

# Fetal Pig Evaluation

Name: \_\_\_\_\_

Block: \_\_\_\_\_

Title Page - presentation, neatness (5 marks)  
- handwritten!

Organization - (5 Marks)

## Lab 27 - External Features and Muscle

Diagram labeled (evaluated for neatness and completeness) (10 Marks)

Questions - completion only (4 marks)

## Lab 28 - Digestive System

Diagram of abdominal cavity 10 marks

Diagram of buccal cavity 10 marks

Questions (2 marks)

## Lab 29 - Circulatory System

Diagram of thoracic cavity (10 marks)

Diagram of heart (10 marks)

Point Form Observations of abdominal cavity (10 marks)

Questions (2 marks)

## Lab 30 - Respiratory System

Point Form Observations (10 marks)

Questions (3 marks)

## Lab 31 - Excretory System

Point Form Observations of abdominal cavity (10 marks) + Diagram (10)

Diagram of kidney cross-section (10 marks)

Questions (2 marks)

## Lab 32 - Reproductive System

Point Form Observations (10 marks)

Questions (3 marks)

♀ Diagram (10 marks) ♂ Diagram (10 marks)

## Lab 33 - Nervous System

Diagram X-section of vertebrae (10 marks)

Questions (4 marks)

lab 47 - Diagram (10 marks) x 2  
Questions (6 marks)

Practical - Neatness in dissection, attention to detail (25 marks)

## External Features and Muscles

### Introduction

Studying the external features of the fetal pig will provide an opportunity to observe several structures that are homologous to pigs and human beings, and orient you to structures that will be studied in later investigations.

Muscles enable the movement of body structures and permit locomotion. Most muscles function in pairs that oppose one another. This allows an organ to be moved one way and then returned to its original position.

### Purpose

To observe and study the external features and muscles of a fetal pig.

### Materials and Equipment

#### Materials

Fetal pig  
Equipment  
scissors  
disposable gloves  
string/cord  
hand lens/dissecting  
microscope

paper towels  
freezer bags (for storage)  
scalpel  
forceps  
probe  
pins  
dissecting tray  
alcohol squirt bottle

### Procedure

#### A. External features

Obtain a fetal pig and place it in a dissecting tray lined with paper towels. Identify the head, neck, trunk, and tail. From the diagram provided, find and observe the following structures:

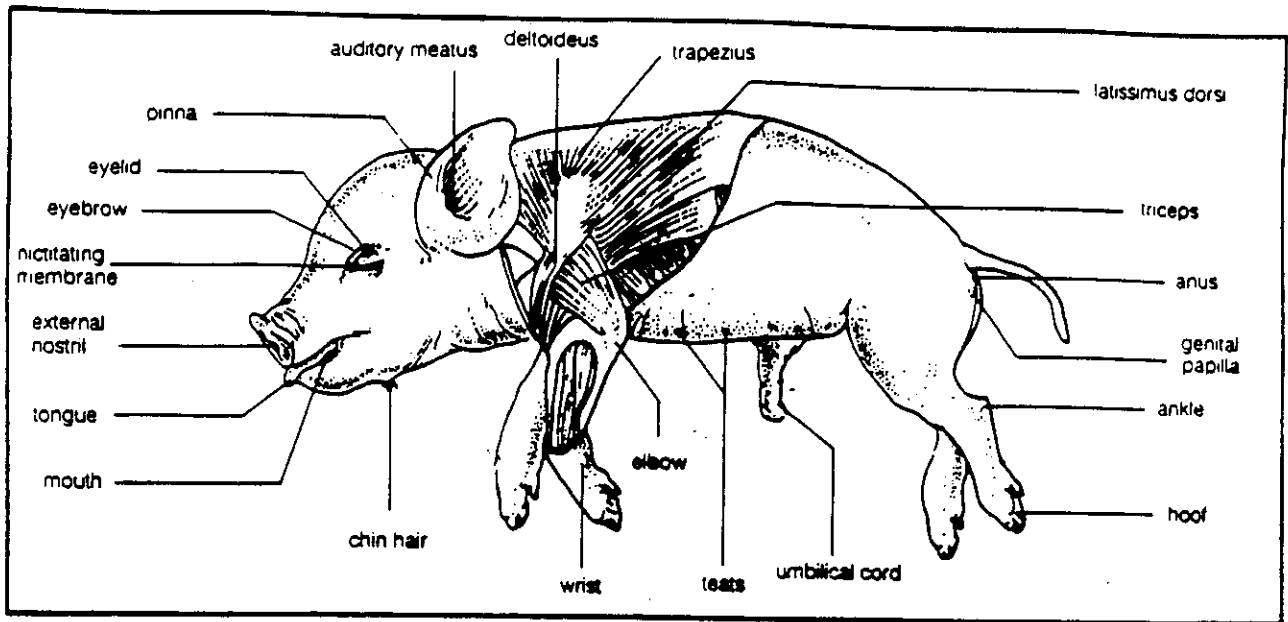
**Head** — mouth, tongue, external nostrils, nictitating membrane (check anterior portion of eyeball), eyebrows, eyelid, pinna, auditory meatus, chin hair.

**Trunk** — Two pairs of legs, wrists, elbow, ankle, knee, toes, hooves, umbilical cord, teats, anus and genital papilla.

Observe the articulation of the elbow, wrist, knee and ankle by gently moving the appropriate appendage. Locate the appendage sections that correspond to the upper arm (brachium), forearm (ante brachium), hand, thigh, shin and foot.

Determine the sex of your fetal pig. In a female pig the common orifice of the vagina and urinary track is located ventral to the anus. Note that the folds (labia) surrounding the orifice come together forming a ventral spike, the genital papilla.

In a male pig the urogenital orifice is located posterior to the umbilical cord. The penis may be felt through the belly skin. The scrotum, which will contain testes in a mature male, is located posterior to the hind legs.



*External features of the fetal pig and muscles of the foreleg and shoulder region.*

## B. Muscles

Place the pig on its right side in the dissecting tray. Using a scalpel make a mid-dorsal incision that runs from the base of the head to the middle of the back. Extend this incision toward the armpit of the left foreleg. At the leg join these cuts to an incision that runs down the inside of the leg to the wrist. An incision that runs completely around the wrist will now allow the skin to be carefully peeled from the body. This will require the use of forceps and a scalpel.

Using the diagram, locate the thin, triangular-shaped muscle (*trapezius*) that originates on the dorsal surface and converges to the scapular spine. The deltoid (*deltoideus*) muscle passes from below the trapezius to pass over the shoulder. Follow it to its insertion on the leg bone (humerus). The deltoid muscle is a protractor muscle.

Below the trapezius and the deltoid muscles, and posterior to the foreleg, a portion of the *latissimus dorsi* (*lats*) is visible. It is a major retractor for the foreleg (arm in humans). Trace this muscle to its point of insertion. Note that it attaches to the humerus on the inside of the foreleg beside the armpit. The *latissimus dorsi* passes beneath the *triceps* muscle at the back of the upper leg to reach its point of insertion.

