LAB PART 5- THE FETAL PIG - EXCRETORY SYSTEM

Procedure 59  To study the excretory system, we will return to the abdominal cavity. In examining the dorsal body wall you will find 2 bean shaped structures - the kidneys. Although they bulge into the abdominal cavity, they actually lie dorsal to it, against the ventral surface of the back muscles.

Observation 39  Describe the shape of the kidneys.

Procedure 60  In examining the kidney, one should notice that a thin layer of tissue (epithelium) covers the ventral surface of the kidneys. PEEL off this protective membrane and you should be able to see the renal artery carrying blood to the kidneys and the renal vein carrying blood away. (Any time you see the word “Renal” it is referring to the kidneys.)

Observation 40  How are you able to distinguish between the renal artery and renal vein?

Procedure 61  Examine the kidney again to find a tube located at the posterior end of the kidney leading from the kidney to the bladder - this is called the ureter. Trace the ureter posteriorly along the muscles of the back to see where it enters the urinary bladder.

Observation 41  Were you able to find and follow the ureters?

Procedure 62  Examine the flap of tissue that is folded back between the hind legs. In both males and females, the urinary bladder is found on the ventral surface just beneath the umbilical cord situated between the 2 umbilical arteries

Observation 42  Describe what the urinary bladder looks like.

Procedure 63  Remove one of the kidneys and cut it right in half so each half is like a pancake. Examine this cross sectional cut of the kidney

Observation 43  Is there any evidence of blood vessels in the kidney?

LAB PART 6- THE FETAL PIG - REPRODUCTIVE SYSTEM

Procedure 64  Although you will dissect the reproductive system of only one sex, you should study the opposite sex on another student’s specimen.

Procedure 65  Dissection directions are the same for both sexes. With a razor blade, cut through the cartilage of the pelvic girdle and lay the legs out flat. Look for and identify the following structures:
PIG LAB PT 5 to 7 - INTERNAL EXAM CONT.-EXCRETORY, REPRODUCTIVE AND NERVOUS SYSTEMS

Female

a. Ovaries. Small, bean shaped, light yellow or whitish bodies in the lower end of the abdominal cavity. They are suspended by mesentery. Ovaries produce eggs (female gametes) and hormones.

b. Uterine tubes and horns. Very small coiled tubes lying on the dorsal surface. These tubes carry the eggs to the uterus. If the egg is to be fertilized, fertilization occurs in this tube.

c. Uterus. Union of the uterine horns. This is where the fetus develops.

d. Vagina. The two uteri unite and just below this junction you will find the vagina - the birth canal through which the fetus must pass to be born.

e. Urogenital sinus. Just underneath the tail, you will find the urogenital opening - a common passageway for the urinary and genital systems.

Male

a. Urogenital opening. An opening located just beneath the umbilical cord through which urine or sperm may pass.

b. Penis. A long muscular tube through which urine or sperm passes. The penis is found on the ventral flap of skin located between the legs. It is on the opposite side of the flap from the umbilical arteries.

c. Testes. Carefully remove tissue in the area of the hind legs on either side of your incision. Embedded within this tissue on either side is an elongated, dark colored sac into which the testes descend during embryonic development. The testes are probably located within these sacs. Testes produce sperm (male gametes) and hormones.

Observation 44 Which of the reproductive structures were you able to identify?

LAB PART 7- THE FETAL PIG - NERVOUS SYSTEM

Procedure 66 OPTIONAL - BRAIN EXAMINATION. See Ms. M for instructions

Questions:
45. Explain the function of the kidney.
46. What is the function of the renal arteries and renal veins?
47. What is the function of the ureter?
48. What is the function of the urinary bladder?
49. What is the function of the urethra?
50. State in chart form the functions of the reproductive organs for your particular pig (Consult your lab procedure- you may exclude the urogenital sinus).
51. One more time! Analyze how the excretory system meets the definition of a system using all 7 of the systems principles. Be specific- give examples for each principle. (By now you should be writing an essay style answer organized into paragraphs. Each system principle should be illustrated by an example related to the excretory system.
How does the urinary system work?
(http://kidney.niddk.nih.gov/kudiseases/pubs/yoururinary/)

Your body takes nutrients from food and uses them to maintain all bodily functions including energy and self-repair. After your body has taken what it needs from the food, waste products are left behind in the blood and in the bowel. The urinary system works with the lungs, skin, and intestines—all of which also excrete wastes—to keep the chemicals and water in your body balanced. Adults eliminate about a quart and a half of urine each day. The amount depends on many factors, especially the amounts of fluid and food a person consumes and how much fluid is lost through sweat and breathing. Certain types of medications can also affect the amount of urine eliminated.

The urinary system removes a type of waste called urea from your blood. Urea is produced when foods containing protein, such as meat, poultry, and certain vegetables, are broken down in the body. Urea is carried in the bloodstream to the kidneys.

