External Anatomy

1. Say hello to your pig. To determine the sex of your pig so that you can give him/her an appropriate name, look for a little hole DIRECTLY posterior (toward the tail end) to the umbilical cord. If there is one, you have a bouncing baby boy, and what you are looking at is called the urogenital opening at the tip of his penis, which is below the skin (not hanging down like you might think!). On females, this same opening is located way at the back end under the tail just anterior to (toward the head end) the opening to the digestive tract, the anus. The urogenital opening is partly covered by a small, triangular flap of skin called the urogenital papilla. Males do not have this urogenital papilla.

Both males and females have rows of nipples, or teats, and the umbilical cord will be present in both.

Find the nares (nostrils), digits, wrist, elbow, ankle and knee. Careful!! Some are tricky!

2. Make sure you are familiar with terms of reference: anterior, posterior, dorsal, ventral. In addition, you'll need to know the following terms: Medial: toward the midline or middle of the body, Lateral: toward the outside of the body. Your eyes are lateral to your nose.
Proximal: close to a point of reference. Distal: farther from a point of reference. Relative to your elbow, your wrist is proximal and your fingers are distal.

3. Put one blade of the scissors inside the mouth and one outside right at the angle of the jaw, where upper and lower jaw meet. Cut deeply so that the mouth will open easily.

Open the pig's mouth and locate the **hard and soft palate** on the roof of the mouth. The hard palate has ridges, the soft one is posterior to it. Can you feel your own hard and soft palates with your **tongue**? Notice the taste buds on the tongue? Can you feel teeth? Do you have teeth at this stage of your life?

To locate the **epiglottis**, a triangle-shaped flap deep in the back of the mouth, you need to really get your piggy to open wide; some gross sounding ripping and tearing noises may occur as you open the mouth wide enough, but eventually that little flap will pop out from deep in the throat. It is what keeps food from going down your windpipe (trachea) most of the time. The **pharynx** is the cavity in the back of the mouth - it is the junction for food (esophagus) and air (trachea). You may see two **salivary glands** pop up here on either side of the throat.
Carefully lay the pig on one side in your dissecting pan and cut away the skin from the side of the face and upper neck to expose the masseter muscle that works the jaw, lymph nodes, and salivary glands. The salivary glands kind of look like chewing gum, and are often lost if you cut too deeply, so look for those two on either side first.

**Time to open up and bring home the bacon**

Place your fetal pig in the dissecting pan ventral side up. Use string to "hog-tie" your pig so that the legs are spread eagle and not in your way. Take about two feet of string, tie one end around a wrist, pass the string under the pan and tie the other end to the other wrist. Wrap string around the wrists as necessary to have both arms spread wide. Now do the same for the legs.

Use scalpel and scissors to cut through a skin layer and a muscle layer according to the diagram. Basically, you are turning your pig into a book. Cut across the chest from shoulder to shoulder, and across the lower belly from hip to hip. Now connect these with a cut up the middle that goes down to the umbilical cord and then around it on both sides. Do not remove the umbilical cord. Now you can open the left and right flaps of your pig-book and pin them down. After completing the cuts, locate the umbilical vein that leads from the umbilical cord to the liver. You will need to cut this vein in order to pull back the flap of skin with the umbilical cord and open up the abdominal cavity.

Your pig may be filled with water and preservative, drain over the sink if necessary and rinse organs. Be careful to turn the water on FIRST, then put the pig under it. Locate each of the organs below.

**Diaphragm.** This muscle divides the thoracic and abdominal cavity and is located right on top of the liver and under the lungs. It is connected to the body wall all the way around and you had to tear it a bit to open the body cavity. The diaphragm aids in breathing. The space above the diaphragm is the thoracic cavity, which holds the heart and lungs, and below it is the abdominal cavity which holds the liver, guts and other good stuff that they grind into sausage.
2. **Liver**. This structure is lobed and is the largest organ in the body. The liver is responsible for making bile for digestion and doing over a thousand different reactions.