Cut through the *latissimus dorsi* muscle tissue to expose the *triceps* completely. Note the three points of origin at the shoulder and locate the tendon that leads to insertion on the lower arm bone (ulna). The *triceps* is an extensor of the forearm.

Locate the smaller *biceps* muscle on the anterior surface of the humerus. Expose it completely and note its points of origin and insertion. The *biceps* is a flexor for the forearm.

## Questions

1. What is the function of the nictitating membrane?
2. What is the structural relationship between the fetal pig's toes and hooves? How many toes per foot are found on the specimen?
3. One end of a muscle is attached to a skeletal structure that is in a fixed position while the other end of the same muscle is attached to a skeletal part that is free to move. Which end is the insertion and which is the origin?
4. Explain the following antagonistic relationships:
  - a) flexion / extension
  - b) protraction / retraction
  - c) adduction / abduction

## Digestive System

## Introduction

The digestive system functions to break down complex molecules in food into small molecules that can be absorbed by the cells lining the digestive tract.

## Purpose

To study the digestive system of the fetal pig.

## Materials and Equipment

Use the materials and equipment listed in Investigation 27.

## Procedure

## A. Exposing the thoracic and abdominal cavities

Place the pig, dorsal side down, in the paper-lined dissecting tray. Tie string (cord) to one foreleg and pass the string under the tray to be tied to the other foreleg. Spread the forelegs as much as possible before tying the second foreleg. Repeat this procedure for the hindlegs.

Using forceps, gather a fold of skin and muscle at the midline of the pig's throat, toward the apex of the jaw. Cut through this fold with scissors (Figure 1). Insert the scissors into this opening and cut down the ventral midline to the umbilical cord. While making this cut, lift the points of the scissors upward so that the underlying organs are not damaged.

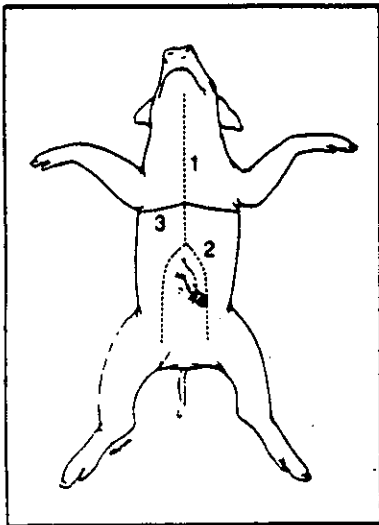


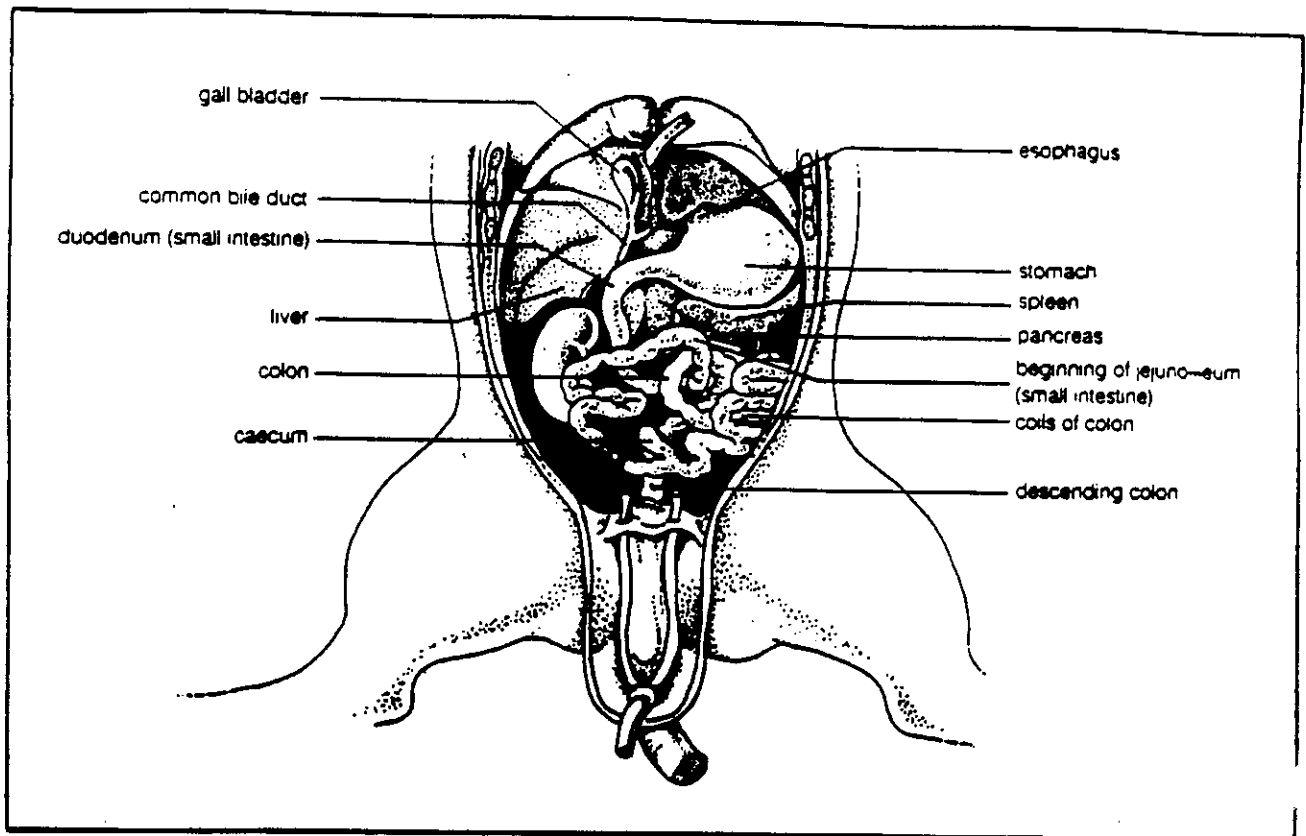
Figure 1. The numbered lines indicate the location of the incisions to expose the internal organs.

At the umbilical cord shift the line of the cut to one side of the midline and continue the incision posteriorly to the groin. When this is completed make a second incision that begins slightly anterior to the umbilical cord and extends to the groin. This second incision should parallel the first cut. This will result in the umbilical cord and, if the pig is male, the urogenital tract, forming a midstrip between the two incisions. This flap may now be folded posteriorly out of the way after the underlying umbilical vein is cut. Note and record the location of this vein. Make a third incision laterally across the ventral surface. This incision should cross the first incision a few centimetres anterior to the umbilical cord.

Using a probe, lift this abdominal flap and locate the diaphragm. The diaphragm divides the thoracic and abdominal cavities. Using scissors make incisions that follow the abdominal side of the diaphragm. Using a probe and a scalpel, cut the diaphragm away from the thoracic wall.

## B. Organs of the digestive system

Open the abdominal flaps and secure them with pins. Note the shiny membrane, the *parietal peritoneum*, lining the inner surface of the abdomen. Gently cut this away. Note that the internal organs are joined by membranes called *omenta* and that organs are connected to the body wall by *mesenteries*.



