpel, forceps, probe, and twine

General Directions

All bold words must be located on your pig and drawn in your lab notebook. Most cuts can be done with the scissors. Dissection is an art and you must be as careful as you can during this laboratory. At the end of each class period, you need to clean your station and ensure your pig is put away properly.

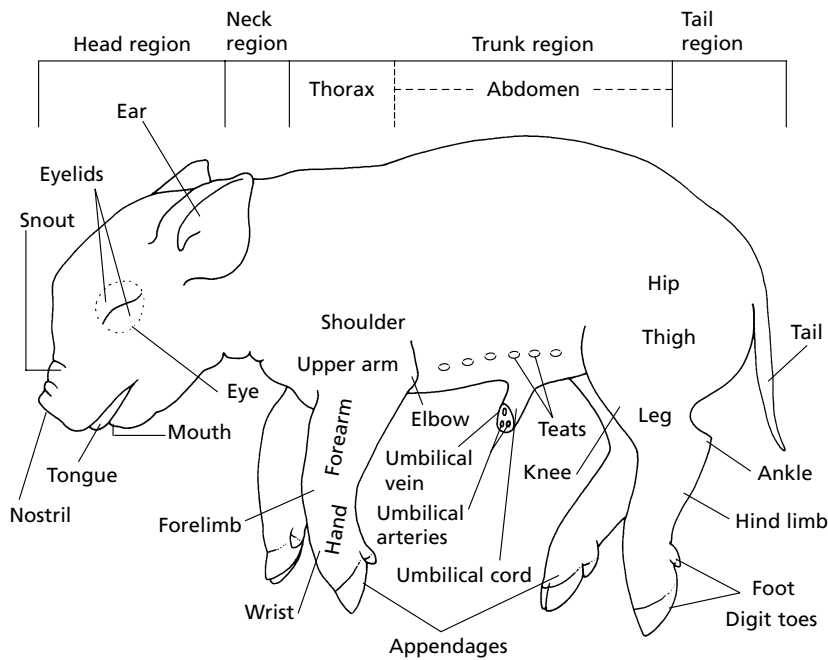
Pig Lab #1 - External Anatomy

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. Record your estimated gestation time in your lab notebook.

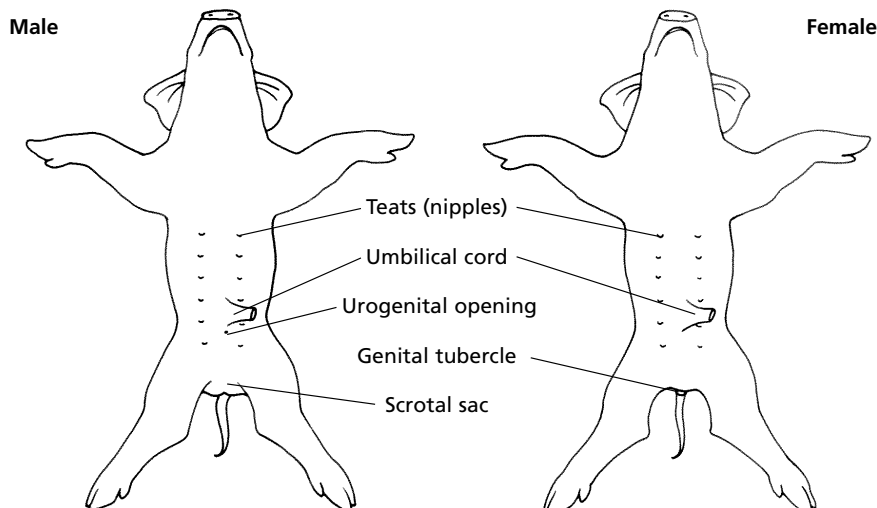
| | |
|-----------------|-------------------|
| 21 days - 11 mm | 56 days - 40 mm |
| 35 days - 17 mm | 100 days - 220 mm |
| 49 days - 28 mm | 115 days - 300 mm |

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

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 .



1. Examine the mouth. 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.
2. Examine the ears. They have a flexible outer flap called the **pinna**. The pinna helps the pig hear by focusing the sound.
3. 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.
4. 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.
5. The pig's **trunk** is divided into two regions: **thorax** (chest) and **abdomen** (stomach). Examine the **umbilical cord**. Using scissors, cut the umbilical cord near where it joins the abdominal wall. In the umbilical cord, locate the two umbilical arteries and the one umbilical vein.
6. Observe the paired row of **teats** (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.



