9. THE URINARY SYSTEM AND URINALYSIS

Station 1: Organs of the Urinary System

References: ***Lab Manual, Exercise 35, p. 192-193 and complete Fig. 35.1, p. 192.***
Textbook, p. 792-793 and 816-820 and Fig 20.1, p. 793.
Workbook, p. 263, #1, p. 264, #2, p. 271, #16, and p. 272, #17.

On the model of the urinary organs:

Q1A. The kidneys are located behind the parietal peritoneum against the deep muscles of the back. What word describes this location?

Q1B. What holds the kidneys in place?

Q2A. Which letter identifies a structure made of transitional epithelium that expands and contracts with urine volume? Name it. Name the tube that removes urine from it. Which letter identifies the tube?

Q2B. Which letter identifies a structure that receives urine from the kidneys and transports it by peristalsis? Name it. What is its expanded upper end called?

Station 2: Kidney Anatomy

References: ***Lab Manual, p. 193 and complete Fig. 35.2, p. 193.***
Textbook, p. 792-793 and Fig. 20.4, p. 795.
Workbook, p. 265, #3 and p. 266, #4.

Q3A. Which letter identifies the fibrous connective tissue layer that protects the kidney? Name it. Color it purple on Fig. 15-2, p. 265 in your workbook.

Q3B. What is found on the outside of the layer in Q3A that further protects and supports the kidney?

Q4A. The kidney is divided into two areas. Which letter identifies an area that is richly supplied with blood vessels to feed the nephrons that are forming urine? Name it. Label this area and color it yellow on Fig. 15-2, p. 265.

Q4B. Extensions of the area named in Q4A extend down into the other area of the kidney, separating its parts. Which letter identifies these extensions? Name them and color them yellow also on Fig. 15-2.

Q5A. Which letter identifies the inner area of the kidney? Name it. Why does this area appear striated?

Q5B. Which letter identifies cone-shaped masses that fill the area in Q5A? Name them. Color them orange on Fig. 15-2, p. 265. What is found at their tip?

Q6A. Which letter identifies short tubes that carry away urine to be removed from the body? Name them. Color them blue on Fig. 15-2, p. 265.

Q6B. Which letter identifies the funnel-shaped collecting chamber that drains urine into the ureter? Name it. Color it pink on Fig. 15-2, p. 265.

On the Preserved Kidney:

Observe the preserved kidney. The same letters are used to identify the structures named in Q4a-6b. Make sure you can identify these structures on models and the preserved kidney.

Station 3: The Nephron

References: ***Lab Manual, p. 194 and complete Fig. 35.3, p. 194.***
Textbook, p. 796-802 and Fig. 20.10, p. 799.
Workbook, p. 266, #5.

On the nephron model:

Q7A. Which letter identifies the structure where filtration occurs? Name it. Label it on Fig. 15-3, p. 267 in your workbook.

Q7B. The structure in Q7A is made of two parts, one contributed by the circulatory system and one that is a part of the nephron. What two letters identify these parts? Name them. Color the circulatory part red and the nephron part pink on Fig. 15-3, p. 267.

Q8A. The nephrons in the kidney may be divided into two groups. About 80% of them belong to one group. Name this group. Which letter on the lab table identifies a nephron of this group?

Q8B. The other group of nephrons is important in regulating water balance in the body. Name this group. Which letter on the lab table identifies a nephron of this group?

Q9A. The remainder of the nephron is composed of renal tubule. The renal tubule is divided into three parts. Name these parts. What three letters identify them on the lab table? Label them on Fig. 15-3, p. 267.

Q9B. Once the urine leaves the nephron it enters a tubule which runs through the medulla of the kidney. Which letter identifies this tubule on the lab table? Name it. Color it orange on Fig. 15-3, p. 267.

Station 4: Urine Formation

References: ***Lab Manual, p. 194-195.***
Textbook, p. 802-815.
Workbook, p. 269, #7 and #8.

Q10A. Urine formation consists of three processes: filtration, reabsorption, and secretion. Which letter identifies the part of the nephron where filtration occurs? Name it. Draw purple arrows on p. 267 in your workbook to indicate the direction of filtration.

Q10B. What is the fluid produced as a result of filtration called? What structure does it drain into? Which letter identifies this structure on the model?

Q11A. What system described in your text regulates filtration? What structure controls this by sensing the concentration of sodium in the nephron fluids?