**Figure 2. Organs of the digestive system.**

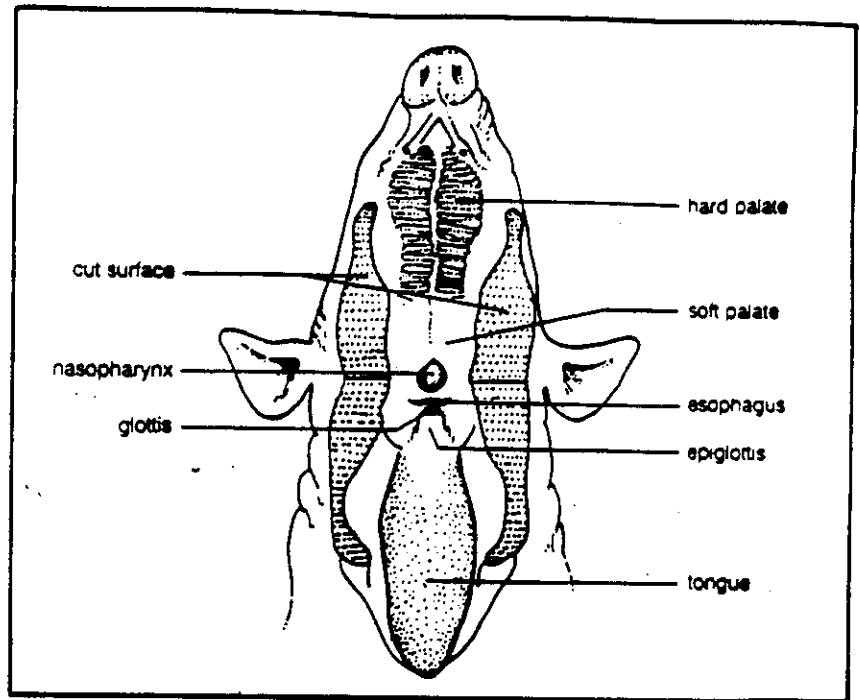
From the diagram provided (Figure 2), find and observe the following structures in the fetal pig specimen:

- liver (count the number of lobes)**
- gall bladder (often colourless, embedded on ventral surface of the liver)**
- common bile duct**
- esophagus (move liver away from left centre)**
- stomach**
- spleen (to what system does it belong?)**
- pancreas**
- small intestine**
- caecum**
- large intestine (colon)**

Using scissors, cut through the esophagus as it passes through the diaphragm into the abdomen. Remove the gastrointestinal tract from the specimen by cutting the bile and pancreatic ducts, any mesentery tissue from the tract, and by finally cutting the colon at the rectum.

Place your fingers at the junction of the stomach and small intestine (duodenum). Roll this section back and forth in your fingers. Move down the intestine and repeat this. Compare the feeling. Located at the division of the stomach and small intestine is the muscular *pyloric sphincter*. This sphincter keeps food in the stomach until digestion is advanced enough to allow the small intestine to continue the process. A similar muscle, the *cardiac sphincter*, may be felt where the esophagus leads into the stomach.

**Figure 3.** Oral cavity of the fetal pig.



Using scissors, cut open and flush out the stomach. It is often filled with a bile-stained mucus. Use a hand lens to view the *rugae* or folds on the inner surface of the stomach. Run your fingers over these folds. With a scalpel open three sites along the small intestine. Flush these and observe, using a hand lens, the inner lining and its *villi*. Run your fingers over these structures.

Using a probe to break away any mesentery, and pins to secure one end, extend the small intestine. Measure and record its length. Repeat this procedure with the large intestine.

Insert scissors into the side of the fetal pig's mouth. Cut through the cheeks and jaw bones on both sides. Open up the oral cavity. Locate the following structures using the diagram provided (Figure 3):

tongue  
 esophagus  
 soft palate  
 hard palate  
 teeth (may be emerging or beneath the gums)  
 nasopharynx  
 glottis  
 epiglottis

### Questions

1. Compare the texture and surface area of the stomach and small intestine. Explain the reason for the difference.
2. Both the small and large intestines were measured. Which is the longest? How does the structure of these two organs relate to their functions?

## Circulatory System

## Introduction

The circulatory system transports many different substances throughout the body. Food nutrients, respiratory gases, metabolic wastes, and hormones are transported to body tissues in blood vessels, the arteries, veins and capillaries. The heart pumps the blood via the arteries to the capillaries where the exchange of substances between the blood and the tissues occurs. The skeletal muscles provide most of the force that moves the blood from the capillaries via the veins back to the heart.

This study can be used in conjunction with the more detailed dissection of the mammalian heart, Investigation 37.

## Purpose

To study the circulatory system of the fetal pig.

Materials  
and  
Equipment  
Procedure

Use the materials and equipment listed in Investigation 27.

Open the thoracic cavity completely. This may require further cutting. Secure these flaps. A clear view of the heart is likely blocked by the *thymus gland*. Note the location of the thymus and remove it completely. Note the pericardial sac around the heart. Carefully remove it. From the diagram provided (Figure 1) find and observe the structures listed below on the fetal pig specimen:

