

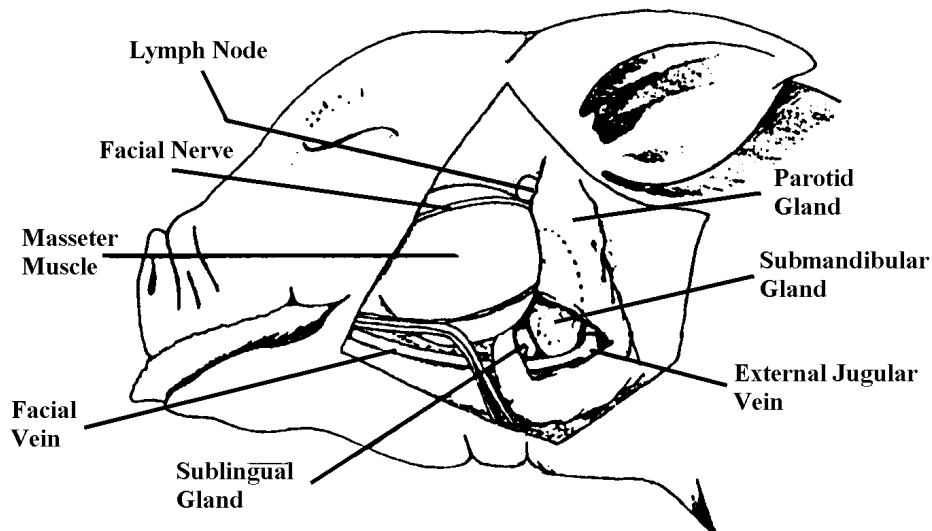
Background Information

The digestive organs of the fetal pig are very similar to those of the human. Observe carefully the difference between the two organisms, such as the arrangement of the **colon**, and the absence of both the **vermiform appendix** and the **uvula** in the pig. Be prepared to trace the path of food through the digestive tract.

Procedure**I. Dissection of the Salivary Glands**

1. As in the human, there are three pairs of salivary glands in the pig. However, the size and shape is variable in the fetal pig, making dissection and accurate identification difficult. Use Figure 1 as a guide for the following dissection of the salivary glands.
2. Starting at the base of the ear, inferior to the **external auditory meatus**, make a shallow incision through the skin.
3. Continue the incision down the side of the face to the shoulder. Separate the skin carefully from the musculature and glands on either side of the incision.
4. The **parotid gland** is a large, thin, light-colored, triangular gland which usually extends from the base of the ear to the shoulder. It is underdeveloped in the fetal pig and may not be easily visible.
5. Stensen's duct, the thin, white duct of the parotid gland, is located along the posterior border of the **masseter muscle**, the large muscle anterior to the parotid gland covering the angle of the lower jaw. The duct opens into the oral cavity by the fourth upper premolar. It may be necessary to dissect away some of the parotid gland to locate this duct.
6. The **submandibular gland** lies deep beneath the parotid gland. To locate this gland, make a shallow incision through the parotid gland at the level of the inferior border of the masseter muscle. Reflect the lower portion of the parotid gland. The submandibular gland should now be visible.
7. The sublingual gland is located anterior to the inferior border of the submandibular gland. A small lymph node may be located by separating the dorsal anterior border of the parotid gland from the masseter muscle.