7. Locate the **urogenital opening**. In the male, the opening releases both sperm and urine from the body. In the female, the urogenital opening is located immediately ventral to the **anus**, the external opening of the rectum. The anus is ventral to the tail. Lift the tail to locate the anus. Locate all three openings (urethral opening, vaginal orifice, and anus) on the female pig. The urethral opening excretes urine and the vaginal orifice is the opening of the birth canal. In males, the urogenital structures consist of the penis (which has an opening just behind the umbilical cord) and two saclike swellings called the scrotum, containing the testes. The scrotum lies ventral to the anus. The anus of the male is at the base of its tail. Locate these two openings: urogenital opening of the penis and the anus. They are just behind to the umbilical cord.

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.

Pig Lab #2 - Oral Cavity

You will now study the **oral cavity** (mouth) of the pig.

1. Pry open the mouth with a probe. Using scissors, cut through the joint between the upper and lower jaws to aid in your observations. This may be difficult as you must cut through both tissue and bone.
2. In the oral cavity, or mouth, find the **tongue**. The teeth have usually not erupted. 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**.
3. Locate the **pharynx**, the mouth cavity that begins at the jaw hinges and extends to the **esophagus**. In the pharynx, try to locate the **glottis** (the opening of the **trachea**) and the **Eustachian tubes**, which extend from the pharynx to the middle ear. Then locate the esophagus in the back of the pharynx.

Figure #2

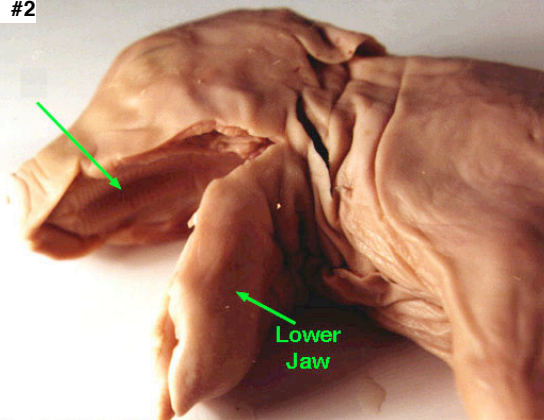


Figure # 4

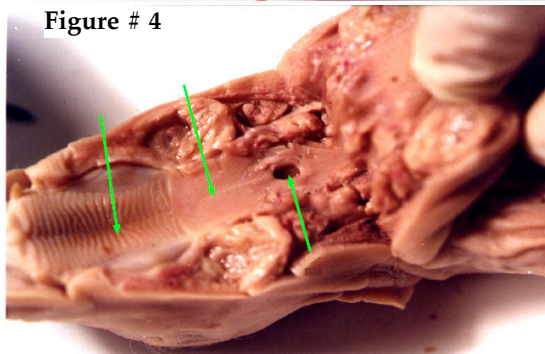
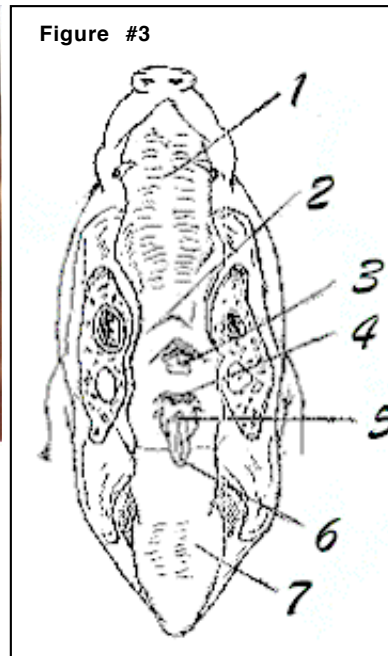