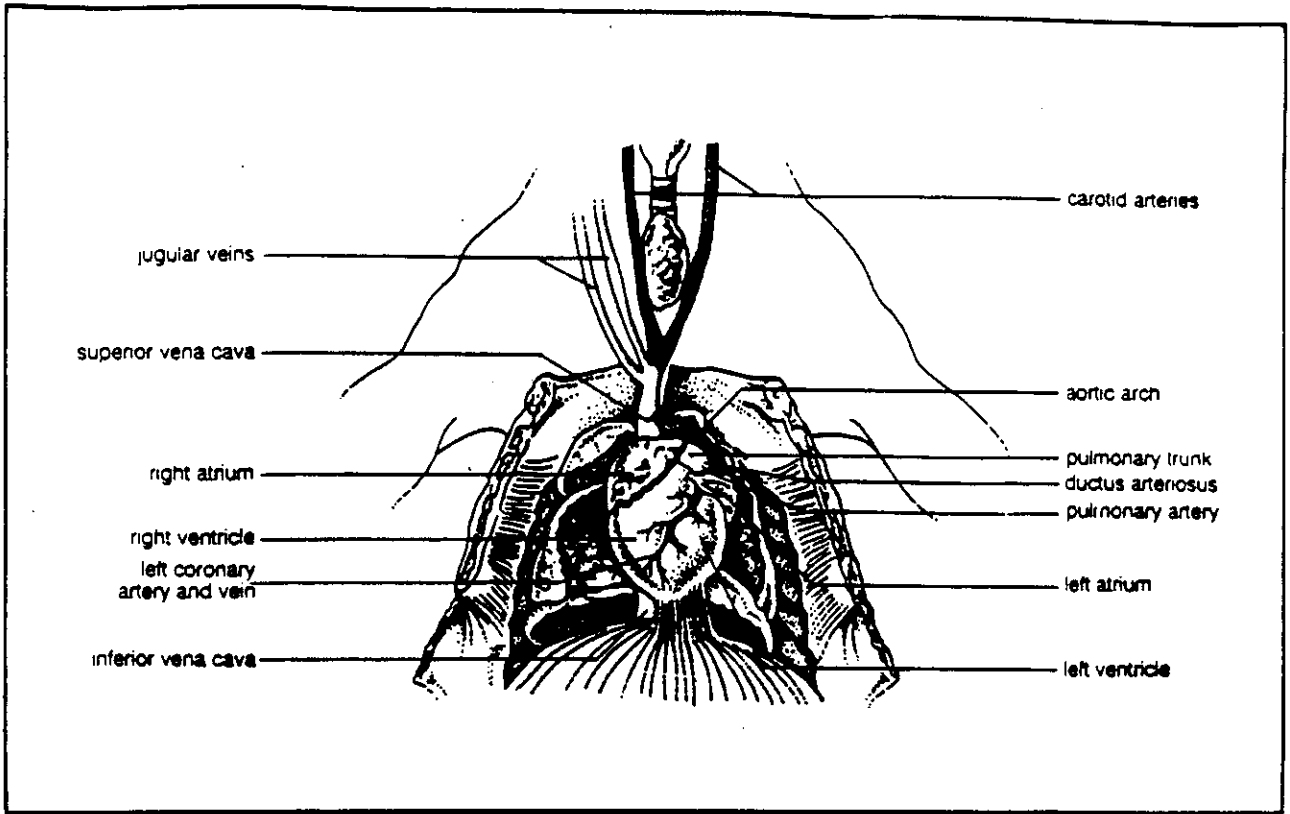
right atrium	coronary artery
left atrium	aortic arch
right ventricle	superior vena cava
left ventricle	inferior vena cava
pulmonary trunk	ductus arteriosus
pulmonary artery	

Note the position of the heart and then remove it completely from the body cavity. Cut the vessels about 1 cm from the heart. Place the heart in the dissecting tray in a position similar to the one it had in the thoracic cavity. Using a scalpel, dissect the heart into a frontal and hind section. This is accomplished by starting the incision high on the right atrium, approximately 5 mm back from the ventral surface. Continue this incision downward to the apex. Open the heart to check that your incision exposes both the right atrium and right ventricle. Repeat this procedure from the left atrium to the apex. Remove the front of the heart by making an incision through the septum that divides the right and left chambers.

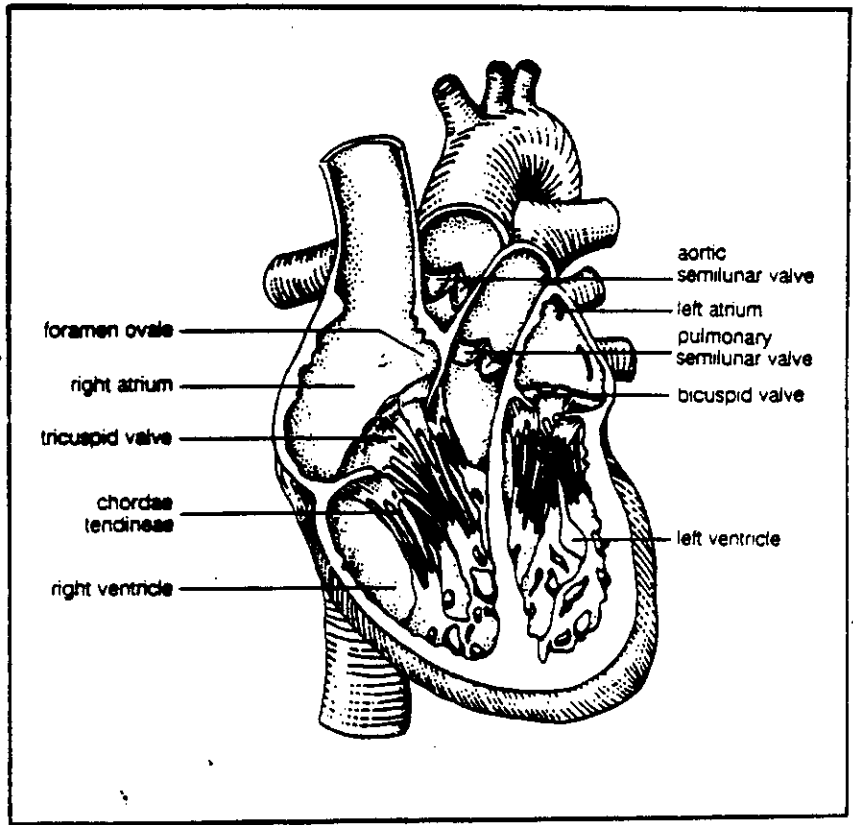
From the diagram provided (Figure 2) find and observe the structures listed below in the fetal heart:

right atrium	right ventricle
left atrium	left ventricle
chordae tendinae	pulmonary semilunar valve
bicuspid valve	aortic semilunar valve
tricuspid valve	foramen ovale