Figure 1 Dissection of the Salivary Glands



II. Dissection of the Mouth or Oral Cavity

1. Cut through the angle of each jaw toward the ears, depressing the lower jaw until it is possible to see the **epiglottis** and the opening into the throat (**pharynx**). The interior of the mouth can now be examined (see Figure 2).
2. Locate the **vestibule**, the space between the lips and the teeth, and the **oral cavity**, the principal cavity inside the mouth.
3. The **tongue** is attached ventrally throughout most of its length by a membrane called the **lingual frenulum**.
4. The surface of the tongue contains numerous **papillae**. Taste buds are associated with the papillae.
5. If the **teeth** are not visible, cut into the jaw and expose them. The dental formula for the deciduous set of teeth in the pig is 3 1 4 0. **Use the Internet** and find out what these four numbers mean and how do these numbers compare to the teeth of an infant. Try the Google site. The address is www.google.com.
6. Observe the bony ridged **hard palate** and the muscular **soft palate**, posterior to the hard palate. The pig lacks the **uvula**, which is the posterior extension of the soft palate in humans.
7. Identify the fauces, the opening of the oral cavity into the oropharynx. Look up the pronunciation for fauces. Go on line to www.bisonscience.org/abbas and then click on the button "**Dictionary**".
8. The **pharynx** is divided into three regions: the nasopharynx behind the nose, the oropharynx behind the mouth, and the laryngeal pharynx opening into the **larynx**. The larynx is also known as the voice box in humans.
9. Make a median incision through the entire soft palate to expose the nasopharynx. Do not cut into the dorsal wall of the nasopharynx for this will expose a portion of the brain tissue.
10. Locate the two small slits, about 1 mm in diameter, in the lateral dorsal walls of the nasopharynx. These are the openings of the **Eustachian tubes**. The internal nares also open into the nasopharynx.
11. Locate the opening of the pharynx into the **esophagus** dorsal to the larynx.
12. Locate the **glottis**, the opening into the larynx. The **epiglottis** can be seen as a small tongue-like flap at the entrance to the larynx.