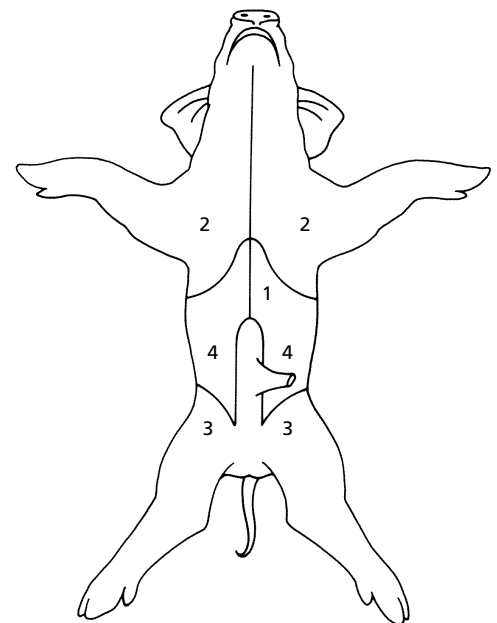
Figure #3

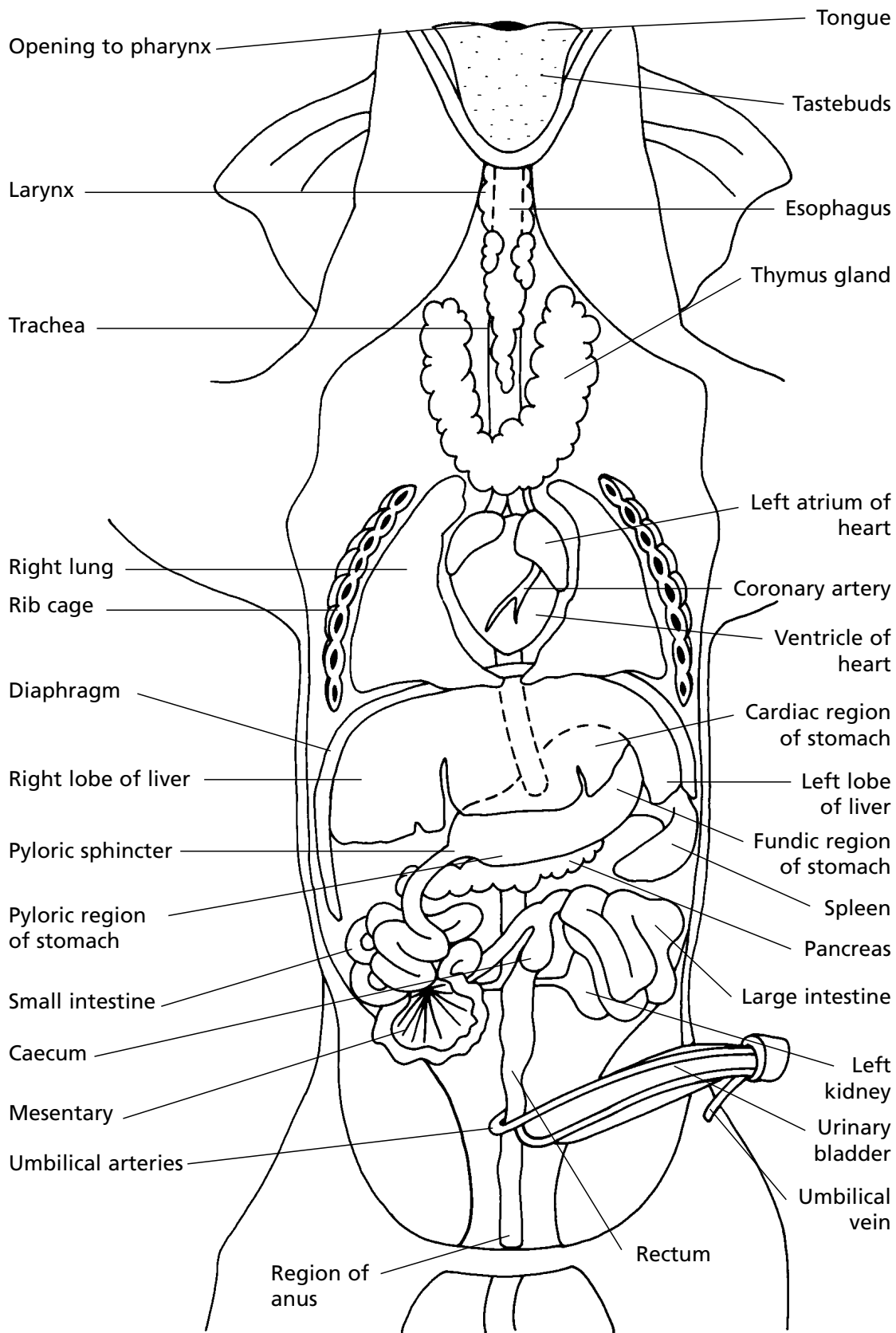


Pig Lab #3 - Digestive System

Follow the diagram below, which shows where incisions, numbered in sequence, should be made.