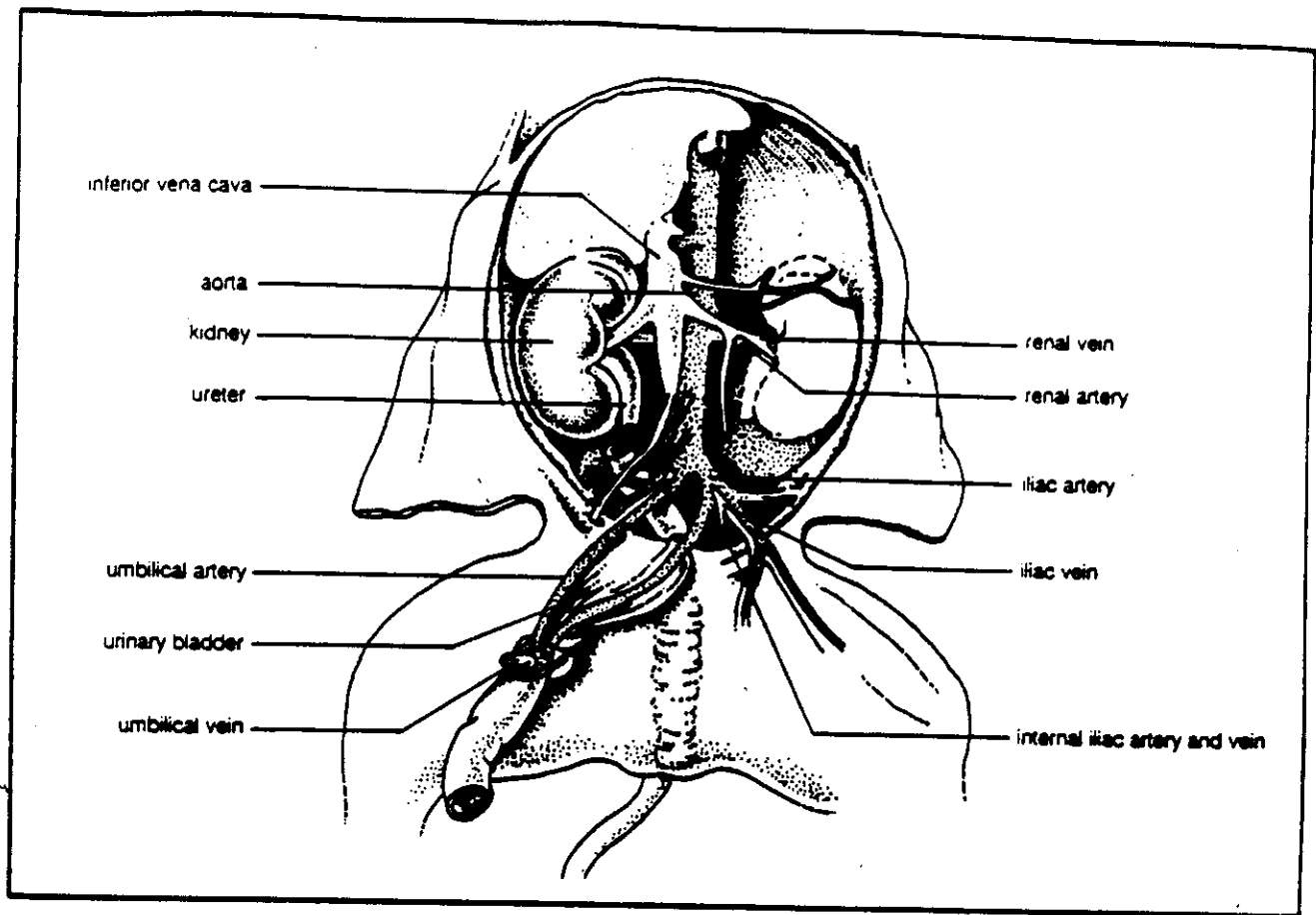




**Figure 1.** The heart and major vessels of the circulatory system.



**Figure 2.** Structures within the fetal heart.



**Figure 3.** Major vessels of the abdominal cavity

Turn the hind portion of the heart over. Locate the aortic arch, pulmonary arteries, pulmonary veins, superior vena cava and inferior vena cava.

Locate the severed end of the superior vena cava. Trace it anteriorly to the point that it branches. Note that two pairs of branches come from the neck area. These are the *jugular veins*. Move these to one side and locate the *carotid arteries* that carry blood to the head. Trace these back to the aortic arch.

By observing the abdominal cavity, the pathway of the aorta and inferior vena cava may be traced. From the diagram provided (Figure 3), find and observe the structures listed below in the fetal pig specimen:

- |                    |                  |
|--------------------|------------------|
| aorta              | iliac artery     |
| inferior vena cava | iliac vein       |
| renal artery       | umbilical artery |
| renal vein         | umbilical vein   |

### Questions

1. What is the function of the ductus arteriosus?
2. The major arteries are often located deeper into the body cavity than are major veins. Why is this the case?

## Respiratory System

## Introduction

The respiratory system functions to transport oxygen and carbon dioxide to and from the lungs. Here oxygen diffuses into the blood for transport to the body tissues. Carbon dioxide, a by-product of cellular respiration, diffuses from the blood into the lungs and is exhaled.

## Purpose

To study the respiratory system of the fetal pig.

Materials  
and  
Equipment  
Procedure

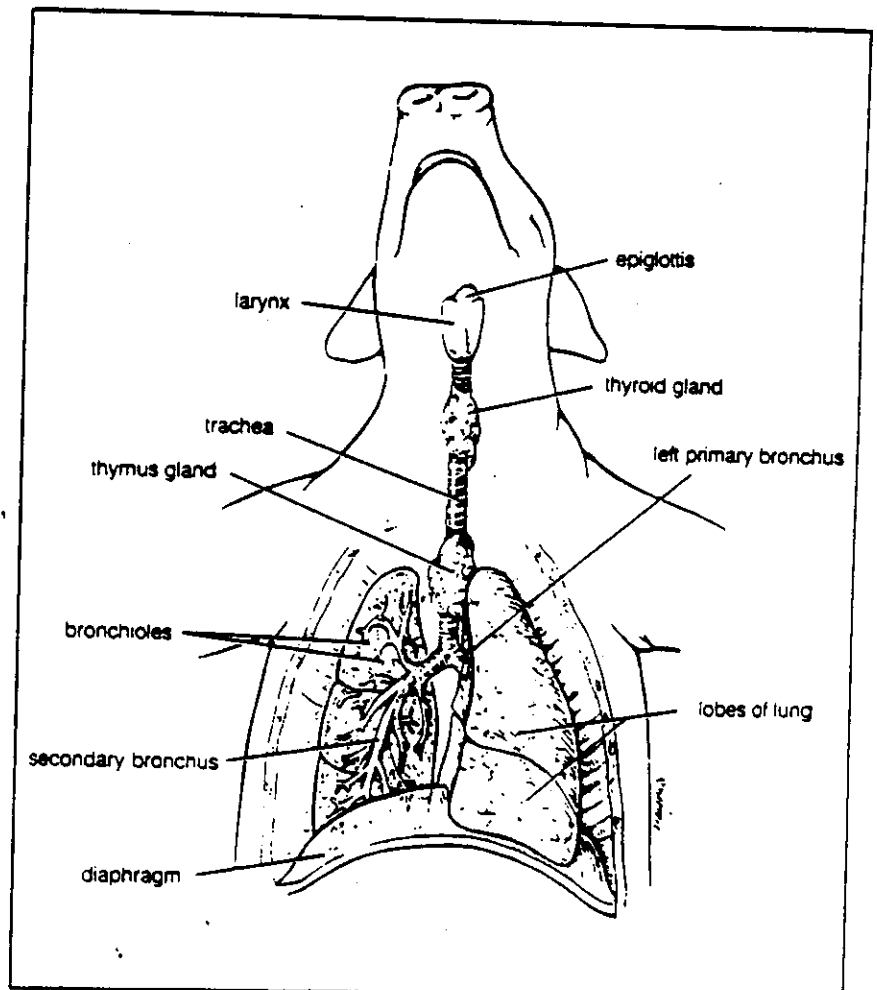
Use the materials and equipment listed in Investigation 27.

Extend the thoracic incision anteriorly to the base of the fetal pig jaw. Spread this incision to expose the underlying tissue. From the diagram provided, find and observe the structures listed below in the fetal pig specimen:

larynx  
trachea  
bronchi

diaphragm  
lungs

*Respiratory structures of the fetal pig.*



Using a scalpel, make an incision into the trachea at the point where it branches into the bronchi. Continue the incision anteriorly to the larynx. Note the toughness of the trachea, the shape and position of cartilage, and the structure of vocal cords in the larynx. Use a hand lens to observe the texture of this air duct. Pass a probe up the trachea and out the glottis. Check the mouth to see the top of the probe.