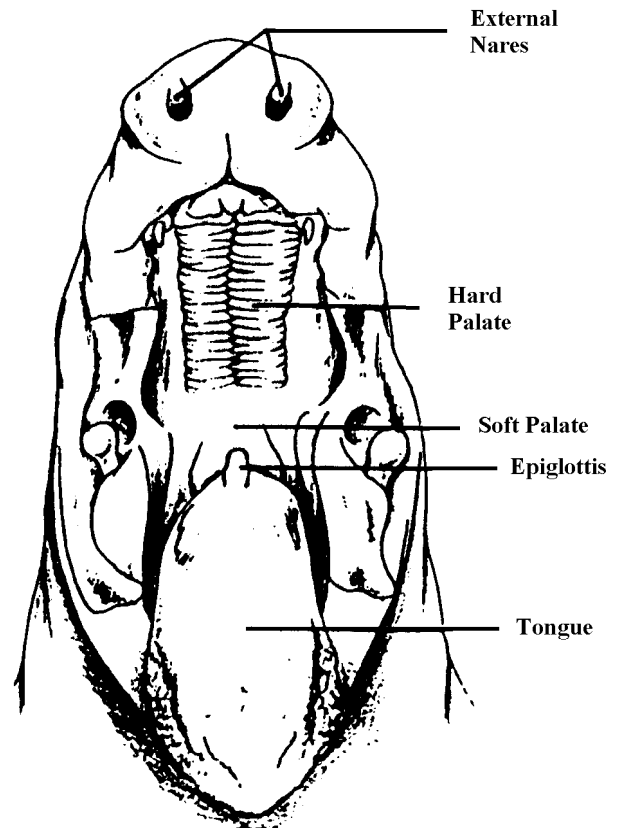
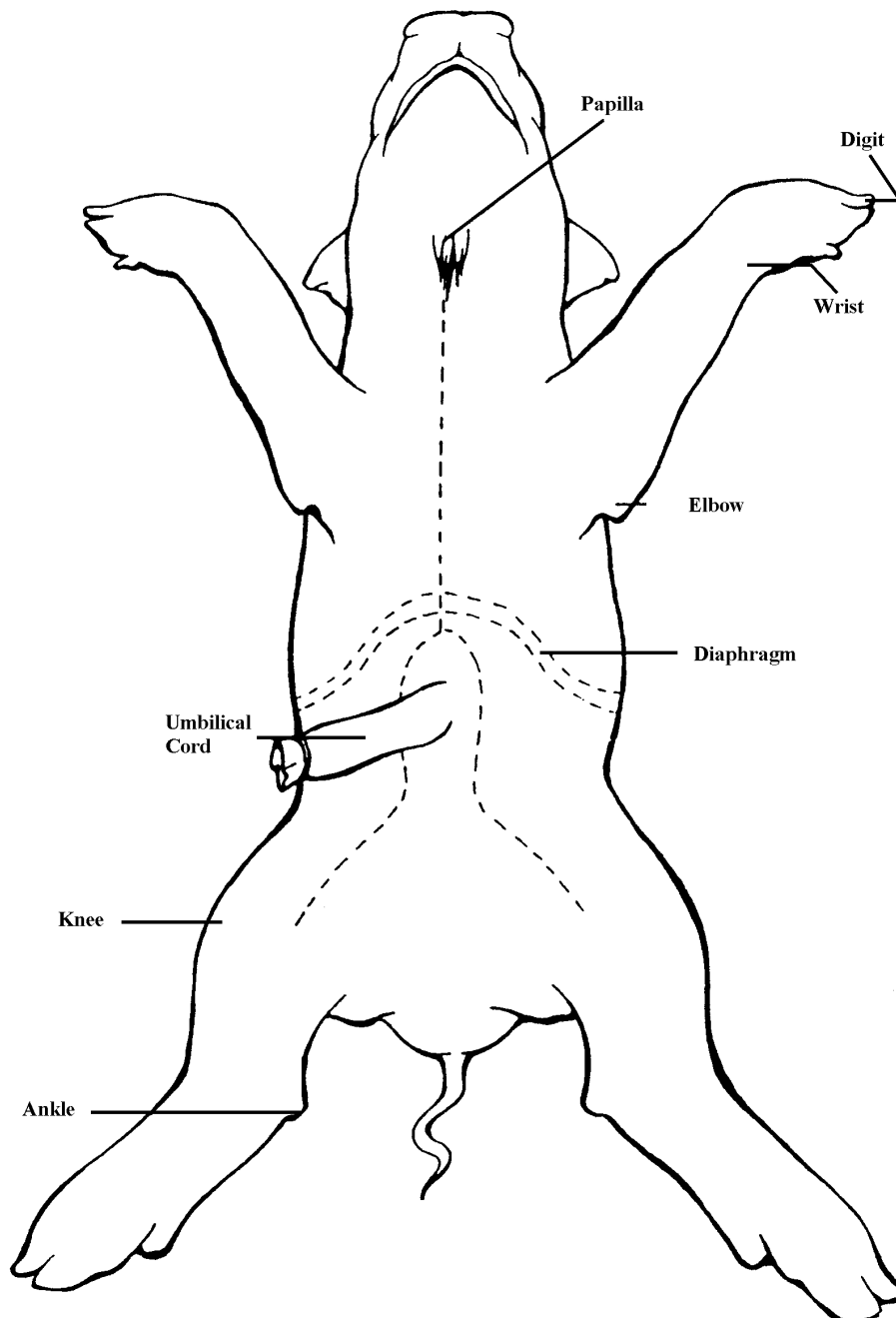


