

Name \_\_\_\_\_ Date \_\_\_\_\_



## Gen Bio 2 Lab# 11: Mammalian Vertebrates & Forensic Dissection of a Fetal Pig

### **Pre-Lab Vocabulary:**

1. Dorsal side –
2. Ventral side –
3. Anterior –
4. Posterior –
5. Lateral –
6. Medial –
7. Proximal -
8. Distal –
9. genitalia-
10. pulmonary-
11. Coronary –

### **Pre-Lab Reading:**

You will examine a fetal pig using the protocol of a human autopsy. The anatomy of a fetal pig is very similar to human anatomy. The pig's external features such as birth marks, hair, and skin, and internal features such as organs, systems and tissues are much like those of a human. Autopsy is a Greek word meaning "to see with one's own eyes," and there are two types of human autopsies: 1) clinical which is done in a hospital to determine the cause of death, usually for research or due to a family request, and 2) forensic which is done for legal purposes when 'foul play' is suspected (think CSI). You are now a forensic pathologist (someone who studies/determines the cause(s) of death by closely inspecting tissue morphology) and you will be conducting an autopsy on your piglet. A forensic pathologist has graduated from medical school

and completed a residency (4-6 years of training in pathology and forensic pathology) which qualifies them to sit for a board exam. The information you obtain from the autopsy would normally be admitted as state's evidence in a court of law for convicting person(s) responsible for the victim's death. Upon passing the exam, they become referred to as 'board certified' in forensic pathology.

You will examine the body with upmost care and professionalism, recording all of the minute details of what is seen externally and internally that would have caused the pig's death. As you conduct your investigation, you will **remove all of the organ systems from the body cavity**. This will give 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. **You will also weigh and measure each organ and record the data.** You will conclude your investigation by placing all of the organs and tissues back into the body cavity. You will then suture the incision with a suture needle and thread. In the real world, the human body would then be sent to the mortuary, where it would be embalmed and dressed for public viewing or cremated without embalming.

**Procedure 1:** Observe vertebrate skull and brain structures through evolutionary time: fish (Carp), amphibian (Frog), reptile (Turtle), bird (Chicken), and mammal (Rabbit). **What changes/alterations do you observe between vertebrate phyla?**

**Procedure 2:** Observe vertebrate heart structures through evolutionary time: fish (Perch), amphibian (Leopard Frog), reptile (Snake), bird (Pigeon), and mammal (Pig). **What changes/alterations do you observe between vertebrate phyla?**

**Procedure 3:** Observe preserved mammals: Whole-mount white lab mouse (*Mus musculus*) and dissected Wistar white lab rat (*Ratus norvegicus*). **Compare the rat internal anatomy to the dissected pig. What similarities do you see?**

**Procedure 4:** Observe embryonic pigs (*Sus domesticus*): Biosmount plastic = 6mm (~15 days), 8mm (~20 days), 10mm (~30 days), 15mm (~45 days), preserved specimen in plastic bottle: 6cm (~59 days), preserved specimen with placenta: 9.5cm (~62 days), and dissected preserved specimen: 25cm (~100 days). **What changes do you see as development progresses?**

**Procedure 5:** Observe X-rays of additional mammals: European rabbit (glands under the chin generate a secretion marking underground territory), Common marmoset (tropical rainforests of South America) & Infant kangaroo (aka Joey, crawls into mother's marsupium after only 33 days of gestation). **What major differences in skeletal arrangement or organization stand out to you among the 3 different mammals?**

## **Procedure 6: Fetal Pig dissection**

(All notes must be made next to the references for examination) \*If procedures tell you to examine, you must write down what you see.

1. Equipment you will need:

- Dissecting pans
- Paper towels to place in the pan
- Fetal pig
- Dissecting equipment: probe, scalpel, scissors, pins
- 2 x 25 cm of string/twine
- Sewing needle & 20 cm of waxed twine
- Apron
- Gloves

2. Rinse your pig under a low stream of water near the bottom of the sink.

3. Measure the length of the pig from the tip of the nose to the base of the tail. The age of your fetal pig from conception can be determined from the overall length. See the following table.

