STUDENT GUIDE
EXPLORE 2 LESSON 11

Food and Agriculture Center for Science Education

Part 1: Our Motivation

Record the question(s) that you want to investigate.

Part 2: Analyzing Data About Urine Color

What experiences do you have with a change in your urine color? When does it seem to happen the most?

Analyze the data set in the Urinalysis handout that shows changes to urine color before and after exercise. What changes to urine color happened to the population in this study? How does this compare to what we saw in our Module Phenomenon?

Observe the demonstration with food coloring in water that your teacher shares.

- What do you notice that results in the change in the color of the simulated urine?
- What do you think this model can tell us about what happens to urine when exercising and when drinking milk to recover after exercise?

Part 3: Analyzing Data on Changes to the Water Content of Blood During Exercise

Working in pairs, analyze the following experiment design and data collected.

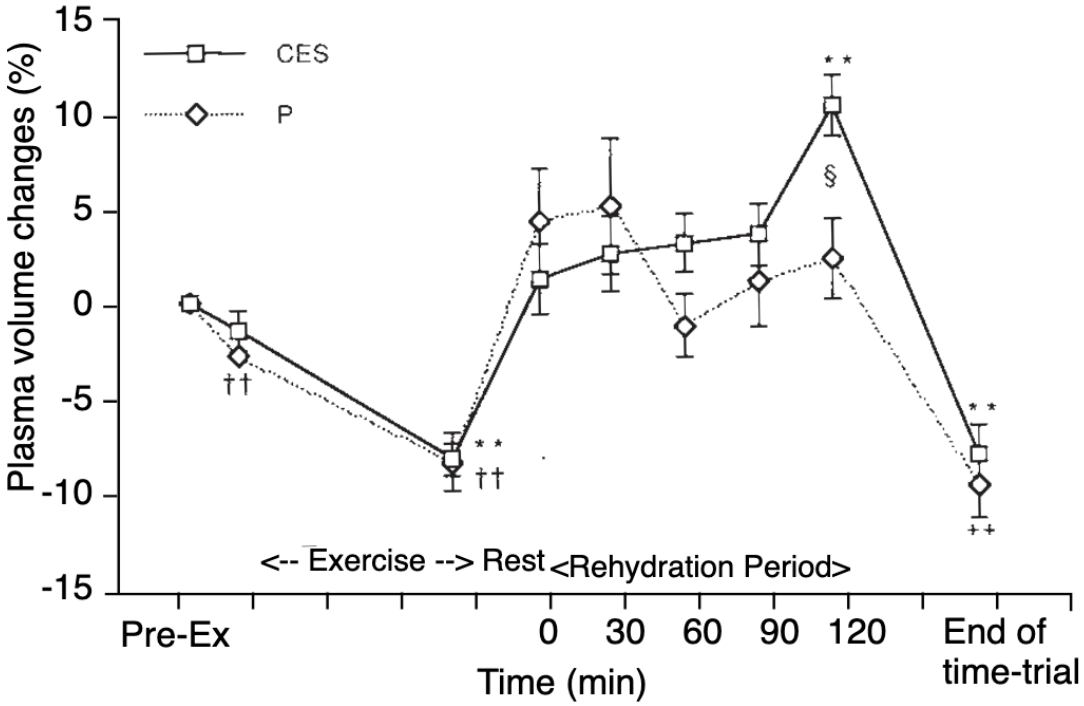
Thirteen healthy male competitive cyclists, triathletes, or recreational athletes participated in this study. The study aimed to test the effects of a carbohydrate beverage on the recovery of water volume in the blood after exercise. Fifteen minutes before exercise, a catheter fitted with a 3-way tap was inserted into a forearm vein for blood sampling; this catheter remained in place for the remainder of the study. An initial blood sample was obtained: this sample represented the pre-exercise state.

The subjects then exercised on a stationary bicycle in an environmental chamber (28ºC; 63% RH) at an intensity of 50% max effort for 90 minutes to dehydrate approximately 3% of body weight. The second and third blood samples were drawn 1 minute into the 50% max effort dehydration exercise and during the last minute of the dehydration exercise.

After the dehydration exercise, the subjects were allowed 10 minutes to cool off, change their clothes, and resume a seated position in a thermo-neutral environment (20ºC). Thirty minutes after exercise and after twenty minutes of sitting, a fourth blood sample was obtained. Immediately afterward, the subjects were seated and drank one of the two test drinks (CES: Carbohydrate-electrolyte solution or P: Placebo (artificial sweetener and water) in a volume (in milliliters) equal to the mass (in grams) of 50% of the fluid lost. This signaled the beginning of the 2-hour rehydration period.

After 30 minutes, the subjects drank 40% of the fluid lost; the remaining 30% of the rehydration drink, necessary to replace 120% of the fluid lost, was ingested at 60 minutes. Further blood samples were collected every 30 minutes during the rehydration period. This was followed by a time trial in which the subjects were asked to perform a maximum-effort ride on the stationary bicycle. After the maximum

effort time trial, the final blood sample was collected. The scientists then measured the changes in the volume of each blood sample taken, which can indicate the changes in the amount of water in the blood sample.



Data obtained from:
https://www.researchgate.net/publication/11155143_The_effects_of_rehydration_on_cycling_performance_after_exercise-induced_dehydration

Paraphrase the goal and design of this experiment in simpler, yet still accurate terms.

What changes do you notice happening over time? What does this indicate about the amount of water in the blood?

How can you explain the trends in this data with the lens of stability and change?

Part 4: Using a Model of Sweat, Thirst, and Urine Color Change

As a class, you will engage in a Science Theater model to determine the mechanism that controls the amount of water lost from the body.

As you review your role, record a summary of the role your cells and organ will play in regulating the amount of water in the body. Describe what function your organ has and how specialized cells contribute to its function.

How Specialized Cells Contribute:

Engage in the model. As you **enact** the model, record observations you make about the actions that various specialized cells take.

Organ & Specialized Cells:

Organ & Specialized Cells:

As you **observe** the model, record how different organs and their specialized cells function to regulate the amount of water in the body. Write or sketch your response as you choose.

Organ & Specialized Cells	Role of Organ and Specialized Cells in Regulating the Amount of Water in the Body
Brain	
Blood Vessels	
Kidney	

Bladder	

Record your observations from the model about how a negative feedback loop helps to prevent water loss in the body.

What conditions changed?	How a feedback loop functions to regulate water levels in the blood
Water is lost due to sweat during exercise.	

Water is replenished by drinking milk.	