Figure 2 The Oral Cavity

III. Opening the Body Cavity

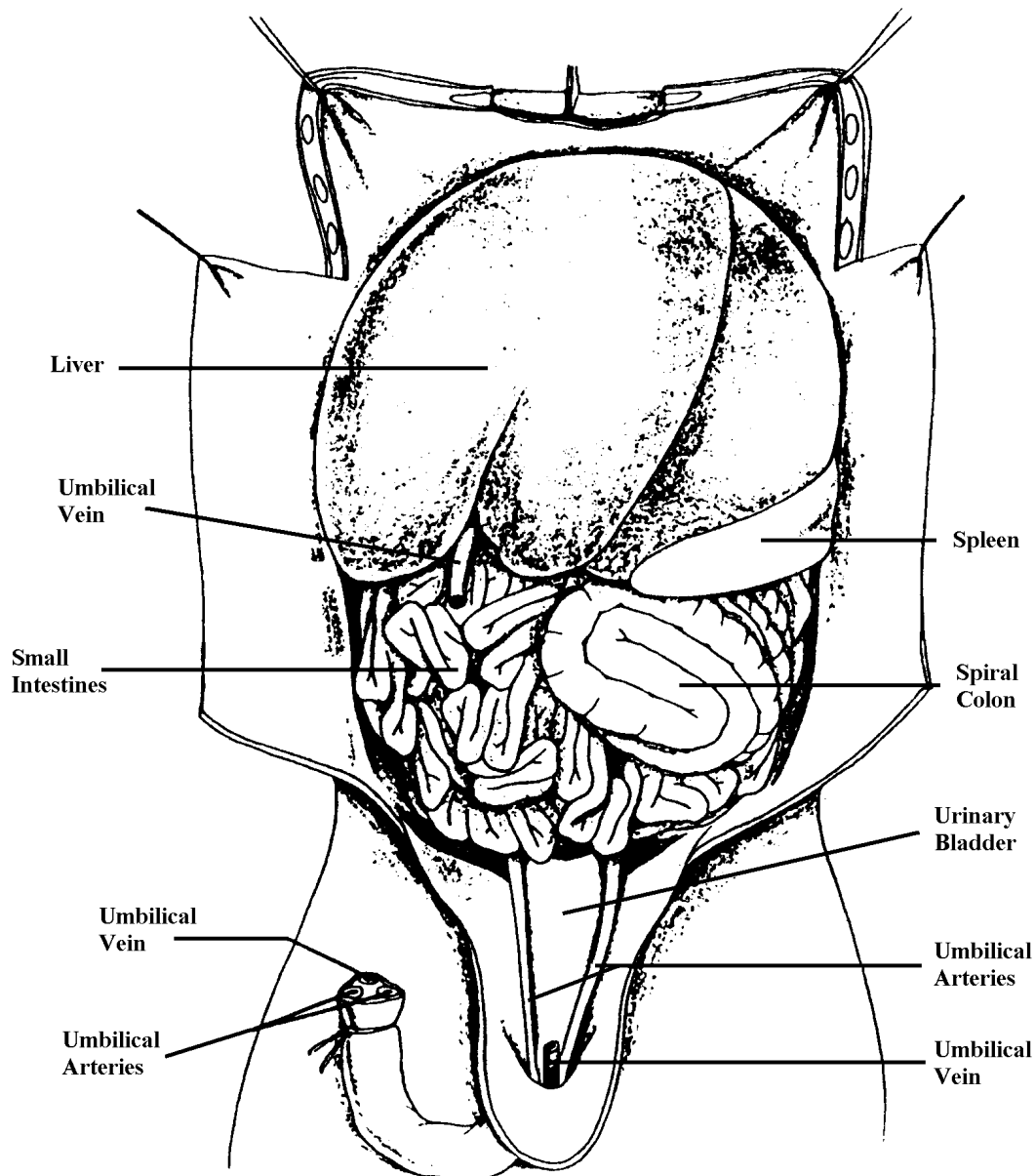
1. Lay the pig, ventral surface up, on the dissecting pan. To spread the legs of the specimen, use large rubber bands attached to the front legs of your specimen. Stretch the rubber bands underneath the pan. You may have to use more than one rubber band depending on the size of the pig and the length of the rubber bands. Use the same set up to spread the hind legs. At the end of each period of dissection, the rubber bands should be wrapped around the fetal pig's body therefore eliminating the process of finding more rubber bands to hold the pig down on the dissecting tray.
2. Use Figure 3 as a guide for opening up the body cavity in this dissection.
 - a. Make an incision with the scalpel through the skin from the small hairy papilla on the upper part of the throat down the midline to a point just anterior to the sternum.