Size: \_\_\_\_\_ Approximate age: \_\_\_\_\_

**Length of Specimen Approximate Age in Days from Fertilization**

- 4 cm 56 days
- 20 cm 75 days
- 25 cm 100 days
- 30 cm 112 – 115 days (full term)

4. Use the following orientation terms when describing the location of external and internal features:

- Dorsal side (back)
- Ventral side (stomach)
- Anterior (towards the head)
- Posterior (towards the butt)
- Lateral (left and right sides)
- Medial (towards the middle)
- Proximal (closer aspect)
- Distal (aspect further away)

5. Examine the external features of your pig beginning with the head. What is the color of the hair, any birthmarks noticeable, or other markings? \_\_\_\_\_

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6. Examine the mouth, nostrils, tongue, ears and eyes. \_\_\_\_\_

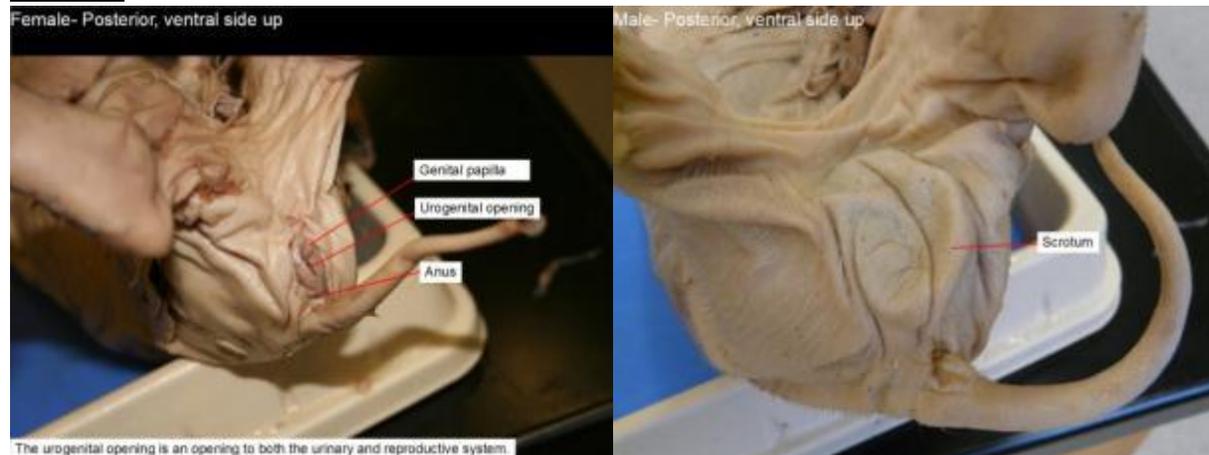
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7. Examine the feet and describe how this animal would walk and run. \_\_\_\_\_

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8. Determine the sex of your pig by locating the external genitalia. See Figure 1.

**Figure 1**



9. Place the pig in the dissecting tray on its back.

10. Pull open the front legs as far as you can, tie one in of the string around right front leg, loop the string under the dissection pan and tie the other end of the string to the left front leg. Make sure you pull tightly spreading the front legs as much as possible.

11. Repeat the process with the hind legs. See Figure 2.

**Figure 2**

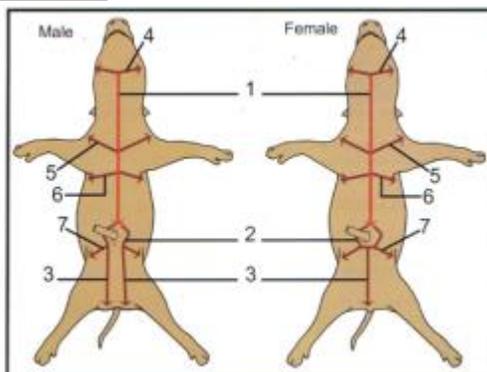


12. With a scalpel, make a Y-shaped incision. The arms of the Y start from the top of each shoulder anterior to the front legs and come down to the sternum, which is directly over the heart between the front legs. The incision should be just deep enough to cut through the muscular chest wall.