Count the number of lobes on each lung of the fetal pig. Note the attached mesentery tissue. Carefully remove one lung. Observe it using a hand lens or dissecting microscope. Locate the bronchus entering the lung. Using a scalpel, open the bronchus to see it begin to rebranch repeatedly into bronchioles. Cut a section through the lung and note the density of this tissue.

### **Questions**

1. What is the function of the tracheal cartilage? What shape is it?
2. How many lobes does each lung of the fetal pig have?
3. The bronchus subdivides into a series of smaller ducts that terminate in many sac-like end structures. What are these ducts called?

## Excretory System

## Introduction

The excretory system functions to remove nitrogenous wastes from the body. Nitrogenous wastes are filtered from the body by the kidneys, after which the urine that is formed is temporarily stored in the urinary bladder until it is expelled.

This study can be used in conjunction with Investigation 47, Kidney Structure.

## Purpose

To study the excretory system of the fetal pig.

Materials  
and  
Equipment  
Procedure

Use the materials and equipment listed in Investigation 27.

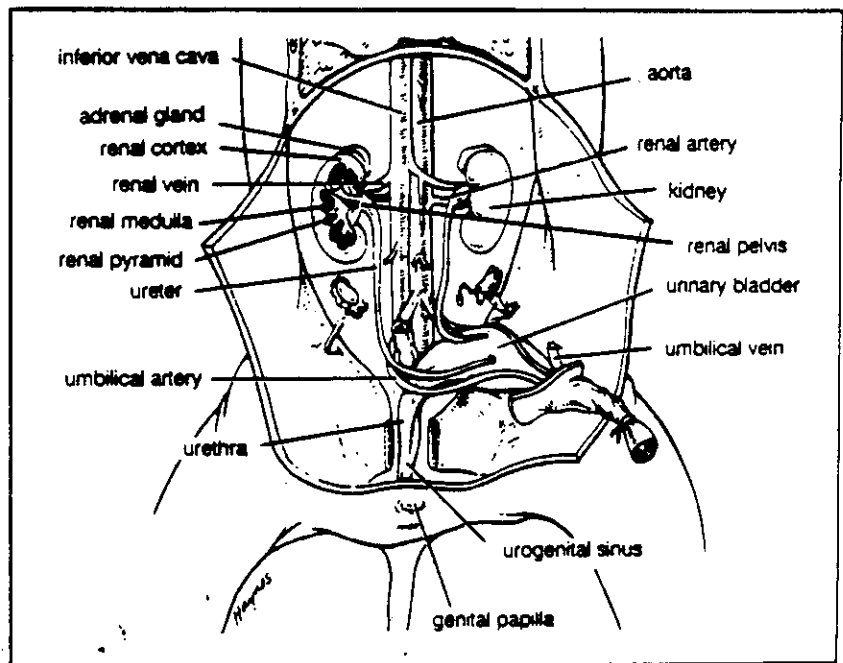
Open the abdominal flaps of the fetal pig and secure these to expose the abdominal cavity. Fold the midflap of tissue downward. This tissue contains the umbilical cord, bladder, and, if the pig is male, the penis. Locate the kidneys, one on either side of the spine, high on the dorsal wall. Note that the kidneys are behind (or outside) the peritoneum.

Using a scalpel and forceps, carefully remove the peritoneum. From the diagram provided, find and observe the structures listed below on the fetal pig specimen:

adrenal gland  
kidney  
renal artery  
renal vein  
ureter

allantoic (urinary) bladder  
umbilical cord  
urethra  
penis (on the male specimen)  
genital papilla (on the female specimen)

*Urinary structures of the fetal pig (female). The right kidney is sectioned in the frontal plane to show the internal structures.*



Using a scalpel, make an incision into the bladder at a point just posterior to where a ureter enters the bladder. Continue the incision posteriorly, and slightly downwards, towards the urethra.

Locate the points where the ureters enter the bladder. Note their appearance. Observe the urethra and note changes in wall thickness, indicating a sphincter.

Using scissors, remove one kidney. Dissect the kidney into frontal and hind sections. To accomplish this, make the first incision ventral to the point where the ureter leaves the kidney. Using the diagram provided, find and observe the structures listed below on the fetal kidney:

renal cortex  
renal medulla  
renal pyramids  
renal pelvis

renal artery  
renal vein  
ureter

### Questions

1. Prior to birth, does the urethra function? If not, how would wastes be removed?
2. What is the function of the urethral sphincter?

## Reproductive System

## Introduction

The function of the male reproductive system is to produce sperm and place them in the female's reproductive tract. The female reproductive system produces egg cells, receives the sperm and nourishes the developing offspring.

This study can be used in conjunction with the study of the human reproductive system, Investigation 60.

## Purpose

To study the reproductive system of the fetal pig.

## Materials and Equipment

Use the materials and equipment listed in Investigation 27.