1. To open the chest, begin with incision 1. With forceps, lift the thick skin and related tissue to be cut, beginning at the belly. Make a small slit with a scalpel. Then use scissors to extend the cut to the chin. CAUTION: The initial cut may cause preservative to spurt or splash out. Be very careful in the neck area to avoid disturbing any glands. You will be cutting through the muscle. It is better to carefully cut twice rather than damage the organs beneath the muscle with one deep cut.
2. Make the incisions labeled 2 and 3. Next, follow line 4 as a guide to cutting around the umbilical cord, and fold back the thick skin flaps.
3. Using the diagram on the next page, locate the **liver** (the largest organ), and observe the umbilical vein that runs from the liver to the umbilical cord. Cut the vein. Now you can fold down the area that contains the umbilical cord. Note: Dissecting pins can be used to hold back the skin.
4. Gently lift up the liver and probe it to locate the **gall bladder** which is on the pig's right side.
5. The **diaphragm** (a thin brown muscular tissue) is the tough muscle which separates the thoracic and abdominal cavities. The esophagus goes through it to the stomach. The esophagus carries the food from the pharynx to the stomach.
6. 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.
7. The constricted caudal portion of the stomach leads to the **small intestine**. The first 3-4 cms of the small intestine is the duodenum. The remaining length is divided into the ileum and jejunum. 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. Inside the small intestine are finger-like projections called villi. The villi increase the surface area of the small intestine for absorption. These villi are microscopic.
8. 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. This is the same item that is the appendix in humans. It helps in the slow digestion of plant materials in other animals.
9. 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**.
10. 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 through the pancreatic duct. This duct is difficult to find in the pig. The red elongated organ extending around the outer curvature of the stomach is the **spleen**. It resembles a tongue. The spleen helps destroy old red blood cells.





Pig Lab #4 - Circulatory System

The circulatory system of the pig consists of the **heart**, arteries, veins, and capillaries. There are two major parts to this system. Pulmonary circulation supplies the lungs with blood. The systemic circulatory system supplies all parts of the body except the lungs.

1. You will need to cut through the sternum to open the thoracic cavity. Covering the heart is a thin, tough membrane called the **pericardium**. Partially covering the heart is the **thymus** gland (globular structure). The thymus is largest in young individuals. It is part of the immune system.
2. The heart is composed of 4 chambers. Locate the 2 **atria** and 2 **ventricles**. With your finger, touch the atria and ventricles. The pig may have been injected with colored latex which makes it easy to locate the veins (blue) and the arteries (red). Locate the anterior and posterior vena cava. These carry blood from the cranial and caudal portions of the body, respectively.
3. Find the **pulmonary veins** which carry blood from the lungs to the left atrium. This carries oxygenated blood from the lungs back to the heart. The most noticeable artery is the **aorta**. The aorta curves to the left and passes cranially along the dorsal side of the thoracic and abdominal wall. The next largest artery is the **pulmonary artery**. It arises from the anterior portion of the right ventricle and soon divides into the right and left pulmonary arteries.
4. On the surface of the heart are the **coronary arteries** and **veins**.

Pig Lab #5 - Respiratory System

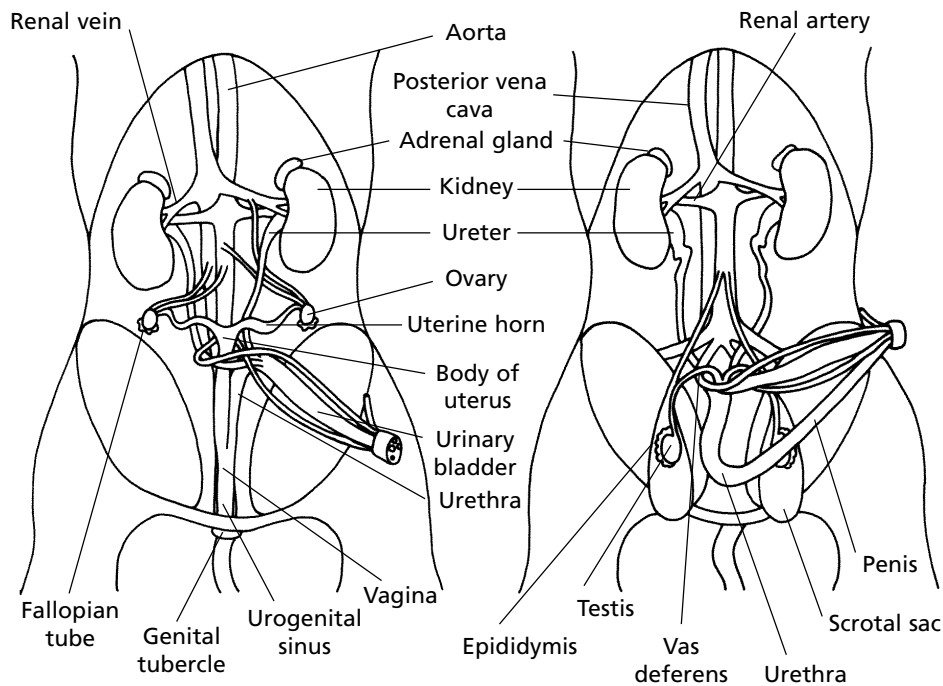
The respiratory system is responsible for the exchange of gasses. The pig must take in oxygen to burn food and must rid itself of carbon dioxide waste once it's born.

