



Chapter 38 Project

Urine Trouble

Project Goal + Timeline

Elimination of nitrogenous waste is a critical issue for many multicellular organisms. Our body accomplishes this elimination, and much more, via the urinary system. For example, the urinary system removes urea (a nitrogenous waste product), regulates ion concentration, and maintains water balance within the body. Because of the essential functions performed by the urinary system, minor alterations to the system can result in impacts throughout the whole body.

Sometimes, the best way to understand a system is to find ways to challenge or disrupt it. Here, you will do that with the urinary system. The goal will be to make changes to the structure and function of the human urinary system at molecular, cellular, and tissue levels, and apply your knowledge from the chapter to predict the effects of these changes in isolation or when occurring together. This project should be completed on your own or with a partner and should take between one and two hours to complete.

Directions

Part 1: Molecular Change

Propose a molecular or biochemical change to the urinary system. This could be a change to the enzymes in the urea cycle, to the transport proteins in the cells (such as aquaporins), or to other molecular components.

1. What are you changing and how?
2. What is the normal function of the component you changed?
3. How would your change affect the overall function of the urinary system? What broader impacts would the change have on host physiology?

Part 2: Cellular or Tissue Change

Propose a change to the structure of cells and tissues that make up the nephron.

1. What are you changing and how? Draw a depiction both of a normal nephron and the altered version you have created.
2. What is the normal function of the component you changed?
3. How would your change affect the overall function of the urinary system? What broader impacts would the change have on host physiology?

Part 3: Organ or Organ System Change

Propose a change to the structure of the tissues in the kidney or a change to the entirety of the urinary system.

1. What are you changing and how? Draw how you have rearranged the tissues and/or organs involved.
2. What is the normal function of the component you changed?
3. How would your change affect the overall function of the urinary system? What broader impacts would the change have on host physiology?

Part 4: Cumulative Changes

Now, consider how your changes occurring in tandem or all together could affect human physiology. Fill out Table 1 by first describing the effect each of your proposed changes in isolation has on the physiological parameters given in the table. You can also provide additional physiological parameters that may be affected by the changes. Then, consider the effect of pairs of two of these changes occurring in tandem. Finally, consider the effects of all three of these changes occurring.

TABLE 1: Effect of Urinary System Changes on Physiological Functions

Changes	Removal of Nitrogen	Removal of Salts and Wastes	Blood Pressure	Other Physiological Parameters
Molecular				
Cell/Tissue				
Organ/Organ System				
Molecular & Cell/Tissue				
Molecular & Organ/Organ System				
Cell/Tissue & Organ/Organ System				
Molecular & Cell/Tissue, & Organ/Organ System				

Now, consider one or more of your proposed changes.

1. Compare and contrast your proposed change(s) with an excretory system found in another animal. Does the change make the human urinary system more similar to another type of excretory system?

Project Materials

- Project worksheet
- Pen or pencil

Student Checklist

- ☐ Complete Part 1 questions
- ☐ Complete Part 2 questions
- ☐ Complete Part 3 questions
- ☐ Complete Table 1
- ☐ Complete Part 4 question