## Procedure

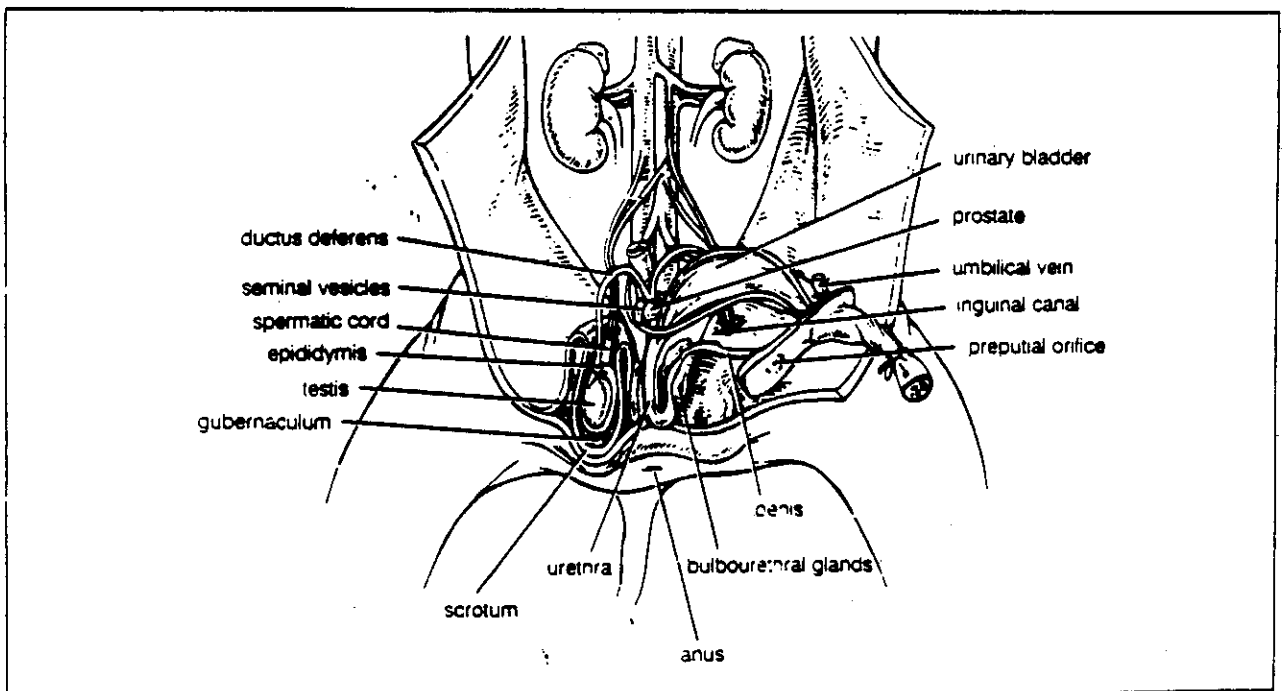
## A. Male fetal pig

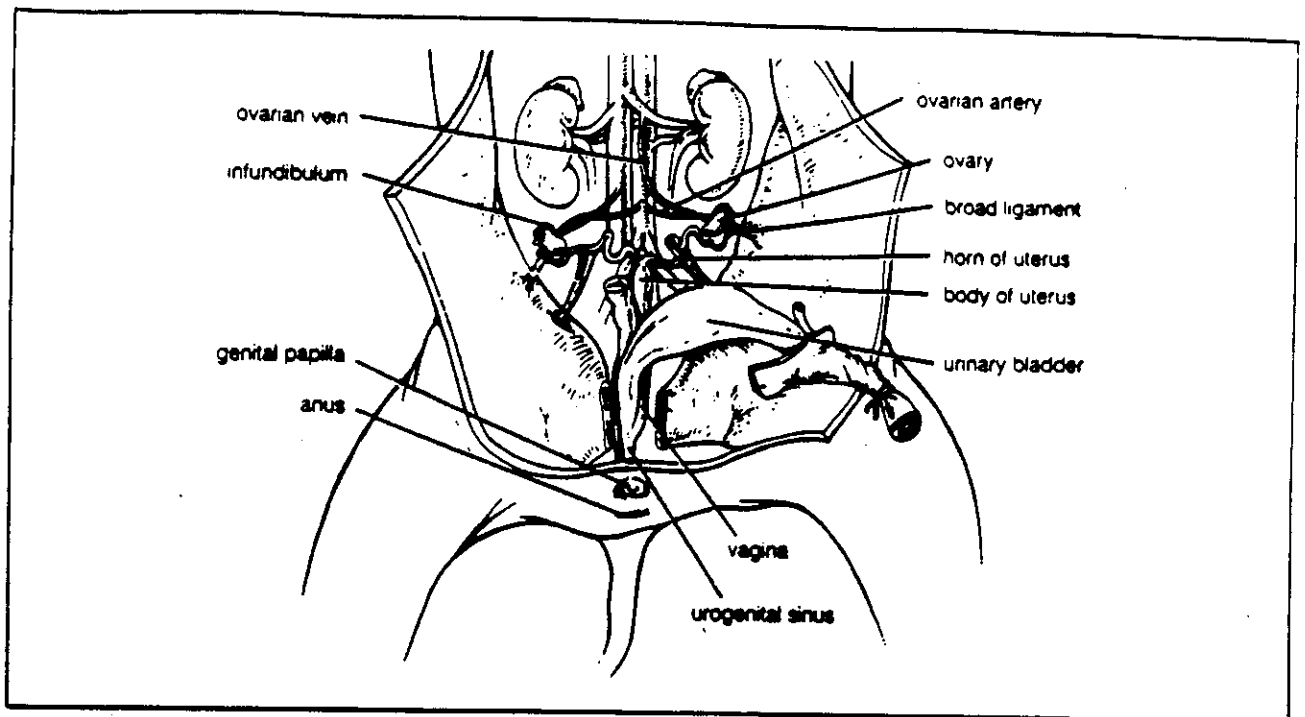
Locate the urogenital orifice posterior to the umbilical cord. Using scissors, carefully cut the mid-ventral strip from the orifice posteriorly. Fold this tissue to expose the penis. From the diagram provided (Figure 1), find and observe the structures listed below on the fetal pig:

penis	prostate gland (may be difficult to see)
urethra	bulbourethral gland
preputial orifice	seminal vesicles
ductus deferens	

Using a probe, trace the ductus deferens to the scrotum. Using a scalpel, make an incision in the scrotum to expose the testes, epididymis, and the gubernaculum. The gubernaculum is the cord posterior to the epididymis that runs to the scrotum.

Figure 1. The reproductive system of the male fetal pig.





**Figure 2.** The reproductive system of the female fetal pig.

### B. Female fetal pig

Locate the Y-shaped (bipartite) uterus. Using a scalpel and scissors, open the pelvic girdle to expose the urethra and the vagina. From the diagram provided (Figure 2), find and observe the structures listed below on the fetal pig:

infundibulum  
vagina  
broad ligament

ovaries  
body of uterus  
horns of uterus

Using a probe, locate the site where the urethra and vagina merge to a common chamber (*urogenital sinus*). Use a scalpel to open this sinus. Locate the urethral opening, clitoris, cervix of the uterus.

### Questions

1. Explain why the testes are located in the scrotal sac.
2. What may be one function of the gubernaculum?
3. What are the structural differences between a human and pig uterus? What does this suggest?



## Nervous System

### Introduction

The nervous system coordinates the activities of all the body's organ-systems. This is accomplished primarily by nerve impulses. Coordination of the body's systems takes place by means of impulses transmitted from the brain and the spinal cord to muscles and glands. These impulses are initiated as a result of impulses sent to the brain and spinal cord from sensory receptors. These receptors detect changes occurring in the internal and external environment. The body's response to these changes is coordinated by the nervous system.

This study can be used in conjunction with the dissection of a mammalian brain (Investigation 49).

### Purpose

To study the nervous system of the fetal pig.

### Materials and Equipment

Use the materials and equipment listed in Investigation 27.