13. Cut away the tissue and pull the flap back toward the nose until the protruding larynx is exposed. What organ system does the larynx belong to? \_\_\_\_\_

14. Continue to cut the tail of the Y down the middle of the abdomen to the top of the umbilical cord. *If the pig is male*, cut a semicircle around the anterior portion of the umbilical cord, then cut straight down on each side of the abdomen. *If the pig is female*, the incision should circle the entire umbilical cord, and then with a single cut, continue straight down. See Figure 3.

**Figure 3**

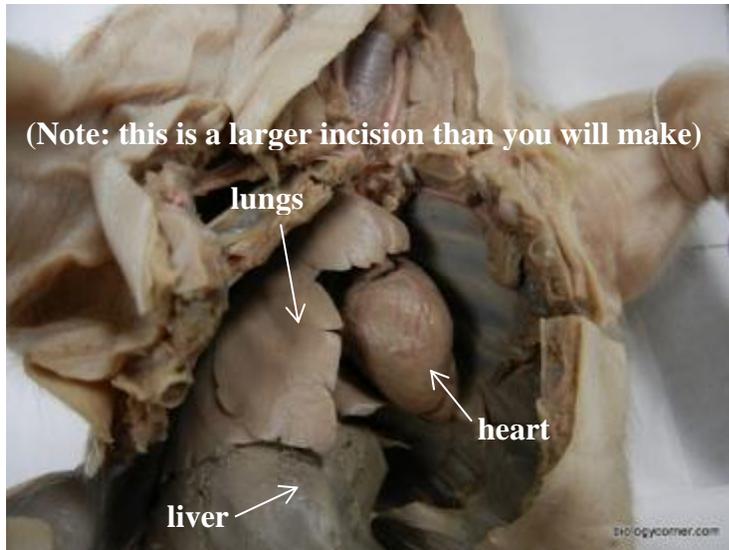


15. Cut the skin, muscle, and soft tissues of the chest wall on top and on both sides to expose the chest plate (sternum and rib cage).

16. With dissecting scissors, start at the bottom of the ribcage and cut the ribs in half going up the right and left sides of the sternum.

17. The chest plate can now be lifted up. Remove the chest plate and expose the heart, lungs, and liver as shown Figure 4.

**Figure 4**



18. All of the organs of the trunk can now be removed in ‘one block.’ Use a scalpel to free the larynx and esophagus. Make a cut just below the larynx and pull the attached trachea downward. Detach the chest organs from the spine with your scalpel.

19. Cut the diaphragm away from the body cavity and pull the abdominal organs out and down. The only remaining attachments to the organs are pelvic ligaments, the bladder, and the rectum. These can be severed with a scalpel or scissors, and then all the organs can be removed in one block. See Figure 5.

**Figure 5**



20. Place the entire block of organs in the dissecting pan. Note how all the organs are connected and how their symmetry allows for a perfect fit in the body cavity. How long do you think it would take for evolution via adaptation to get this design correct? (Look up the pig evolutionary tree for this question)

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**Respiratory system:**

21. 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 \_\_\_\_\_ lobes and the left lung should have \_\_\_\_\_ lobes.

22. Locate the esophagus, which is flat when it does not contain food. Separate it from the rest of the chest organs using a blunt probe.

23. Can you find the thymus on either side of the trachea? \_\_\_\_\_ It is an endocrine gland involved in the immune system during infancy.

24. Ventral to the thymus and dorsal to the trachea is a small reddish brown oval structure. This is the thyroid. It regulates metabolic rates.