Q11B. Most tubular reabsorption occurs in one part of the renal tubule. Which part is it? Which letter identifies it on the model? On Fig. 15-3, p. 267, draw blue arrows between the structure you named and the peritubular capillaries surrounding the nephron to indicate the direction of reabsorption.

Q12A. Which letter on the model shows where potassium ions may be secreted into urine? Name this structure. What hormone controls the secretion of potassium? Draw green arrows on p. 267 to show the direction of secretion between the structure you named and the peritubular capillaries surrounding the nephron.

Q12B. The structure named in Q12A is also affected by a hormone that controls water balance in the body. Name this hormone. From what gland is it produced?

Q13A. Which letter on the model identifies a structure that is responsible for the countercurrent mechanism? Name it. What does the countercurrent mechanism regulate?

Q13B. One of the main secretory products of the nephron is hydrogen ions. What effect will this concentration of hydrogen ions have on the urine?

Station 5: Urinalysis

References: ***Lab Manual, Exercise 36, p. 196-199. Study Table 36.1 and 36.2, p. 196.***
Textbook, p. 815-816.
Workbook, p. 270, #9, #10, #11, and #12, and p. 271, #13 and #14.

Q14A. What is the normal range for urine output for 24 hours? Name a condition that could cause this to change.

Q14B. What is the most abundant organic product in urine, and what is the most abundant inorganic product in urine?

Q15A. What color is normal urine? What pigment gives urine this color?

Q15B. What is turbidity? Is fresh, normal urine turbid?

Collect a sample of fresh urine for analysis. Samples should be collected in the provided urine cups and should contain about 60 ml of urine. Read the instructions for this analysis carefully and do not discard any urine until you are finished with it at the end of the lab. When you are finished with equipment used to measure characteristics of your urine, clean those items with soap and water and sterilize them with disinfectant spray. **WEAR GLOVES DURING THIS LAB EXERCISE.**

Choose a sample of unknown urine from the selection on the lab table. Write the letter of the urine sample you use at the top of your lab report.

Using a separate Multistix or Combistix for your sample and for the unknown sample, dip the test stick into your urine. After 30 seconds, begin reading the test results. Start with Glucose, then Bilirubin, then Ketone, Specific Gravity, blood pH, Protein, Urobilinogen, Nitrite, and Leukocytes. Note any abnormalities in your urine. Repeat the process with the unknown urine sample that you chose.

Q16A: List any areas that reported out of normal range for your urine sample.
Q16B: List any areas that reported out of normal range for your unknown urine sample.
Q17A. Was your specific gravity normal? Concentrated urine has a (high/low) specific gravity.
Q17B. Dilute urine has a (high/low) solute content and therefore it has a (high/low) specific gravity.
Q18A. What was your urine pH? How would a diet high in proteins affect urine pH?
Q18B. Did your urine contain glucose? What might cause a temporary nonpathogenic appearance of glucose in urine?
Q19A. Did your urine contain ketones? What nutrient produces ketones when incompletely metabolized?
Q19B. Did your urine contain leukocytes? Why might leukocytes appear in the urine?

Return your unknown urine sample to the beginning of this station.
Dispose of your personal urine sample by pouring it down the sink with lots of water.

Station 6: Microscopic Analysis

Your lab instructor will operate the centrifuge for you at this station.

1. Four different students should donate their urine samples (not the unknown sample) to be centrifuged. *Do not attempt to operate the centrifuge yourself.* After the samples have been centrifuged, a small pellet will be formed in the bottom of each test tube.
2. Pour off the supernatant (the top liquid).
3. Add 1 drop of Sedistain to the test tube.
4. Mix the stain by tapping the end of the test tube.
5. Place 1-2 drops of the solution from the test tube onto a slide using a disposable dropper.
6. Cover specimen with a cover slip and observe the specimen under the microscope.
7. Use the Atlas on the lab table and Fig. 36.1, p. 199 in your lab manual, to identify crystals, cells, and casts observed in the specimen.
8. Throw away the disposable dropper.
9. Discard your urine sample in the sink and rinse the drain with water.
10. Clean the test tubes as directed.

Q20A. Give one example of a pathogenic cause of bacteriuria.
Q20B. What are CASTS?

Q21: CLINICAL APPLICATION THOUGHT QUESTION: (Answer at the bottom of your lab report.)

Parents of a newborn are shocked when they change their baby's diaper for the first time and see blue urine. What is this condition? Relating this to metabolic processes, why is it occuring?

Turn in p. 265 and 267 from your workbook with this lab report.