### Procedure

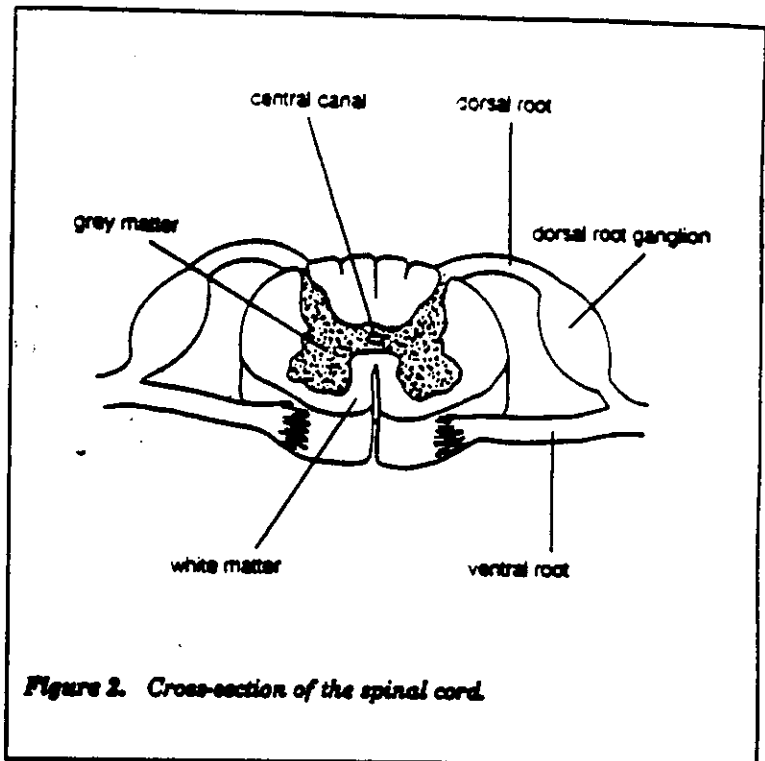
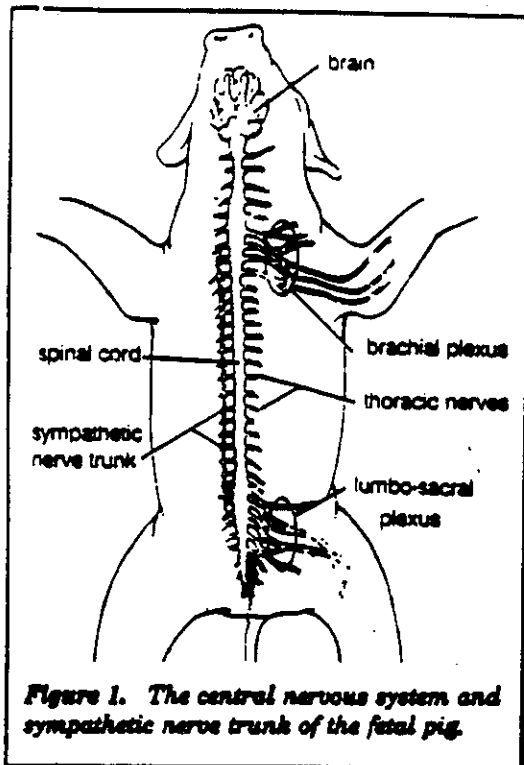
With the pig dorsal side down, open both thoracic and abdominal flaps. Locate the spinal column and follow it anteriorly towards the lungs. Shift the lungs slightly and locate a slender white cord that appears to have lumps. This is the sympathetic nerve trunk (Figure 1). The sympathetic nerve trunk lies outside the central nervous system (brain and spinal cord) and is part of the peripheral nervous system.

Select a site along the spine (e.g., the thoracic pectoral area) and remove any organs blocking your view of the spine. Using a scalpel, expose the spine and locate any emerging nerves. Select one and trace it as far as you can into the body.

Place the pig dorsal side up in your dissecting tray. Locate the thoracic region and remove the skin and muscle to completely expose 10 mm of the vertebral column. Note the thoracic nerves extending from the spine to the muscles.

Using forceps to grip the spinous process and scissors for cutting, open the vertebral canal by cutting off the vertebral arch. Note the *dura mater*, the outermost covering of the brain and spinal cord. Locate a vertebral joint and use scissors to cut through this connection. Make cuts on both sides of the spine from this initial incision between vertebrae. Fold the spine section upward for viewing and secure it with a probe.

Make an incision in the *dura mater* and peel it to one side. Using a hand lens, locate a dorsal root, dorsal root ganglion, ventral root, central canal, and also note the external and central spine colouration (Figure 2).



Place the pig on its side in the dissecting tray. Using scissors and a scalpel, remove the *pinnae* to expose the auditory meatus and the skull ventral to this canal. Using forceps, a probe and scissors, remove tissue surrounding the auditory meatus to expose the *tympanic membrane*. This site is ventral to the outer end of the auditory meatus. Note the size of the tympanic membrane. Using a hand lens or dissecting microscope and forceps, remove the tympanic membrane. Try to avoid breaking off the *malleus* which is attached to the membrane. Enlarge this opening dorsally using forceps. Note the size of the middle ear cavity. Carefully remove the auditory ossicles, the *malleus*, *incus*, and *stapes*. Allow these to dry and then identify them. Note the small hole from which the stapes was removed. This is the *oval window*.

Locate the *round window* and the opening to the *Eustachian tube*. The round window is ventral and posterior to the oval window. The Eustachian tube opening into the middle ear cavity is a slit anterior and ventral to the location of the malleus. When this slit is located, insert a probe into it and observe where it opens in the nasopharynx of the pig specimen.

### Questions

1. What are the "lumps" in the sympathetic nerve trunk? What causes these?
2. Which portion (central, external) of the spine section is darker? lighter? What is the reason for this difference?
3. What is the function of the round window of the inner ear?
4. What is the function of the tympanic membrane and middle ear ossicles?

## Kidney Structure

## Introduction

The kidneys are bean-shaped organs about the size of a clenched fist. They are attached to the body cavity by mesentery. Each kidney is embedded in fat which helps cushion it from shock as well as holding it in place. The kidney is structurally subdivided into three areas: the *renal cortex* which makes up the outer portion of the kidney, the *renal medulla* which represents the inner two-thirds of the kidney, and the *renal pelvis* which is a sac-like cavity. The renal pelvis empties its contents into the ureter, which leads to the urinary bladder. When the bladder is emptied, urine passes to the outside via the urethra.

Each kidney is composed of approximately one million *nephrons*. The nephrons are the functional units of the kidney. Each nephron is a filtration unit which controls the composition of the urine. The blood is brought by paired renal arteries to the kidneys where it is filtered and then carried away from the kidneys by paired renal veins. Structurally, each nephron consists of a small cup-shaped structure called the *Bowman's (nephric) capsule*. A small, winding, proximal tubule leads from each capsule and becomes the *loop of Henle (nephric loop)* which then leads to the *distal tubule*. The distal tubule fuses with the *collecting tubule* whose contents empty into the renal pelvis.

## Purpose

To study the structure of a mammalian kidney.

Materials  
and  
Equipment

## Materials

sheep or hog kidney

kidney model

## Equipment

prepared slide of a kidney  
cross-section

compound microscope

dissecting tray

scalpel

prepared slide of a kidney  
longitudinal section

probe

## Procedure

Obtain a kidney and note the shape, colour, fat deposits, hilum, blood vessels, and ureter. Draw and label the above noted structures. Carefully bisect the kidney longitudinally, beginning at the hilum. Note the outer renal cortex, the inner renal medulla, and the renal pelvis. The medullary portion of the kidney is composed of wedge-shaped structures called the renal pyramids. Draw and describe the previous four structures. Using a prepared slide of the kidney, locate the renal pelvis; describe the structures observed. Make a drawing of a nephron and label the Bowman's capsule, proximal tubule, loop of Henle, distal tubule, and the collecting tubule.

## Questions

1. In what portion of the kidney are the renal pyramids located?
2. Where does the ureter originate?
3. What structures of the nephron are found in the renal cortex?
4. What structures of the nephron are found in the renal medulla?
5. What major blood vessels bring blood to the kidney and carry blood away from the kidney?
6. List two major functions of the kidneys.