Figure 3 Initial Incisions to Open the Body Cavity



- b. Continue to deepen the incision very carefully, cutting to the cartilaginous sternum, until the chest cavity is reached. Carefully cut around the sternum on each side, so that the sternum and a large portion of the ribs can be removed exposing the heart and lungs. Be careful not to cut the large veins and arteries as you remove this part of the pig's torso.
 - c. To enlarge the exposed chest cavity, make the following incision, which will facilitate subsequent dissections and at the same time leave the diaphragm intact. Cut laterally, immediately below the diaphragm. Make a second incision directly above the diaphragm. The **diaphragm** is a muscular sheet that divides the chest cavity from the abdominal cavity in mammals. It is the principal muscle used in respiration.
 - d. Cut around the cord as illustrated and continue the incision laterally on each side to the head of the femur in the ventral thigh region. If the directions are followed, a flap will be produced which includes the umbilical cord and some **urogenital organs**. Look up the meaning of urogenital.
 - e. Pull the flap that contains the umbilical vessels back carefully and observe the **umbilical vein** which runs from the umbilical cord to the **liver**. The umbilical vein continues on as the ductus venosus which passes through the liver and then enters the inferior vena cava.
 - f. Tie a thread around the umbilical vein and cut it between the thread and the flap. The thread will enable quick location of the severed umbilical vessel. Pull the ventral flap further back and observe the **umbilical arteries** injected with red latex, on the inner surface.
 - g. Locate the **urinary bladder**, the large sac situated between the two umbilical arteries, at the posterior portion of the **abdominal cavity**.
 - h. If the body cavity is filled with a dark fluid, flush it out with water; be careful not to damage any organs.
3. Locate the **esophagus** again in the thoracic cavity in order to determine its position relative to the heart.
 4. Locate the **diaphragm** which separates the thoracic cavity from the abdominal cavity.
 5. Use Figures 4 and 5 to assist you in locating the following organs:
 - a. 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.
 - b. 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.
 - c. Lift up the right lobe of the liver and locate the **gall bladder**, the small, pear-shaped sac embedded in the right central lobe.
 - d. The **umbilical vein** can be found entering the liver to the left of the gall bladder.
 - e. 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 lesser omentum 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.

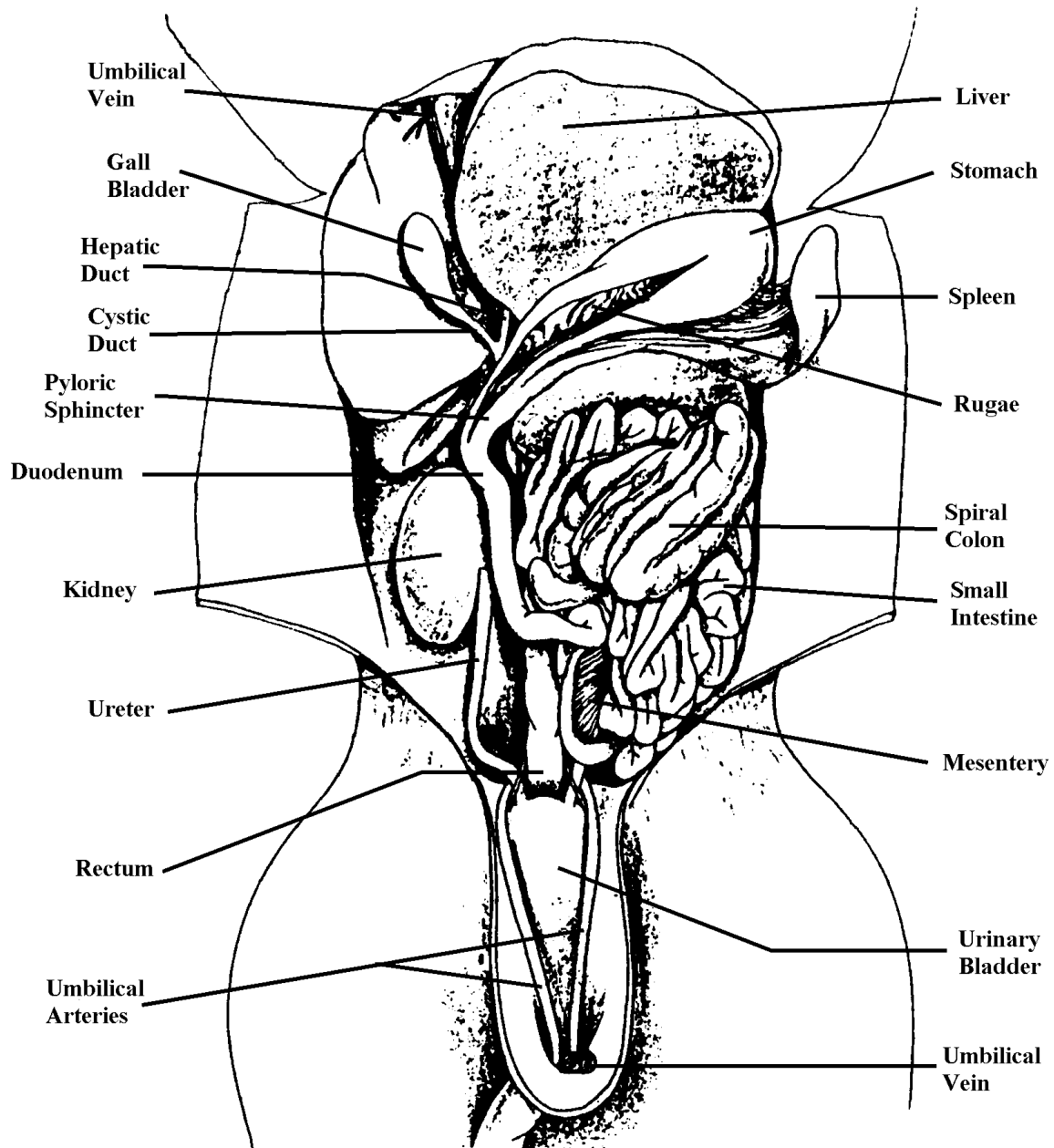
Figure 4 Superficial View of the Digestive Organs of the Fetal Pig