The kidneys are bean-shaped organs about the size of your fists. They are near the middle of the back, just below the rib cage. The kidneys remove urea from the blood through tiny filtering units called nephrons. Each nephron consists of a ball formed of small blood capillaries, called a glomerulus, and a small tube called a renal tubule. Urea, together with water and other waste substances, forms the urine as it passes through the nephrons and down the renal tubules of the kidney.

From the kidneys, urine travels down two thin tubes called ureters to the bladder. The ureters are about 8 to 10 inches long. Muscles in the ureter walls constantly tighten and relax to force urine downward away from the kidneys. If urine is allowed to stand still, or back up, a kidney infection can develop. Small amounts of urine are emptied into the bladder from the ureters about every 10 to 15 seconds.

The bladder is a hollow muscular organ shaped like a balloon. It sits in your pelvis and is held in place by ligaments attached to other organs and the pelvic bones. The bladder stores urine until you are ready to go to the bathroom to empty it. It swells into a round shape when it is full and gets smaller when empty. If the urinary system is healthy, the bladder can hold up to 16 ounces (2 cups) of urine comfortably for 2 to 5 hours.

Circular muscles called sphincters help keep urine from leaking. The sphincter muscles close tightly like a rubber band around the opening of the bladder into the urethra, the tube that allows urine to pass outside the body.

Nerves in the bladder tell you when it is time to urinate, or empty your bladder. As the bladder first fills with urine, you may notice a feeling that you need to urinate. The sensation to urinate becomes stronger as the bladder continues to fill and reaches its limit. At that point, nerves from the bladder send a message to the brain that the bladder is full, and your urge to empty your bladder intensifies.

When you urinate, the brain signals the bladder muscles to tighten, squeezing urine out of the bladder. At the same time, the brain signals the sphincter muscles to relax. As these muscles relax, urine exits the bladder through the urethra. When all the signals occur in the correct order, normal urination occurs.
The bean-shaped kidneys (Fig. 11) perform two functions. First, they continuously remove metabolic wastes from the blood (primarily urea resulting from the metabolism of amino acids in the liver). Second, they monitor and adjust the composition of the blood (particularly water and salts) so that the cells of the body are bathed in a fluid of constant composition. Although the kidneys are situated below the diaphragm, they are actually located outside the peritoneal cavity (dorsal to the parietal peritoneum, the membrane that lines the abdominal cavity). Carefully cut one of the kidneys in half longitudinally (slice it as though you were separating the two halves of a lima bean). Within the kidney, the ureter expands to form a funnel-shaped chamber called the renal pelvis. The dark kidney tissue that you see extending into the renal pelvis is known as medullary tissue (medulla). The outermost portion of the kidney is called the cortex. The cortex contains glomeruli, Bowman's capsules, proximal convoluted tubules, and distal convoluted tubules. The medulla contains the loops of Henle and the collecting ducts. The medulla is characterized by high solute concentration, so when "pre-urine" flows down the loops of Henle, water flows out of the loops and into the medullary tissue. The net result of this (and a few other processes of the medulla) is that the "urine" becomes increasingly concentrated. In humans, the kidneys filter 1500 liters of blood a day, producing only about 1.5 liters of urine in that time.

The renal pelvis of each kidney drains into a coiled tube called the ureter. The ureters lead from the kidney to the urinary bladder, where urine is temporarily stored. Note the unusual shape (elongated) and location (between the umbilical arteries) of the urinary bladder in your fetal pig. In fact it extends into the umbilical cord! Urine produced by the fetus actually bypasses the urethra (the tube that transports urine from the bladder to the outside of the body). If a fetus urinated in an adult manner, the amniotic sac would soon be fouled with toxic nitrogenous wastes (urea is toxic). Instead, urine produced by the fetus proceeds from the bladder through the allantoic duct and to the allantois (a special sac for nitrogenous wastes). But remember that most nitrogenous wastes are transported to the placenta via the umbilical arteries. However, even in reptiles and birds, the allantois takes on a dual function. In addition to storing nitrogenous wastes, it fuses with the chorion to create a vascularized membrane that mediates gas exchange. In mammals, this latter diffusion function takes place in conjunction with the placenta, as does nutritional exchange and waste removal. In both pigs and humans, the allantoic duct collapses at birth and urine flows from the bladder into the urethra.

To follow the urethra to the urogenital opening, you will have to also examine the reproductive system, as they are linked together. Examine the urogenital system in your pig. Then examine a pig of the opposite sex. You are responsible for both male and female anatomy.

To examine the urethra and the reproductive structures fully, you will need to carefully cut through the pelvis (pubic bone or pubis) of your pig. Make sure you keep your cut slightly to the left or right of the midline to avoid cutting important structures.