1. Air enters through the **external nares**. Air is drawn into the nasopharynx or nose chambers where sensory nerve cells detect smell. Here, also, is where the **glottis** (the opening of the trachea) may be found. The **trachea** is a tube that extends from the neck to the chest. It is white and lined with cartilage. The enlargement at the anterior end of the trachea is the **larynx** (voice box) which contains the vocal cords.
2. The trachea splits in the chest cavity into two **bronchi**. Each of these air tubes extends into the lungs and splits into smaller tubes called **bronchioles**.
3. The **lungs** are located on either side of the heart. The lungs are made of tiny air sacs called alveoli (microscopic) where gas exchange occurs.
4. Locate the thin muscular **diaphragm** just above the liver. This muscle is responsible for drawing air into the chest cavity. Spasms of this muscle result in hiccups.

Pig Lab #6 - Urogenital System

The "uro" in urogenital stands for the urinary system. The "genital" portion stands for the reproductive system. The urinary or excretory system and genital system are structurally related. Therefore, it is convenient to study them together. Recall that you are dealing with paired structures. What is observed on one side may also be seen on the other.

1. To find the **kidneys**, look for two lumps low in the abdominal cavity. They are behind a membrane called the peritoneum. You will need to carefully remove the **peritoneum** to see the bean-shaped kidneys.
2. 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. The renal artery and vein also come out of the kidney. The artery carries blood to the kidney. The vein carries blood out of the kidney. Remove one kidney and dissect it horizontally into 2 halves.
3. Locate the **cortex** and the **medulla** on one half of the kidney .
4. If your specimen is a female, locate the small, paired, bean- shaped yellow (or dark brown) **ovaries** just posterior to the kidneys. Then locate the **Fallopian tubes**, which will conduct eggs from the ovaries to the uterus. Locate the **uterus**, and observe that it has two uterine horns extending from the lower uterine section. Then locate the muscular **vagina**, which is continuous with the uterus.
5. If your specimen is a male, locate the **scrotal sac**. A median fold divides it into two chambers. Each chamber contains a **testis**. With a scalpel, open the scrotal sac. At each testis, locate the **epididymis** and the **vas deferens**, which enter the **urethra**. The urethra carries sperm as well as urine to the exterior. The **penis** is a long, muscular tube just posterior to the umbilical cord. The penis may be difficult to locate. If you can, use a scalpel to carefully separate it from the ventral body wall.
6. MAKE SURE YOU OBSERVE A PIG WHICH IS THE OPPOSITE SEX OF YOURS. YOU WILL BE RESPONSIBLE FOR BOTH THE MALE AND FEMALE PARTS!!!



Female Urogenital System

Male Urogenital System

Pig Lab #7 - Nervous System: Extra Credit- May only be done after the lab practical

This dissection is difficult, tedious work and requires proceeding carefully to avoid destroying important brain tissues.

1. Position the animal so that the dorsal side 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.
2. The **meninges** are the membranes which cover the brain. Mammals have three layers of membranes. The dura mater is the outermost, the pia mater is the inner membrane, and the arachnoid mater lies in between.
3. You have revealed the two **hemispheres** of the **cerebrum**. Find the **longitudinal fissure** of the two hemispheres.
4. Behind the cerebrum is the **cerebellum**. The cerebellum is principally a motor coordinating center.
5. Behind the cerebellum is the medulla oblongata which leads to the spinal cord. The medulla oblongata controls respiration, heart rate, and blood pressure. It also helps in regulating sensory impulses, hormonal secretions, and general awareness (consciousness).
6. With forceps and a scalpel, remove the muscle from the mid-dorsal line of the back of the body in a strip about 1 1/2 inches long and 1/2 inch wide. Use the scalpel to make a series of "slices" through the vertebrae to expose the thick, whitish **spinal cord**.
7. When you have completed your dissection, remove the specimen from the dissecting tray. Dispose of your materials according to the directions from your teacher.