6. Lift up the liver to expose the **stomach** which is located on the left side of the abdominal cavity.
 - a. Locate the entrance of the esophagus into the stomach.
 - b. Identify the following gross regions of the stomach: the fundus, the upper most portion 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. Make an incision along the greater curvature of the stomach from the pyloric region to the cardiac region. Wash out the stomach. The green debris found here and elsewhere in the digestive tract is called **meconium**, 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.
 - d. Observe the **gastric mucosa** lining the stomach and the **rugae**, the longitudinal folds visible in the interior of the stomach.

- e. Continue the longitudinal incision through 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. In this area there is the small diverticulum of the stomach near the esophagus. This is believed to be the rudiment of the complex chambering of the stomach of the cow.
- f. Continue the same longitudinal incision through the **pyloric sphincter** regulating the passage of food into the **duodenum**.

Figure 5 Digestive Organs with the Liver and Spleen Pulled Back



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 1cm long. The common bile duct can be seen entering the duodenum from the liver.
 - 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. Note that the common bile duct empties into the duodenum through a small papilla, the duodenal papilla.
 - c. 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.
 - d. The two remaining, approximately equal, portions of the small intestine, the jejunum and the ileum 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.
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 is considered to be part of the circulatory system.
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 is connected to the duodenum by the pancreatic duct. This duct is small and need not be dissected out.
10. 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. 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.
 - 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**.
11. 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).
 - c. Observe the mesentery near its point of contact with the dorsal body wall and locate a row of small white bulges. These are **lymph nodes**.
12. 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 but 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.

13. In studying the anatomy of an organism, it is important to know the names of the various body parts but equally important is for you to learn the purpose of each structure. Below is a list of structures. Find out the major role of each structure.
- a. salivary glands
 - b. masseter muscle
 - c. epiglottis
 - d. larynx
 - e. pharynx
 - f. esophagus
 - g. stomach
 - h. sphincter muscles
 - I. small intestine
 - j. large intestine
 - k. liver
 - l. gall bladder
 - m. pancreas
 - n. spleen
 - o. rectum