25. The diaphragm is located just above the liver. This is a curved muscle that separates the thorax from the abdomen and is responsible for breathing. As it contracts and moves downward the chest cavity expands and the lungs fill with air. As it relaxes and moves up, it forces air out of the lungs.

26. Cut the left and right lobes of the lungs from the bronchi with your dissecting scissors, measure, weigh the right lobes and record your data here. \_\_\_\_\_

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27. Why is it necessary for the trachea to have rings of cartilage on its walls? \_\_\_\_\_

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28. Why do the lungs have a large number of blood vessels? \_\_\_\_\_

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**Circulatory system:**

29. 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.

30. 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 are the arteries in humans that are bypassed during bypass surgery. They will often replace them with veins from the patient's leg.

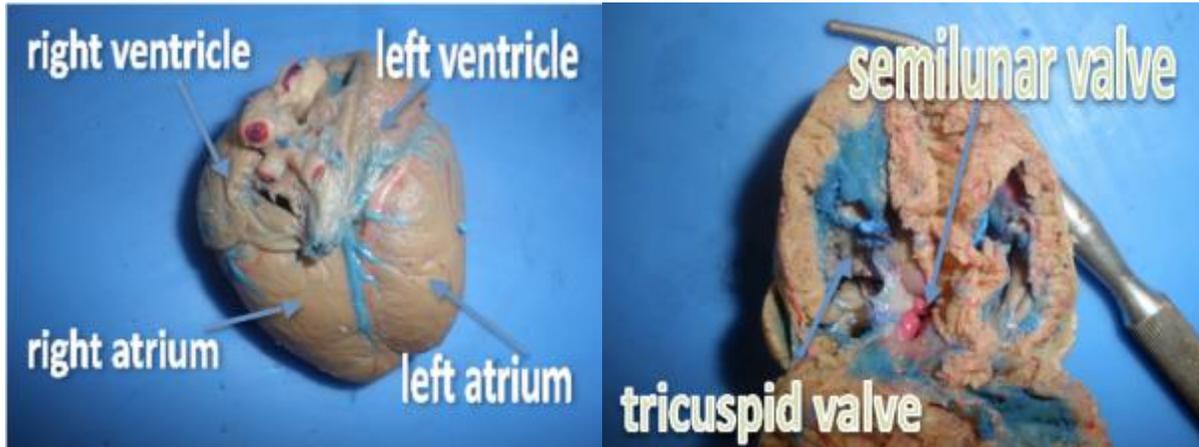
31. Cut all the arteries and veins surrounding the heart and remove it. Measure the length of the heart in cm and the weight in grams. Record the data here: \_\_\_\_\_

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32. Orient the heart as shown in Figure 6. Make a cross section cut of the heart to expose the four chambers. Can you find the sections labeled in the picture? \_\_\_\_\_

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**Figure 6**



33. 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 then the blood passes through the mitral valve and into the left ventricle. *The left ventricle pumps oxygenated blood* through the aortic valve, into the aorta, and out to the body.

34. What are the blocked arteries called that are bypassed in humans by using veins from the patient's legs:

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**Digestive system:**

35. 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.

36. Dorsal to the right lobe is a small, green sac-like structure called the gall bladder. This stores bile produced by the liver. Bile is secreted into the small intestine to emulsify fat. Detach the gall bladder, measure its length, weigh it and record the data here:

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37. Remove the liver for weighing. Record the weight here: \_\_\_\_\_

38. Now you can see the stomach and spleen. The spleen is a 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. Remove the spleen, measure its length, weigh it and record the data here:

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39. Trace the path of the esophagus down to where it enters the upper section of the stomach known as the cardiac region. Remove the stomach by cutting the esophagus just above the cardiac region and cutting the small intestine just below the end of the stomach. Measure the length and weight of the stomach and record the data here:

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40. Lift the upper end of the small intestine. Lying ventrally to the small intestine is the pancreas, which is lighter in color than the stomach or intestines. The pancreas is an endocrine gland that produces pancreatic juice and the hormones insulin, glucagon, and somatostatin. Insulin decreases blood sugar and glucagon increases it to help regulate blood sugar levels. Somatostatin inhibits the release of both of these hormones.