3. **Gall bladder**. Pull the liver back toward the head and look on the surface of one of the lobes on the pig’s right for this teardrop shaped organ. The *bile duct* (4.) is a tube that attaches the gall bladder to the *duodenum* (the first part of the *small intestine*). It might be a slightly different color than the liver, but it might not. The gall bladder stores bile and sends it to the duodenum, via the bile duct.

5. **Stomach**. A pouch shaped organ that rests just underneath the liver to the pig’s left. At the top of the stomach, you’ll find the *esophagus* (1.), the tube from your throat to the stomach.

5. At each end of the stomach are valves that regulate food entering and leaving the stomach. At the esophagus end is the cardiac sphincter valve, and at the duodenum end is the *pyloric sphincter valve*.

The stomach leads to the small intestine (8.), which is composed of the *duodenum* (6.) (straight portion just after the stomach) and the ileum (curly part).

The ileum is held together by *mesentery*, which is clear membrane that you can see if you spread part of the intestine out with your fingers. See the blood vessels that are held in the mesentery? In the small intestine, further digestion occurs and nutrients are absorbed through the arteries in the mesentery.

7. **Pancreas**: a long, bumpy organ located along the underside of the stomach, between it and the duodenum; dig a little deep under the stomach to see it. It looks like the salivary glands (like chewing gum). A *pancreatic duct* leads to the duodenum. The pancreas makes insulin, which is necessary for the proper uptake of sugars from the blood, as well as many enzymes that it sends to the duodenum.

9. **Spleen**: a flattened, long and tapered organ that lies across the stomach and toward the extreme left side of the pig. It looks a lot like a lobe of the lung, so don’t be confused. The spleen stores blood and is not part of the digestive system.

10. At the end of the ileum, where it widens to become the *large intestine*, a "dead-end" branch is visible. This is the cecum. The cecum helps the pig digest plant material.

Warning!!! The pig’s large intestine looks a lot like the small intestine (unlike in you and I). The coils of the large intestine are help together more tightly than those of the small intestine, and the large intestine is more to the pig’s left side.

11. The *large intestine* (colon) can be traced to the *rectum* (12.). The rectum opens to the outside of the pig, at the *anus*; it is usually a bit greenish. There are two other tubes right in this area of the lower pelvis – the *aorta* and *vena cava*. The aorta is white or maybe a little pink, and the vena cava is blue. These colors come from latex paint that has been injected into the veins (blue) and arteries (red). The large intestine reabsorbs water from the digested food, any undigested food is stored in the rectum as feces.
Urinary and Reproductive Systems

Lying on either side of the spine are two bean shaped organs: the kidneys. They are covered by a mostly clear layer of tissue that makes it hard to see the three vessels attached to them at their central, medial side. If you take a probe and lightly start to scratch this tissue, you can slowly tease it away to uncover the kidneys and the vessels. There is a renal vein (blue) branching to each kidney from the vena cava, and a red renal artery branching from the aorta. The third tube is the ureter. It travels from the kidney toward the posterior end of the pig. The kidneys are responsible for removing harmful substances from the blood, these substances are excreted as urine. (more on this later).

13. Two umbilical arteries can be seen on either side of the flap that has the umbilical cord on its outside surface, and the flattened urinary bladder lies between them.

Male
1. Find the scrotal sacs at the posterior end of the pig (between the legs), testes are located in each sac. If your pig is young, the testes might not have descended into the scrotum, and you will find them up just below the posterior end of the kidneys. They will greatly resemble the ovaries in a female pig. They are homologous, right, so this should not be a surprise.
2. Sperm cells produced in the testes pass into a tube called the vas deferens, or sperm duct (in humans, a vasectomy involves cutting this tube).
3. The penis can be located by cutting away the outside skin on the flap near the umbilical cord. This tube-like structure eventually exits out the urogenital opening, also known as the urethra.