41. The small intestine has three main sections – the duodenum (adjacent to the stomach), the jejunum (middle section), and the ileum (the end).

42. Look just below the junction of the small and large intestine. Notice the caecum (the large pouch-like structure). The bacteria in this structure secrete the enzyme cellulase, which helps to digest cellulose from plant material. These are similar to the protozoans in the digestive system of termites. Humans do not have this structure. We do have an appendix that aids our immune system.

43. To remove the small intestine, cut it away with the pancreas. Weigh the small intestine and record that here: \_\_\_\_\_

### **Urogenital System**

44. You should now be able to see the kidneys that normally lie on the dorsal wall on both sides of the spine.

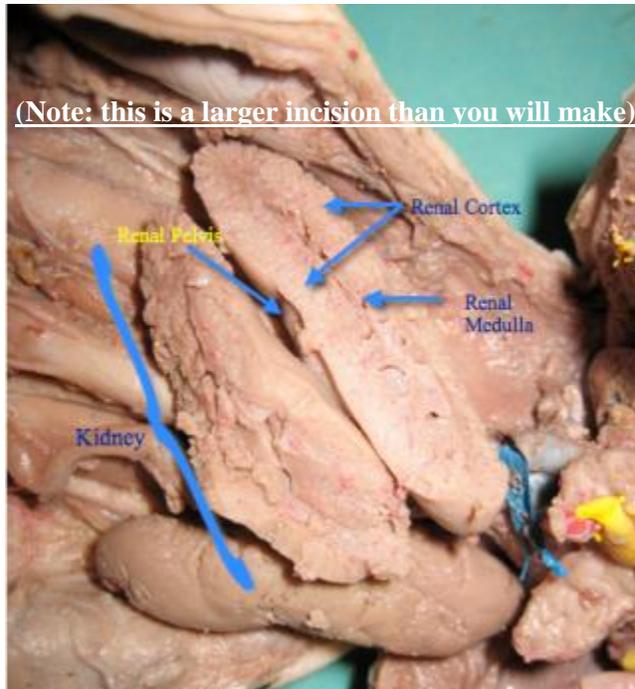
2. Remove each kidney by cutting the ureter, as it exits the kidney. Weigh the left and right kidney, measure the lengths, and record the data. Do they both have the same weight and length?

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3. Cut one kidney in half longitudinally from the anterior to the posterior end, you should be able to see three distinct regions - the renal pelvis (funnel like structure exiting the kidney) the medulla (dark tissue in the center), and the cortex (tissue in the outer rim). See Figure 7. The cortex and medulla contain nephrons which filter the blood to regulate the optimum amount of salts and water.

**Figure 7**



**\*\*In your opinion, what caused poor Wilbur's demise? What clues led you to this conclusion?**

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### **The Final Steps**

1. The final steps of a human autopsy include the placement of all the organs back into the body cavity, not necessarily in their original locations, or to incinerate the organs and pack the body cavity with filler material. The idea is to give the body cavity a normal shape for viewing at a mortuary.
2. You will follow the protocol of placing all of the organs back into the body cavity (thorax and abdomen), arranging them to approximate the original body shape, suturing the "Y" incision, editing and filing your autopsy report, and disposing of the specimen.
3. Thread your suture needle (caution, sharp tip) with 20cm of waxed thread (provided). Divide the line into two equal portions and tie a knot at the open ends. Starting at the bottom of the Y incision, insert the needle into either side of the incision and start a "running stitch" with over and under stitches on both sides, like baseball stitches. Pull the incision closed as you work along the opening. At the end of the incision pull the string taut and tie another knot. Cut off any remaining string.

4. Wrap 'Wilber' in a funeral shroud of paper towels and place him in the class disposal bag.