Female
4. In the female pig, locate two bean shaped ovaries located just posterior to the kidneys and connected to the curly oviducts.
5. Trace the oviducts toward the posterior to find that they merge at the uterus. Trace the uterus to the vagina. The vagina will actually will appear as a continuation of the uterus. It is pretty hard to expose the vagina through all the tissue around it, so do your best and look at the pictures.
Dissection of the Thoracic Cavity

You may need to cut through the pig’s sternum and expose the chest cavity (thoracic cavity) to view. Put one edge of the scissors under the posterior end of the sternum and lift as you cut. There are lots of things right under here, so cut carefully. You will need to cut all the way up into the pig’s neck, almost to the chin, and open the thoracic cavity. Identify each of the following organs.

1. Find the **diaphragm** again. Remember that the diaphragm separates the abdominal cavity from the thoracic cavity and it aids in breathing. Above the diaphragm, center of chest, is the heart.

2. With the probe, tease away the **pericardium**, which is a thin membrane that surrounds the heart.

3. The structures visible on the heart are the two **atria**, and the **ventricles** which are two chambers not visible from the outside.

4. The most obvious vessel on the top, front of the heart is the **pulmonary artery**. It curves upward right from the top of the heart and joins the **aorta** - a vessel which arches from the heart just dorsal to the pulmonary artery and curves around to go to the lower part of the body - where it is called the abdominal (dorsal) aorta. The aorta supplies the body with blood.

6. Anterior to the heart, the aorta branches into arteries - the common **carotid** up either side of the neck, and the **subclavian arteries**. The subclavians supply blood to the arms and follow the clavicle bone
8. Observe the **coronary arteries** on the outside of the heart going diagonally from the pig’s upper left to lower right - these vessels supply blood to the muscle of the heart.

10. Lift the heart to look on its dorsal side (toward the back), you should be able to see the anterior and posterior **vena cava**, which brings blood from the body back to the heart. Above the heart, you should also be able to find the left and right **jugular veins** that drain blood from the head and run parallel to the carotids, right up the left and right side of the neck.

11. Push the heart to the side to locate two spongy **lungs** located to the left and right side. The lungs are connected to bronchial tubes (not visible) which connect to the **trachea** (forming a Y).

Now comes one of the tougher parts to dissect.

From the heart to the chin, carefully tease back the skin and muscle just below it to see the throat region. If you are careful and lucky, you will see some **thymus gland** right below the muscle. The thymus is like the salivary glands and pancreas – kind of like bubble gum. It lays right on top of the **larynx**, **thyroid gland** and **trachea**. You can also see a patch of thyroid on the top half of the heart, right in the middle of the two atria.

12. Lying atop the trachea, locate the pinkish-brown, bean-shaped structure called the thyroid gland. This gland secretes hormones that control growth and metabolism. Move the thyroid off to the side to see the trachea. The trachea is easy to identify due to the cartilaginous rings, which help keep it from collapsing as your baby inhales and exhales. At the anterior (toward head) of the trachea, you can find the hard light colored larynx (or voice box). The larynx allows the pig to produce sounds - grunts and oinks, or words in Wilbur’s case. Now go back down to the lower regions near the pelvis.
Fetal Pig - Dissection of the Lower Arteries

1. Trace the abdominal aorta (also called the dorsal aorta) to the lower part of the body, careful tweezing of the tissue will reveal several places where it branches, though some of the arteries may have been cut when you removed organs of the digestive system.

4. The renal arteries lead to the kidney.

7. The abdominal aorta splits into two large vessels that lead to each leg - the femoral arteries.
Now let’s see what kind of brain your pig has!

Nervous system

1. Peel the skin off the skull using a scalpel and/or scissors, cutting around like the edges of a hat.
2. Starting near the ear, put one point of the scissors against the skull and start twisting it until you penetrate the skull bone just barely.
3. With just that one point of the scissors underneath the skull, but just barely, lift and use small snips to cut all the way around so that you can remove the skull like it was a ski cap. Don’t cut too deep or you will damage the meninges, the membranes that surround the brain and spinal cord.

Locate the cerebellum, cerebrum, medulla oblongata and spinal cord.